Economic Review

December 2018

National Bank OF BELGIUM
Eurosystem

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Economic projections for Belgium – Autumn 2018

Introduction

Although world growth has been rather erratic in the past year, it has generally fallen well short of expectations. In the advanced countries, growth clearly picked up from the spring, but that was due mainly to specific developments in certain countries. For instance, the tax reforms and expenditure increases in the American budget gave the economy a strong boost, while Japan and the United Kingdom also recorded clearly positive growth again following a particularly weak first quarter. Since then, however, the global economy has slackened pace somewhat, and so far the short-term confidence indicators do not suggest any strong recovery in the months ahead. The same picture emerges from the substantial downward revisions that most international organisations have made to their forecasts during the autumn. In fact, there are various factors holding back world growth. For instance, world trade has slowed significantly since the beginning of the year against the backdrop of increasing trade barriers which, owing to the uncertainty that they generate and the interdependence of global production chains, often have a greater negative impact than just their direct effect on the countries and products concerned. In addition, the steady rise in interest rates resulting from increased inflation expectations in the United States is contributing to growing volatility on the financial markets. Moreover, it also leads to escalating financing problems for many emerging economies with current account deficits, due to a reallocation of international capital resulting from changes in relative yields.

In the euro area, too, activity has slowed sharply since the beginning of the year, mainly owing to a decline in the growth contribution of (net) exports. This deceleration in the euro area should not be considered solely in the context of the aforesaid global factors, such as the slight weakening of world growth and the trade slowdown, but could also be connected with the more expensive euro, given its appreciation until the first quarter of the year. According to the initial quarterly statistics, investment does not appear to have suffered too much as yet from the uncertainty surrounding world trade, but the growth of household consumption has lost momentum. The latter could be due to the steep rise in oil prices – and hence inflation – and the still relatively moderate increase in wages. During the third quarter, growth in the euro area weakened further, dropping to its lowest level in four years: in Italy and Germany, activity actually declined. However, this contraction in activity would be attributable partly to temporary production slowdowns in the (predominantly German) car industry as a result of new test procedures for environmental standards and the disappearance of this temporary factor should subsequently support growth in Germany and in Europe from the fourth quarter onwards, even though the relevant short-term growth indicators have not yet improved.

In general, the common assumptions for these projections, of which the main ones are described in the box, are based on a scenario in which the decline in world trade bottomed out in the second half of the year, so that the export markets relevant for the euro area will pick up somewhat in the coming years. In addition, according to these assumptions, the ongoing monetary tightening will cause only a gradual rise in euro area interest rates and the oil price will continue to subside steadily, following the sudden fall since October. It should be noted that the present projections for both the euro area and Belgium are largely based on these common assumptions. However, there are

significant, predominantly downside risks to this favourable baseline scenario. For instance, renewed disruption of international trade or rising interest rates in the euro area, fuelled by doubts over the sustainability of fiscal policy in certain countries, could erode growth to a greater extent than foreseen in the projections. On the other hand, oil prices have continued to decline since the cut-off date for these common assumptions, and that could have a favourable influence on the outlook.

According to the new Eurosystem estimates – of which the autumn projections presented in this article form part – activity growth in the euro area will weaken to 1.9 % this year, representing a further downward revision compared to the September 2018 ECB estimates, mainly as a result of the disappointing growth in the third quarter. However, activity appears to have picked up from the fourth quarter, regaining a pace more in line with potential growth. After that, year-on-year growth is set to diminish gradually to reach 1.5 % in 2021 owing to increasing labour market tensions and the waning impact of the easing of fiscal policy in certain countries in 2019. This year, as in 2017, inflation in the euro area was propelled by higher energy prices. After adjustment for these and other volatile components, core inflation rises throughout the projection period in line with increasing domestic cost pressure, to reach 1.8 % in 2021.

For Belgium, the latest quarterly statistics on real GDP growth up to the third quarter of this year are broadly in line with the spring forecasts, and there has also been very little change in the growth estimate in the last quarter. The growth estimate for 2018 therefore still stands at 1.5 %. Nonetheless, the pace of Belgian economic growth is weakening steadily to an average of around 0.3 % per quarter, or annual growth of 1.2 %. The corresponding storyline is more or less unchanged compared to the spring projection exercise, namely the cooling of the business investment cycle and a slowdown in exports which is only partly offset by the expected upturn in private consumption. The negative growth gap which has existed between Belgium and the euro area since 2015 is set to narrow slightly but will not be entirely eliminated over the projection period.

Employment growth slightly exceeded expectations once again during the first three quarters. However, as labour costs rise and activity slackens pace somewhat, the expansion of employment will gradually diminish. Similarly, the growing impact of supply constraints on the labour market – already evident from the rising number of vacancies – will make it increasingly difficult for firms to find suitable staff and will therefore also contribute to this slowdown. Nevertheless, partly on account of this labour market tension, the average number of hours worked – which has already risen lately – will continue to increase. The harmonised unemployment rate, which – on the basis of a survey – measures the number of people actually seeking work, has stabilised at an exceptionally low level not seen in this century except in 2001. Moreover, as the continuing expansion of the labour force – due partly to the measures aimed at limiting early departure from the labour market – is more or less keeping pace with job creation, the unemployment rate will remain particularly low throughout the projection period, despite the weakening activity growth.

The surge in energy prices gave a particularly strong boost to inflation this year. The rise in domestic electricity prices, triggered by fears over the shutdown of nuclear power plants, adds to these steep increases in gas and oil prices on the international markets up to October. However, in the months ahead inflation should begin subsiding again, judging by the price cuts already seen and the common assumptions concerning oil prices. While core inflation will pick up during the projection period, the sharp rise in labour costs will, just like in the past, not be fully reflected in prices, but lead to a contraction in profit margins which, after having increased considerably in recent years, should revert to a level only just above their long-term average by 2021.

Finally, turning to public finances, the budget deficit is set to decline a little further in 2018 to 0.8 % of GDP. This improvement in the deficit compared to last year is due mainly to the strong rise in advance payments by businesses in the context of the further increase in the surcharge on any shortfall in advance payments. However, this is a temporary factor which will result in lower assessments when corporation tax is settled. The budget deficit will therefore deteriorate again during the projection period, despite the continuing decline in interest charges on the outstanding debt. By the end of the projection period, the deficit is expected to increase again to 2 % of GDP, which is a long way from the target of a structurally balanced budget. Here it should be pointed out that, in accordance with the Eurosystem rules for these projection exercises, account is only taken of measures which, on the cut-off date for the estimates, the government has already specified in sufficient detail and has formally approved, or is very likely to approve. In addition, the estimates of the impact on the budget of certain measures, such as those to combat fraud, deviate from the amounts included in the budget.

1. International environment and assumptions

1.1 World economy

Following a strong performance in 2017, the world economy ran out of steam somewhat this year. On the basis of the known quarterly figures, world growth clearly fell short of the favourable spring forecasts. Moreover, world growth is less broad-based than last year, in an environment where risks and uncertainties have significantly increased. In this context, trade – which had expanded vigorously in 2017 – also decelerated sharply. At present, short-term indicators show no sign of strengthening economic growth or trade flows, and in autumn, international institutions systematically downgraded their forecasts for next year.

In the advanced countries, growth was rather volatile. An anaemic first quarter gave way to a vigorous recovery. However, that was attributable to specific factors in certain economies. For instance, the fiscal stimulus measures adopted in the United States triggered a – probably temporary – growth acceleration, supported by a substantial rise in consumption and investment. In these circumstances, unemployment fell to an historically low level, while inflation climbed to reach the 2 % target of the Federal Reserve, which continued to normalise its policy, raising interest rates on three occasions this year, by 25 basis points at a time, to a range of 2-2.25 %. A fourth interest rate hike is expected in December.

This year, the United Kingdom's growth figures were greatly influenced by unforeseen factors. While activity was hit by bad weather in the first quarter, it was supported by a revival in consumption growth in the second and third quarters. Nonetheless, the uncertainty over the outcome of the Brexit negotiations continued to weigh on investment and the outlook. Following negative growth in the first quarter, activity in Japan staged a temporary revival, driven by robust domestic demand. High profits revitalised investment and consumption was robust despite low pay rises. However, growth came to a halt again in the third quarter, as activity was hit by the impact of two natural disasters – floods in July and an earthquake in September.

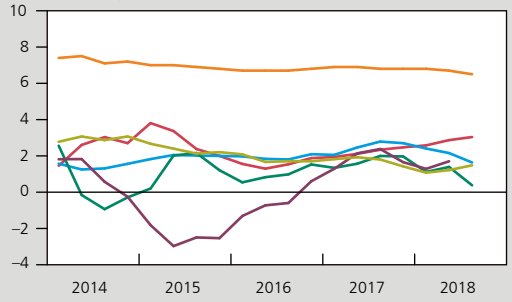
Following last year's steady quarterly growth of 0.7 %, euro area growth lost momentum, dropping to 0.4 % in the first two quarters, and even 0.2 % in the third. The international trade slowdown and the euro's past appreciation weighed on euro area exports. Furthermore, temporary factors such as production interruptions in the car industry due to new emissions tests, curbed activity in the third quarter. Their impact was felt mainly in Germany, where GDP fell sharply in the third quarter, but growth also clearly cooled in Italy and the Netherlands. Conversely, activity picked up in France in the third quarter, following two weak quarters. Leaving aside the said temporary factors, domestic growth dynamics remained fairly strong in the euro area following an exceptional 2017, underpinned by substantial job creation and still favourable financing conditions.

Unemployment declined in most advanced countries this year, and even dropped to its lowest level in over 40 years in the United States and the United Kingdom. Among the major advanced economies, only in the euro area, the unemployment rate is still not below the level prevailing immediately before the crisis. Nevertheless, with the notable exception of the United States, growing labour market shortages have not yet generated sufficient wage growth to rekindle inflation as well. While the consumer price index has risen in most of the advanced economies, propelled by higher oil prices, core inflation has remained fairly stable at around, respectively below, 1 % in the euro area and Japan. In those countries, monetary policy has therefore remained highly accommodative. However, in view of the estimated rise in inflation, the ECB announced in June that it would terminate its programme for the purchase of public and private bonds by the end of the year. Nonetheless, the key interest rates are expected to remain at their present levels at least through the summer of 2019.

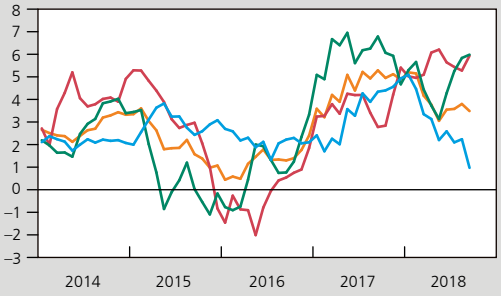
Like the advanced countries, emerging economies presented a fairly mixed picture this year. While the oil-exporting countries benefited from the rise in oil prices, and activity in China and India maintained a steady growth rate, the economy slowed down in certain oil-importing countries with substantial domestic and external imbalances. The appreciation of the US dollar since spring – against the backdrop of the further tightening of monetary policy and robust economic growth in the United States – raised questions about the resilience of a number of emerging countries which had borrowed heavily in US dollars in recent years. Although all the emerging economies were confronted to some degree by the reversal of investor sentiment – in the form of capital outflows and depreciation of the national currency – it was primarily certain particularly vulnerable countries, such as Turkey and Argentina, which were seriously

CHART 1 THE GLOBAL ECONOMY AND DEVELOPMENTS ON THE FINANCIAL AND COMMODITY MARKETS

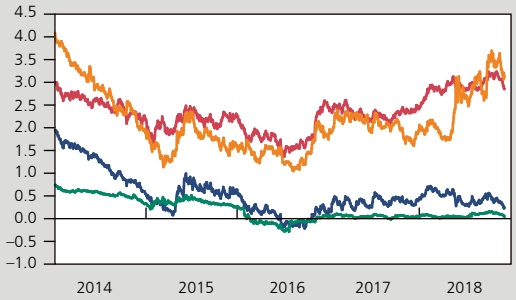
REAL GDP
(quarterly data, percentage changes compared to the previous year)



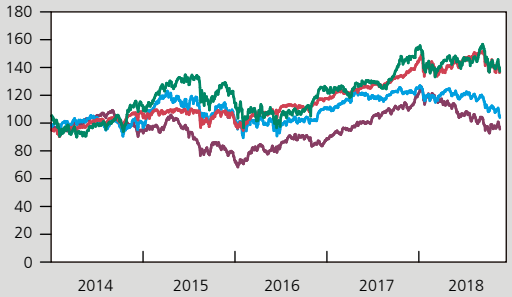
INTERNATIONAL TRADE
(seasonally adjusted three-month moving average of export and import volumes, percentage changes compared to the previous year)



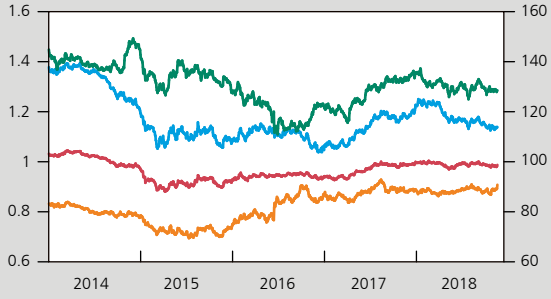
TEN-YEAR GOVERNMENT BOND YIELDS
(daily data, in %)



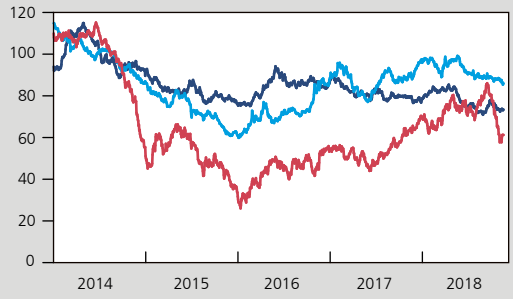
STOCK MARKET PRICES
(daily data, indices 2014 = 100)



EXCHANGE RATES
(daily data)



COMMODITY PRICES
(daily data, in $)



Sources: CPB World Trade Monitor, OECD, Thomson Reuters.

affected. In those countries, the situation escalated during the summer months, but then stabilised somewhat as a result of more restrictive policy measures, including an IMF programme for Argentina.

Chinese growth weakened during the year, but, at 6.5 % in the third quarter, remained within the government's target range. Activity was supported by consumption, the accommodative macroeconomic policy and exports, which remained steady despite the mounting trade tensions with the United States. However, that could be a temporary phenomenon to the extent that firms anticipated the introduction of higher tariffs in January 2019 and therefore brought forward some of their exports. At the end of 2018, it nevertheless became clear that these new tariffs would not be imposed before March 2019, depending on the progress of the trade talks between the United States and China. In addition, the depreciation of the renminbi also bolstered exports. Conversely, investment in infrastructure slowed sharply following measures to restrict the activities of the shadow banks, which represent a major source of funding in that sector. In addition, excess capacities in a range of industrial sectors continued to depress investment. India's growth on the contrary peaked at 8.2 % in the second quarter before subsiding somewhat to 7.1 % in the third quarter. Higher oil prices, liquidity problems in the shadow banking sector, and less favourable financing conditions weighed on activity in the third quarter.

The recovery continued in Russia and Brazil. In Russia, consumption benefited from the rise in real wages and the credit expansion. Uncertainty over possible new American sanctions nevertheless impeded investment and fostered the depreciation of the rouble. Production interruptions as a result of strikes in the transport sector depressed Brazilian growth in the second quarter, but activity picked up in the third quarter, sustained mainly by a revival of investments.

Following last year's surge, international trade flows slowed down significantly in 2018. It is unclear to what extent the trade tensions between the United States and China have already affected international trade. The deceleration probably reflects a combination of factors, such as the decline in growth in the euro area and the more modest increase in trade-intensive investment following the marked revival in 2017, in an environment characterised by increased uncertainty. However, the existence of interlinkages between global production chains implies that the negative repercussions of protectionist measures often extend beyond the impact on the product groups and countries directly targeted.

After the worldwide upturn in the previous two years, financial markets experienced periods of intense volatility this year. Although American stocks underwent a substantial correction recently, it was mainly European stocks – and particularly bank shares – that showed a mediocre performance ; the uncertainty over the impact of US trade policy on European exports played a role, as did the developments in Italy and Turkey. In the autumn, mounting concerns about world growth steadily began to dent the outlook for corporate profits, leading to a new global stock market sell-off from October. On the bond markets, the United States diverged further from the other advanced economies : while yields on US government bonds continued rising, they remained at historically low levels in Germany and Japan. That reflected the different monetary policy stance and the higher inflation expectations in the United States. In Italy, after rising in May, government bond yields climbed further in the autumn in the context of the budget discussions within the framework of the European regulations on the subject. However, contagion to other euro area countries remained limited so far.

The euro appreciated slightly in nominal effective terms from the middle of the year, following its rise against the currencies of a range of emerging countries. Conversely, the divergence between the monetary policy stance of the Federal Reserve and that of the ECB was reflected in a sharp depreciation of the euro against the dollar.

Oil prices maintained their upward trend of the preceding two years during the first three quarters of 2018, supported by fundamental factors but also by the US government's sanctions against Iran. At the beginning of October, the price per barrel reached around $ 85, its highest level for four years. However, in the past two months the oil price has again fallen significantly owing to weaker demand expectations following the decline in world growth and ample supplies, also because some countries were granted temporary exemptions from the US sanctions on Iranian oil imports.

In general, in their baseline scenario, most international institutions currently expect world growth to be relatively stable in the coming years, though at a rate below previous forecasts. In that connection they systematically point out that the uncertainties and downside risks have increased.

TABLE 1 PROJECTIONS FOR THE MAIN ECONOMIC AREAS

(percentage changes compared to the previous year, unless otherwise stated)

	2017	2018 e	2019 e	2020 e
Real GDP				
World	3.7	3.7	3.5	3.5
of which:				
Advanced countries	2.6	2.4	2.1	1.9
United States	2.2	2.9	2.6	1.9
Japan	1.7	1.1	1.0	0.5
European Union	2.4	2.1	1.9	1.8
of which: United Kingdom	1.7	1.3	1.2	1.2
Emerging countries	4.5	4.7	4.7	4.7
China	6.9	6.6	6.2	5.9
India	6.2	7.4	7.5	7.5
Russia	1.5	1.7	1.6	1.8
Brazil	1.0	1.1	1.9	2.3
p.m. World imports	*5.1*	*4.3*	*4.0*	*3.6*
Inflation[1]				
United States	2.1	2.5	2.4	2.2
Japan	0.5	0.8	1.0	1.3
European Union	1.7	2.0	2.0	1.8
of which: United Kingdom	2.7	2.6	2.0	1.9
Unemployment[2]				
United States	4.4	3.9	3.5	3.5
Japan	2.8	2.7	2.6	2.5
European Union	7.6	6.9	6.6	6.3
of which: United Kingdom	4.4	4.3	4.5	4.7

Source: EC.
(1) Consumer price index.
(2) In % of the labour force.

Box – Assumptions for the projections

The macroeconomic projections for Belgium described in this article form part of the joint Eurosystem projections for the euro area. That projection exercise is based on a set of technical assumptions and forecasts for the international environment drawn up jointly by the participating institutions, namely the ECB and the national central banks of the euro area.

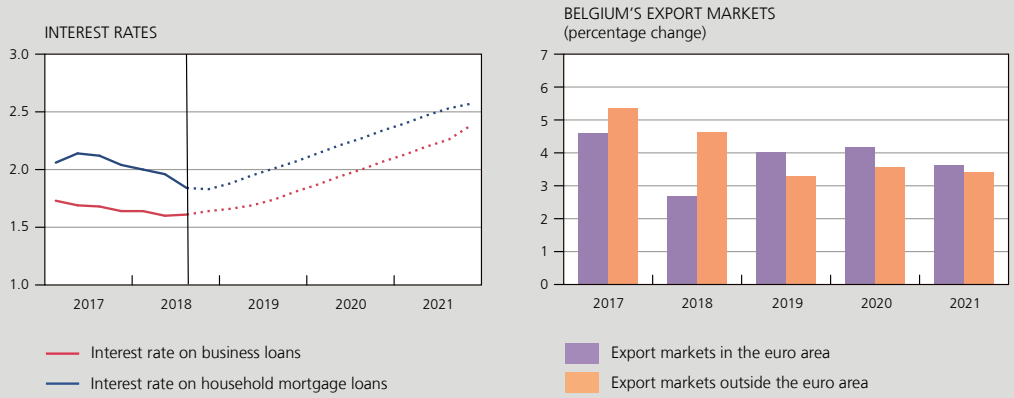
In the projections, it is assumed that future exchange rates will remain constant throughout the projection period at the average levels recorded in the last ten working days before the cut-off date of the assumptions, i.e. 22 November 2018. In the case of the US dollar, the exchange rate then stood at $ 1.14 to the euro.

Although the euro has depreciated slightly since the spring, that still implies a modest appreciation of the euro compared to the average level in 2017.

As usual, the assumptions concerning future oil prices take account of market expectations as reflected in forward contracts on the international markets. While the oil price had risen sharply during 2018, it recorded a sudden, marked fall after the beginning of October. In mid-November 2018 the markets expected the price per barrel of Brent crude to continue declining gradually during the projection period.

The interest rate assumptions are likewise based on market expectations. The three-month interbank deposit rate has been stable for more than two years, at around –30 basis points, but is expected to edge upwards very slowly and become positive again during 2020. The level of long-term yields on Belgian government bonds is also projected to rise, from an average of 0.8 % in 2018 to 1.6 % in 2021.

INTEREST RATES AND VOLUME GROWTH OF EXPORT MARKETS
(in %)



Source: Eurosystem.

Bank interest rates on business investment loans and household mortgage loans are also expected to record a comparable rise. The average mortgage interest rate is currently still at an historically low level, on account of the ECB's extremely accommodative monetary policy and the resulting abundant liquidity. Nevertheless, it is expected to rise to an average of 2.4 % by 2021. The average interest rate on business loans, which is closer to the short-term segment, is also expected to rise gradually over the projection period: in 2021 it is forecast at an average of 2.2 %, i.e. about 0.6 percentage point above the 2018 figure.

As mentioned in chapter 1, the growth of world trade came under pressure this year following 2017's strong performance. The growth of Belgium's export markets will therefore slow sharply in 2018, compared to the spring projections. Nonetheless, the common assumptions predict that these markets for Belgian exporters will pick up slightly during the coming quarters, though after that their expansion will weaken again by the end of the projection period, in line with the spring forecasts.

The trend in Belgian exports is determined not only by the growth of those foreign markets but also by the movement in market shares, and consequently by Belgium's competitiveness. As regards the cost aspects of

competitiveness, fluctuations in the prices that competitors charge on the export markets are a key factor. In 2018, the more expensive euro is reflected in a relatively small increase in the prices of competing exporters outside the euro area. In subsequent years, assuming that exchange rates remain constant, rising inflation in the euro area – but also elsewhere – will gradually lead to renewed upward pressure on the prices of Belgian exporters' competitors.

EUROSYSTEM PROJECTION ASSUMPTIONS

(in %, unless otherwise stated)

	2018	2019	2020	2021
		(annual averages)		
EUR/USD exchange rate	1.18	1.14	1.14	1.14
Oil price (US dollars per barrel)	71.8	67.5	66.8	65.9
Interest rate on three-month interbank deposits in euro	–0.3	–0.3	0.0	0.3
Yield on ten-year Belgian government bonds	0.8	1.0	1.3	1.6
Business loan interest rate	1.6	1.7	1.9	2.2
Household mortgage interest rate	1.9	1.9	2.2	2.4
		(percentage changes)		
Belgium's relevant export markets	3.5	3.7	3.9	3.5
Export competitors' prices	0.4	2.9	2.1	2.0

Source: Eurosystem.

On balance, the adjustments to the assumptions compared to those in the latest spring projections have a fairly neutral impact overall on the medium-term growth forecasts for Belgium. Although the expansion of Belgium's relevant export markets has been clearly revised downwards since the spring projections, the largest revisions concern the recent quarters for which the NAI has already published GDP estimates.

1.2 Estimates for the euro area

The Eurosystem's current estimates for the euro area, like the previous ECB projections, continue to show a progressive slowdown in growth for the years ahead. Following the unexpected continued weakening in the third quarter of this year, attributable partly to temporary interruptions in production in the – predominantly German – car industry, activity in the euro area would nonetheless recover a little in the final quarter, bringing annual growth to 1.9 % for 2018. The growth rate is then set to decline to 1.5 % by 2021. That deceleration is due mainly to the increasing shortages on the European labour markets, a modest rebuilding of savings and the slightly less favourable financial environment following the rise in interest rate levels, but also the waning impact of the fiscal stimulus measures which are expected to support growth in certain countries in 2019. Growth in the euro area will be driven almost exclusively by domestic demand and, despite slowing down, will still exceed its potential level over the whole of the projection period.

Inflation accelerated sharply in the second half of 2018 to over 2 %, mainly owing to higher energy prices. However, the marked reduction in those prices will cause inflation to edge downwards next year, though domestic cost pressure will gradually drive up core inflation over the projection period. The reason is that nominal wages are set to rise significantly

in view of the mounting pressures on the labour market and, during the period between 2019 and 2021, will increase by an average of almost 2.5 % per annum. The increased labour costs will gradually be reflected in prices, so that inflation will climb back to 1.8 % by the end of the projection period.

While the recent employment growth was very vigorous, it is likely to lose momentum over the projection period owing to the slowdown in activity, rising labour costs and the growing shortage of skilled labour. Nonetheless, labour productivity will increase quite considerably throughout the projection period. The labour force, too, will continue to expand, albeit more slowly. In that context, the impact of ageing will be moderated by increased labour market participation, notably among older workers, but also the continuing net immigration and the increasing integration of migrants on the labour market. However, the unemployment rate will maintain its downward trend, dropping to 7.1 % in 2021. That corresponds to around 12.3 million unemployed, broadly comparable to the figure recorded before the great recession.

The average budget deficit in the euro area will decline further in 2018, notably on account of the further fall in interest charges, to reach 0.5 % of GDP. However, that deficit will creep back up next year, essentially owing to the easing of fiscal policy in the form of reductions in charges or additional spending in certain countries with budget surpluses, such as Germany and the Netherlands, but also in Italy. The deficit will then gradually diminish again, reverting to roughly its 2018 level. The fall in the government debt ratio is expected to continue, supported by the low level of interest rates : in 2021 the debt ratio will have contracted by almost 13 percentage points compared to its 2014 peak.

TABLE 2 EUROSYSTEM PROJECTIONS FOR THE EURO AREA

(percentage changes compared to the previous year, unless otherwise stated)

	2017	2018 e	2019 e	2020 e	2021 e
Real GDP	2.5	1.9	1.7	1.7	1.5
Household and NPI final consumption expenditure	1.7	1.4	1.7	1.6	1.4
General government final consumption expenditure	1.2	1.1	1.6	1.4	1.4
Gross fixed capital formation	2.9	3.5	3.3	2.6	2.1
Exports of goods and services	5.5	2.8	3.5	3.8	3.4
Imports of goods and services	4.1	2.7	4.2	4.2	3.6
Inflation (HICP)	1.5	1.8	1.6	1.7	1.8
Core inflation (1)	1.0	1.0	1.4	1.6	1.8
Domestic employment	1.6	1.4	0.9	0.8	0.6
Unemployment rate (2)	9.1	8.2	7.8	7.5	7.1
General government financing requirement (–) or capacity (3)	–1.0	–0.5	–0.8	–0.7	–0.6

Source : ECB.
(1) Measured by the HICP excluding food and energy.
(2) In % of the labour force.
(3) In % of GDP.

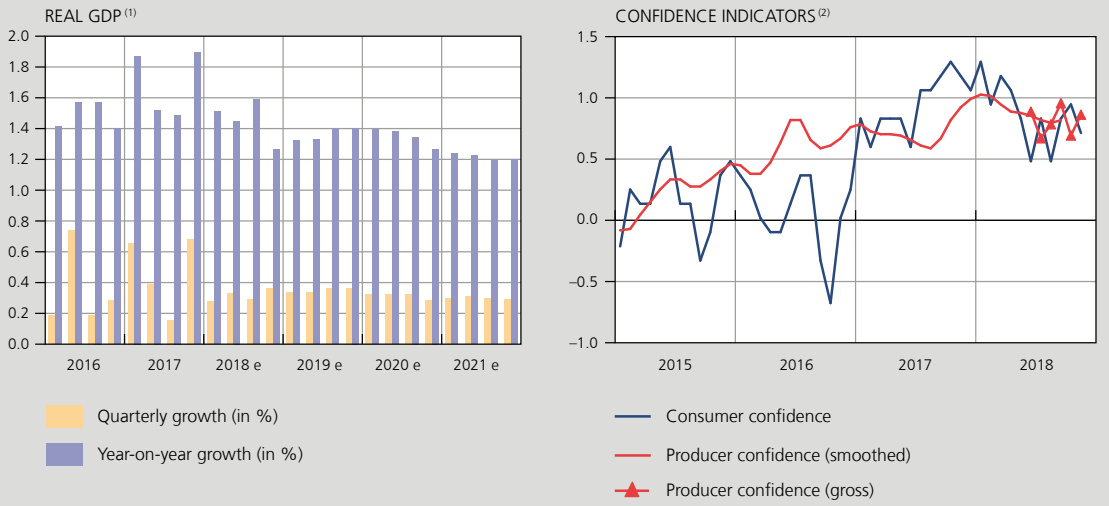
2. Activity and demand

In the first nine months of 2018 the Belgian economy grew at an average rate of 0.3 % per quarter, broadly in line with the spring projections. On the expenditure side, that growth was largely supported by net exports. On the production side, the main factor contributing to growth was the increased activity in services, while value added in the manufacturing industry was virtually unchanged.

However, quarterly growth averaging 0.3 % is well below the 2017 figure, and the same applies in other euro area countries. This weakening mirrors the trend in the confidence indicators, which have come down since the beginning of

the year. Despite this deterioration, the confidence of both producers and consumers in Belgium remains at a high level, exceeding the long-term average. In recent months, the indicators also appear to be slightly more robust than some of those in the euro area as a whole. The immediate forecasting (nowcasting) models used by the Bank therefore show fairly stable growth in the last quarter, rising slightly to just below 0.4 %.

CHART 2 GDP AND BUSINESS CONFIDENCE



Sources : NAI, NBB.
(1) Data adjusted for seasonal and calendar effects.
(2) Data normalised on the basis of the long-term average and the standard deviation.

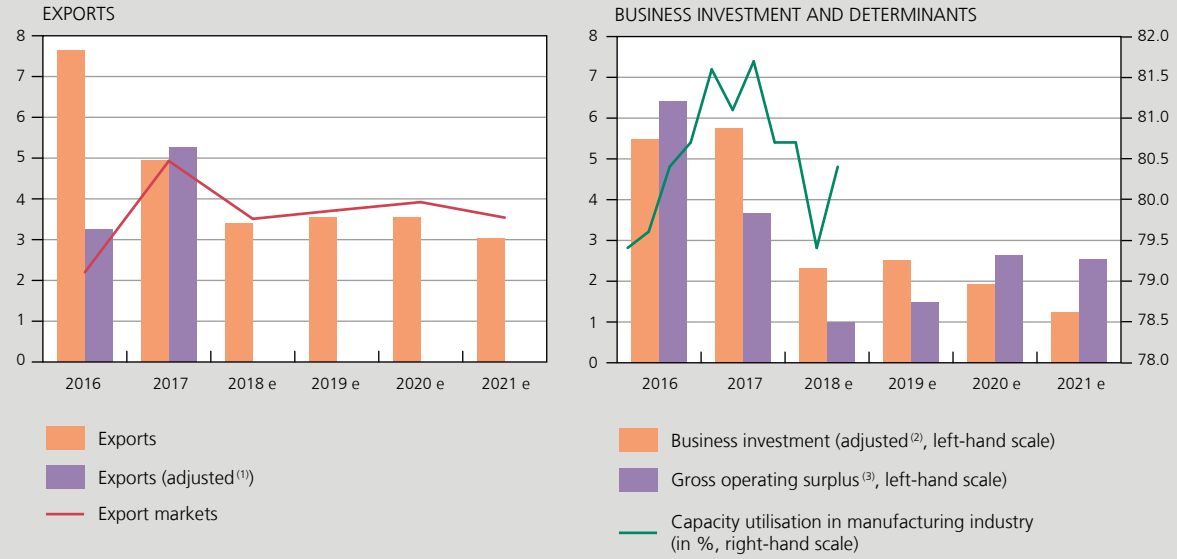
During the rest of the projection period, growth will continue to hover around 0.3 % to 0.4 % per quarter. As in the previous projections, Belgium's annual growth is still set to slacken pace slightly to 1.2 % in 2021, reflecting a normalisation of the expansion of business investment and a deceleration of exports. In addition, and particularly at the end of the projection period, economic growth will also be curbed to a greater extent by supply constraints, especially on certain geographical or functional segments of the labour market.

Over the projection period as a whole, activity growth will be driven mainly by domestic demand. In fact, although net exports will continue to make a positive contribution to year-on-year growth in 2018, mainly as a result of the surprisingly good performance in the first three quarters of the year (at least in comparison with the figures for the euro area in general), export growth will nevertheless gradually lose momentum towards the end of the projection period. While the expansion of Belgium's export markets will be more stable, Belgian exporters will gradually suffer an increasing loss of market shares. Between 2014 and 2017, those shares had remained more or less unchanged, on average, partly thanks to the substantial improvement in cost competitiveness. Now that the pressure of domestic labour costs has begun rising again, Belgium's competitiveness in relation to other countries is no longer improving, so that market shares will drop by more than 1 % over the 2019-2021 period. As the slowdown in imports is a little less marked, the growth contribution of net exports is set to become slightly negative. In addition, according to the technical assumptions adopted for all the quarters covered by the projection period, as usual, the growth contribution of the changes in inventories is considered neutral, particularly in view of the great statistical uncertainty surrounding this concept.

However, domestic demand will also weaken slightly during the projection period, as a result of two opposing forces. While the share of private consumption will rise as incomes increase, investment will slow sharply. Excluding the impact of certain specific transactions in investment goods with other countries, the expansion of business investment was in

CHART 3 EXPORTS AND BUSINESS INVESTMENT

(volume data adjusted for seasonal and calendar effects, percentage changes compared to the previous year)



Sources: NAI, NBB.

(1) Export growth adjusted to take account of expenditure due solely to the reorganisation in 2016 of the commercial activities of a large pharmaceutical company in favour of its subsidiaries based in Belgium so that, from the second quarter of 2016, the statistics show more trade flows to and from Belgium. However, since the upward impact is fairly similar for both imports and exports, there is no net effect on GDP. Nonetheless, an adjustment should be made to take account of this statistical effect when considering the movement in market shares.

(2) Adjusted to take account of major transactions in specific investment goods with other countries.

(3) In nominal terms.

fact particularly marked in both 2016 and 2017, exceeding 5 % in volume during each of those two years. Nevertheless, that growth rate is considered untenable, and that appears to be borne out by the recent quarterly data for 2018. Thus, the autumn projections foresee more moderate business investment growth in line with the expected trend in the underlying investment determinants, namely a slowdown in final demand, a rise in interest rates, and an increase in costs which will only partially be passed on in (selling) prices, thus causing firms' profit margins to shrink, as explained in the chapter 4.

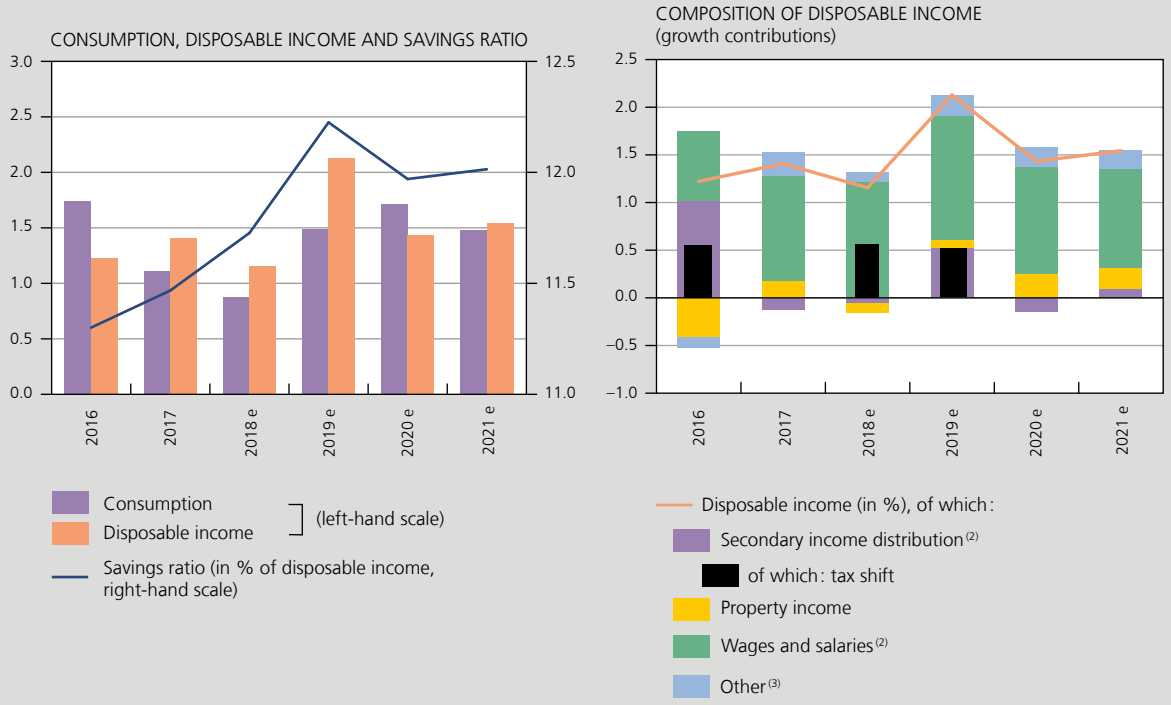
In contrast, the other private investment category, namely household investment in new building or renovation projects, has recorded relatively meagre growth in recent years. Following the decline since the great recession, investment remains well below the peak recorded more than ten years ago. Nonetheless, the current forecasts predict a relatively small rise in investment in housing, averaging 0.4 % quarter-on-quarter over the projection period. While the expected rise in interest rates will also penalise these investments, that effect will still be partly offset by the increase in household incomes.

Household incomes are derived largely from labour. In the coming years, thanks to the expansion of employment – which though decelerating, will remain robust for some time – and above all to the rise in real wages, income earned by labour will increase. In addition, household purchasing power will also benefit from the new tax cut planned for 2019 as part of the tax shift. Similarly, during the projection period, property incomes will contribute positively again to the growth of private incomes, mainly as a result of rising interest rates.

Over the next three years, the cumulative increase in individuals' purchasing power will exceed 5 %. Taking account of the expected population growth, that will correspond to an extra 3.6 % per person. The trend in incomes, particularly labour incomes, also plays a decisive role in household consumption behaviour. In fact, private consumption should maintain a steady expansion during the projection period, with a quarter-on-quarter increase averaging 0.4 %.

CHART 4 HOUSEHOLD CONSUMPTION AND DISPOSABLE INCOME[1]

(volume data, percentage changes compared to the previous year, unless otherwise stated)



Sources: NAI, NBB.

(1) Data deflated by the household consumption expenditure deflator.

(2) Excluding social contributions payable by employers.

(3) 'Other' comprises the gross operating surplus and gross mixed income (of self-employed persons).

However, as usual, households will only gradually adjust their spending in line with the bigger rise in their incomes, so that annual consumption growth will generally lag slightly behind the growth of incomes, enabling households to save more. This should be clearly apparent in 2019, with household incomes being temporarily bolstered not only by the tax shift but also by a marked indexation effect, with a fairly strong rise in the savings ratio. In 2021, the increase in that ratio will also be due to the small rise in the part of disposable income comprising property incomes, because there is tendency to allocate a larger proportion of those incomes to savings.

Finally, as regards public expenditure, the growth of public consumption will remain relatively moderate throughout the projection period. Conversely, public investment will, as usual, mirror the profile of the electoral cycle: following the sharp acceleration in 2018, local investment growth will be considerably lower in 2019. For 2020, and especially for 2021, account is taken of more substantial spending on a number of major public investment projects, e.g. in connection with the Oosterweel link.

TABLE 3 GDP AND MAIN EXPENDITURE CATEGORIES

(seasonally adjusted volume data; percentage changes compared to the previous year, unless otherwise stated)

	2017	2018 e	2019 e	2020 e	2021 e
Household and NPI final consumption expenditure	1.1	0.9	1.5	1.7	1.5
General government final consumption expenditure	0.6	0.8	0.9	1.0	1.0
Gross fixed capital formation	1.8	1.8	2.3	1.7	1.7
general government	2.1	5.7	–2.1	0.5	5.7
housing	0.0	0.5	1.7	1.6	1.3
business	2.3	1.6	3.2	1.9	1.2
p.m. Domestic expenditure excluding change in inventories(1)	*1.1*	*1.1*	*1.5*	*1.5*	*1.4*
Change in inventories(1)	0.0	–0.4	–0.2	0.0	0.0
Net exports of goods and services(1)	0.6	0.8	0.0	–0.2	–0.2
Exports of goods and services	5.0	3.4	3.5	3.5	3.0
Imports of goods and services	4.3	2.5	3.5	3.7	3.2
Gross domestic product	1.7	1.5	1.4	1.3	1.2

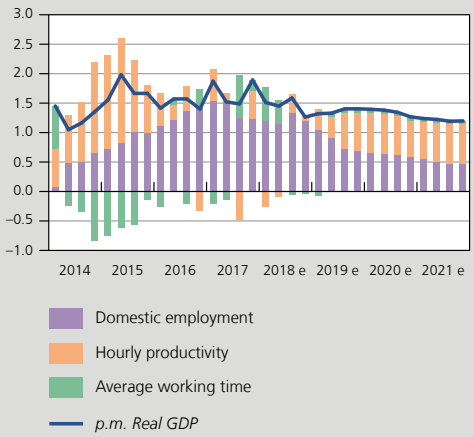
Sources: NAI, NBB.
(1) Contribution to the change in GDP compared to the previous year, in percentage points.

3. Labour market

In recent years, growth in Belgium has been very labour intensive, but during the projection period the expansion of activity will gradually derive more support from increased productivity. Strong job creation should persist in 2018, albeit on a smaller scale than in the two preceding years. Following the substantial increases in 2016 and 2017, the number

CHART 5 DOMESTIC EMPLOYMENT, WORKING TIME AND PRODUCTIVITY

(contribution to GDP growth, percentage points, data adjusted for seasonal and calendar effects)



Sources: NAI, NBB.

of persons in work is expected to rise by a further 58 000 units this year. Employment dynamics are set to weaken over the projection period. Between 2018 and 2021, 153 000 jobs will be created.

This picture reflects the expected decline in activity growth to 1.2 % in 2020. Another factor curbing job creation is the gradually waning impact of the policies introduced in recent years to stimulate net job creation, particularly labour cost moderation. In addition, at this stage of the cycle, after years of strong job creation combined with a steep fall in unemployment, labour shortages affecting certain occupations and some segments of the labour market are holding back the expansion of employment.

This situation also contributes to the upward pressure on average working time. After having fallen until 2016 despite the economic recovery, the average hours worked again displayed a slight upward trend.

TABLE 4 LABOUR SUPPLY AND DEMAND

(seasonally adjusted data; change in thousands of persons, unless otherwise stated)

	2014	2015	2016	2017	2018 e	2019 e	2020 e	2021 e
Total population	55	59	57	54	54	56	60	59
Working age population (1)	9	16	16	12	9	7	6	5
Labour force	33	21	33	37	29	30	20	15
Domestic employment	19	40	59	65	58	40	30	24
Employees	14	30	46	52	48	32	23	17
Branches sensitive to the business cycle (2)	0	18	29	38	35	20	11	5
Public administration and education	7	3	3	2	1	1	2	2
Other services (3)	7	9	14	13	12	12	10	10
Self-employed	6	10	13	12	10	8	8	7
Unemployed job-seekers	14	–19	–26	–28	–29	–10	–11	–10
p.m. Harmonised unemployment rate (4), (5)	*8.6*	*8.6*	*7.9*	*7.1*	*6.3*	*6.3*	*6.3*	*6.3*
Harmonised employment rate (4), (6)	*67.3*	*67.2*	*67.7*	*68.5*	*69.6*	*70.1*	*70.5*	*70.8*

Sources : DGS, FPB, NAI, NEO, NBB.
(1) Population aged 15-64 years.
(2) Agriculture, industry, energy and water, construction, trade, hotels and restaurants, transport and communication, financial activities, property services and business services.
(3) Health, welfare, community, public social services, personal services and domestic services.
(4) On the basis of data from the labour force survey.
(5) Job-seekers in % of the labour force aged 15-64 years.
(6) Persons in work in % of the total population of working age (20-64 years).

In 2018, for the fourth consecutive year, most of the jobs were created in branches sensitive to the business cycle. Only financial and insurance activities continue to record a decline in their workforce. The sectors making the biggest contribution are business services, and the branches comprising trade, transport and hotels and restaurants. However, the market sector's contribution to net job creation is likely to decline over the projection period. Within employment, the growth of the number of employees will decelerate more sharply than the growth of the number of self-employed persons. That is due mainly to the said waning impact of labour cost moderation, which did much to support the expansion of paid employment. In addition, the sustained interest in self-employed status is underpinned in particular by the improvements made to the social security scheme for the self-employed and by the opportunities for retired persons to engage in professional activity under this scheme while drawing a pension.

The growth of the working age population is slowing down as a result of ageing, but the participation rate is still rising significantly. This is to do with cohort effects concerning the participation of women in the labour market, but it is due mainly to the reforms restricting early retirement. Overall, the labour force will expand more slowly during the projection

period. The harmonised unemployment rate, which measures actual availability for the labour market on the basis of a survey, will decline this year to an historically low level of 6.3 %, but will remain fairly constant thereafter as employment growth matches the increase in the labour force. Since the unemployment rate has dropped below its structural level, it is hard to reduce it further without a change of policy. The number of unemployed job seekers has fallen a little more than the harmonised unemployment rate owing to the gradual departure of a large cohort of unemployed persons aged 63 and over entering retirement. However, their exit from the group of unemployed job seekers has no impact on the harmonised unemployment rate since most of them did not state in the surveys that they were actively looking for work. In 2021, there will still be around 466 000 unemployed job seekers, or about 30 000 fewer than this year.

4. Costs and prices

4.1 Labour costs

Labour costs, which had risen steeply last year, are set to maintain an upward trend in 2018, despite new reductions in social security contributions. The main reason lies in the acceleration of negotiated pay rises, though they are limited and smaller than expected, and in the somewhat stronger increase in the wage drift.

Following the 0.2 % rise granted in the private sector in 2017, real negotiated pay increases are not expected to exceed 0.4 % this year. Over the two years of the 2017-2018 central agreement, they will therefore remain well below the 1.1 % wage norm negotiated by the social partners. This moderate rise in negotiated wages is similarly evident in other

TABLE 5 PRICE AND COST INDICATORS

(percentage changes compared to the previous year, unless otherwise stated)

	2016	2017	2018 e	2019 e	2020 e	2021 e
Private sector labour costs (1)						
Labour costs per hour worked	–0.1	1.4	1.8	3.0	2.5	2.9
of which : Indexation	0.5	1.6	1.7	2.2	1.6	1.8
Real increases	0.7	0.1	0.6	0.7	1.0	1.0
Social contributions	–1.5	–0.4	–0.6	0.0	–0.2	0.0
p.m. Labour costs per hour worked according to the national accounts (2)	*–0.2*	*1.4*	*1.7*	*2.9*	*2.5*	*2.9*
Labour productivity (3)	–0.2	0.0	–0.2	0.6	0.7	0.7
Unit labour costs	0.1	1.5	2.0	2.5	1.9	2.2
Total inflation (HICP)	1.8	2.2	2.4	2.0	1.6	1.8
Core inflation (4)	1.8	1.5	1.3	1.6	1.9	2.0
of which :						
Services	2.2	1.9	1.6	2.0	2.3	2.4
Non-energy industrial goods	1.0	0.8	0.9	1.0	1.2	1.3
Energy	–0.6	9.9	9.1	3.6	–1.1	0.0
Food	3.1	1.4	2.8	2.4	1.9	1.8
p.m. Inflation according to the national index (NCPI)	*2.0*	*2.1*	*2.1*	*2.1*	*1.6*	*1.8*
Health index (5)	2.1	1.8	1.8	2.1	1.6	1.9

Sources : DGS, EC, FPS Employment, Labour and Social Dialogue, NAI, NBB.

(1) Labour costs per hour worked are not shown here according to the national accounts concept but according to a broader concept that also includes reductions in contributions for target groups and wage subsidies. That concept gives a better idea of the true labour cost for firms.

(2) Excluding wage subsidies and reductions in contributions for target groups.

(3) Value added in volume per hour worked by employees and self-employed persons.

(4) Measured by the HICP excluding food and energy.

(5) Measured by the national consumer price index excluding tobacco, alcohol and motor fuel.

euro area countries. Meanwhile, as a result of higher inflation, the indexation effect is slightly more important than in 2017 and the wage drift has also intensified. The latter is due partly to structural factors – for instance, the recent reforms slowed the departure of older workers whose earnings are relatively higher – but it may also be due to more individualised pay for workers in the context of growing labour market tensions. For firms, however, the rise in labour costs has been reduced by the additional cuts in social security contributions under the tax shift. Thus, hourly labour costs will rise by 1.8 %, or almost half a percentage point more than in 2017. As labour productivity is down slightly, unit labour costs will rise by 2 % in 2018.

The wage norm for 2019-2020 will only be negotiated at the end of the current year. The technical assumption adopted in these projections reflects the increasing pressure on certain labour market segments : it is assumed that negotiated adjustments excluding indexation will increase to 1.3 % for this two-year period, with a slightly bigger rise in the second year in view of the stylised facts concerning the implementation of those agreements. With considerably higher indexation in 2019 as a result of the rise in energy prices, among other things, and a modest increase of the wage drift throughout the projection period, the growth of gross hourly wages will accelerate in 2019 to 2.9 %, before softening somewhat in line with the outlook for indexation.

Apart from the latest package of tax shift measures which will apply in 2020 and will bring labour costs growth down by 0.2 percentage point to 2.5 %, the profile of labour costs per hour worked is similar to the profile of gross pay. Owing to the weak recovery of productivity growth from 2019, the rise in unit labour costs will be outpaced by the increase in labour costs and will amount to 2.5 % in 2019 and 1.9 % in 2020 before edging back up in line with the movement in hourly labour costs.

4.2 Prices

The accelerating growth of labour costs exerts upward pressure on core inflation, which will rise gradually to 2 % by the end of the projection period. In 2018, it slowed to 1.3 %, mainly as a result of lower inflation in services due to the smaller increase in the prices of telecommunication services and hotel and restaurant prices since the end of 2017, and the abolition of the radio and television licence fee in the Walloon Region last January. However, from 2019 onwards the stronger rise in labour costs will gradually drive services inflation higher again to reach 2.4 % by the end of the projection period. Inflation in non-energy industrial goods will also rise steadily to 1.3 % in 2021.

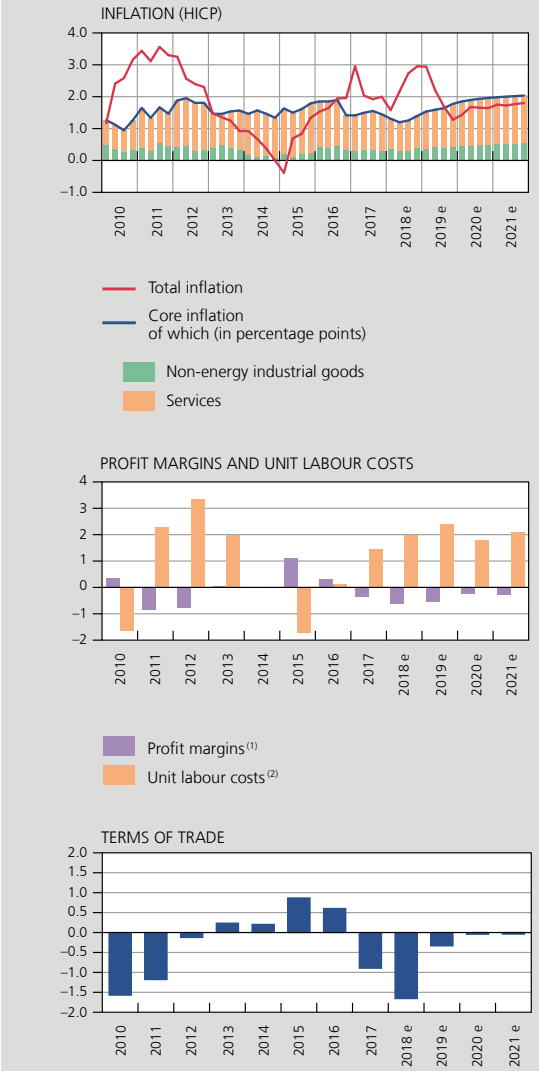
In line with the correlations seen in the past, however, the increasing domestic cost pressure will only partially get passed on in final prices. The rise in core inflation will therefore be smaller than the rise in labour costs, as firms' profit margins also absorb part of the cost pressure. In recent times, those profit margins had expanded because the reduction in labour costs had not been passed on in full, but according to the forecasts they should continue to contract throughout the projection period, reverting to a level close to the average prevailing since 2005.

In the case of products with more volatile prices, the expected stabilisation of energy inflation at a high level in 2018 conceals divergences within its components : in annual average terms, a continuing steep rise in oil prices – causing a deterioration in the terms of trade – , a stronger rise in gas prices and a considerably weaker increase in electricity prices. This last point is due mainly to the abolition of the tax on electricity consumption in the Flemish Region in January 2018. However, owing to the risks of shortages following the shutdown of most of the nuclear power plants in Belgium, there was a surge in electricity prices from October, and that is likely to persist at the end of 2018 and especially in early 2019. There is uncertainty over additional supply capacity owing to technical obstacles (such as delays in the work being done on the power stations, the limited import capacity, and congestion problems) and because winter demand is equally great in the neighbouring countries (so that reserves are limited). In 2020, with prices reverting to levels close to those prevailing before the autumn of 2018, electricity will make a negative contribution to energy inflation. However, over the projection period, energy inflation is influenced mainly by the Eurosystem's common assumptions, which foresee a gradual decline in oil prices.

Food prices in 2018 were considerably higher than in the previous year. That applied to both unprocessed and processed foods. In the case of processed food, the steeper increase in prices of dairy products, alcohol, tobacco and soft drinks was a major factor, particularly owing to the higher excise duty on tobacco and the increase in the "soft drink" tax at the beginning of the year. A return to "normal" is expected from 2019 onwards, with excise duty no longer rising so steeply. In the case of unprocessed food, the end of the decline in fruit prices is the main reason for the average rise in inflation, which is expected to continue increasing in 2019 before subsiding over the rest of the projection period.

CHART 6 INFLATION AND DETERMINANTS

(percentage changes compared to the previous year, unless otherwise stated)



Sources: EC, NAI, NBB.

(1) Difference between the year-on-year rise in unit selling prices and unit production costs.

(2) Including wage subsidies and reductions for target groups. Unit labour costs in the private sector.

Overall, driven by food prices, total inflation is expected to rise from 2.2 % in 2017 to 2.4 % in 2018. It will weaken significantly in 2019 and 2020 as a result of movements in energy inflation. After that, total inflation will only edge up slowly to reach 1.8 % at the end of the projection period.

The above analysis concerns the HICP, which permits comparison of inflation rates across the EU member countries. Inflation measured according to the Belgian national consumer price index (NCPI) may deviate slightly from that figure owing to methodological differences. The NCPI is used to calculate the health index, which excludes tobacco, alcoholic beverages and motor fuel. Following the stabilisation of its growth rate in 2018, the increase in this index will accelerate in 2019 before slowing down again. It is expected that the pivotal index will next be exceeded in April 2019.

5. Public finances

5.1 Budget balance

According to the latest estimates, the public finances will end the year 2018 with a deficit of 0.8 % of GDP, representing a small improvement over 2017. However, in the macroeconomic context described above, the general government budget deficit will increase in the coming years.

TABLE 6 GENERAL GOVERNMENT ACCOUNTS
(in % of GDP)

	2017	2018 e	2019 e	2020 e	2021 e
General government					
Revenue	51.3	51.6	50.7	50.5	50.5
Primary expenditure	49.7	50.1	50.1	50.1	50.5
Primary balance	1.6	1.5	0.6	0.4	0.0
Interest charges	2.5	2.3	2.1	2.0	2.0
Financing requirement (–) or capacity	**–0.9**	**–0.8**	**–1.6**	**–1.7**	**–2.0**
Overall balance per sub-sector					
Federal government[1]	–1.2	–0.3	–1.4	–1.5	–1.7
Social security	0.2	0.0	0.0	0.0	0.0
Communities and Regions[1]	0.0	–0.5	–0.2	–0.2	–0.2
Local authorities	0.1	0.0	0.1	0.1	0.0

Sources: NAI, NBB.
(1) These figures include the advances on the regional additional percentages on personal income tax although, according to the methodology of the ESA 2010, those advances are regarded as purely financial transactions and the regional additional percentages are only taken into account at the time of collection.

Both revenue and primary expenditure will rise in 2018, while interest charges have fallen. The increase in the deficit from 2019 onwards will be due to the erosion of revenue, as primary expenditure will remain more or less stable and interest charges will continue to decline. Corporation tax revenues are set to diminish owing to the decline in revenues collected from the assessments, that being the corollary to the switch to increased advance payments in 2017 and 2018. The tax burden on labour is further reduced via the tax shift, which aims to improve firms' competitiveness and promote employment; the final phase of the tax shift is scheduled for 2020.

The deficits will occur mainly at the level of the federal government, but the subsector comprising the Communities and Regions will also continue to record a small deficit during the projection period. In contrast, the local authority and social security accounts should remain in balance overall. In 2018, the downward revision of the autonomy factor for determining the regional additional percentages on personal income tax results in a one-off adjustment for the excess taxes paid to the Regions since 2015; that will have a negative impact on the budget balance of the Communities and Regions and a positive impact on the federal government budget.

As usual, the projections are based on the assumption of no change in policy. Consequently, they only take account of budget measures which have already been announced and specified in sufficient detail.

5.2 Revenues

In 2018, government revenues will increase by 0.3 percentage point of GDP before declining in 2019 and 2020 respectively by 0.9 and 0.2 percentage point of GDP. In 2021 they should remain stable.

The growth of government revenues in 2018 is due to the increase in corporation tax revenues resulting from the higher advance payments, which had already risen strongly in 2017. The explanation for that lies in the further increase in the basic rate of tax surcharge applied to inadequate advance payments, which goes up to 6.75 % from the 2018 tax year. It therefore makes sense for firms to step up their advance payments, generating a temporary revenue boost in 2017 and 2018, since the amount collected via the assessments will decline in the years ahead. This accounts for the expected sharp fall in corporation tax revenues in 2019. Despite that fall, revenues will still match the highest level recorded before the financial and economic crisis.

TABLE 7 **PUBLIC REVENUES**
(in % of GDP)

	2017	2018 e	2019 e	2020 e	2021 e
Fiscal and parafiscal revenues	44.3	44.5	43.6	43.5	43.7
Levies applicable mainly to labour income	24.9	24.9	24.8	24.9	25.0
Personal income tax	11.1	11.1	10.9	10.9	11.1
Social contributions	13.9	13.9	13.9	13.9	14.0
Taxes on corporate profits	4.1	4.3	3.6	3.5	3.5
Levies on other incomes and on assets	4.1	4.1	4.1	4.0	4.0
Taxes on goods and services	11.1	11.2	11.2	11.1	11.1
of which :					
VAT	6.8	6.8	6.8	6.9	6.9
Excise duty	2.2	2.2	2.2	2.2	2.1
Non-fiscal and non-parafiscal revenues	7.0	7.1	7.0	7.0	6.9
Total revenues	51.3	51.6	50.7	50.5	50.5

Sources : NAI. NBB.

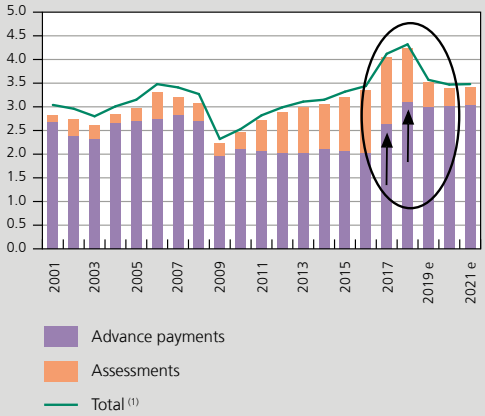
As regards corporation tax revenues, the estimate differs from the assumption made by the federal government in drawing up the 2019 budget, whereby half of the strong rise in advance payments in 2017 and 2018 is due to a structural increase in corporation tax, so that in 2019 those revenues will roughly equal the 2018 figure. The EC also makes the same assumption in its estimates. This factor is the main reason for the divergence between the Bank's estimates and the target deficit of 1 % of GDP planned in the 2019 budget.

Moreover, as mentioned earlier, the measures relating to the tax shift result in a further reduction in the tax burden on labour incomes. In 2018 and 2019 the main cuts concern personal income tax, followed by a reduction in social contributions in 2020. However, the decline in revenues from personal income tax and social contributions should be relatively small owing to the high labour intensity of economic growth, and hence the strong expansion of employment.

Finally, levies on other incomes and on assets will increase in 2018 as a result of the entry into force of the tax on securities accounts and the increase in the rates of the tax on stock market transactions, but in 2019 the measures taken concerning the activation of savings will reduce those levies.

CHART 7 CORPORATION TAX REVENUES

(in % of GDP)



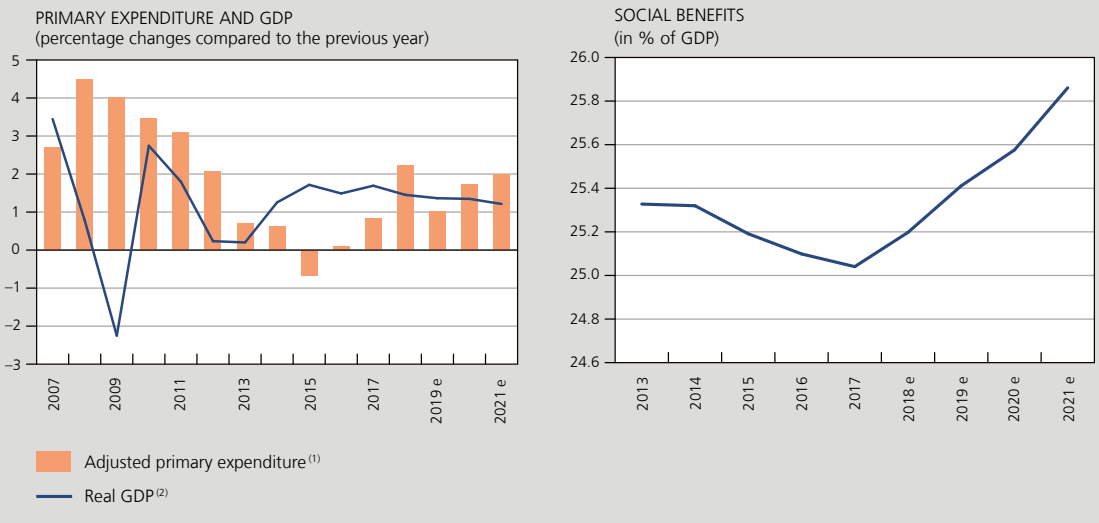
Sources: NAI, NBB.

(1) Including other taxes, primarily the withholding tax on income from movable property.

5.3 Primary expenditure

The downward trend in primary expenditure as a percentage of GDP is expected to come to a halt in 2018. Thus, the expenditure ratio is estimated at 50.1 % of GDP for the current year. After that, expenditure will increase, rising to 50.5 % of GDP in 2021.

CHART 8 PRIMARY EXPENDITURE OF GENERAL GOVERNMENT



Sources: NAI, NBB.

(1) Primary expenditure deflated by the GDP deflator and adjusted for cyclical, one-off and fiscally neutral factors, and for the effect of indexation. The latter is due to the difference between the actual indexation (or the theoretical figure for 2015 and 2016, as a result of the approved index jump) of civil service pay and social benefits and the increase in the GDP deflator.

(2) Calendar adjusted data.

Following adjustment for both temporary factors and the influence of the business cycle, and for the time-lag between inflation and actual indexation, real primary expenditure is forecast to go up by 2.2 % in 2018. Thus, in contrast to the preceding years, that increase will slightly exceed real GDP growth. The main reasons for that excess lie in increased social benefits and the boost to public investment ahead of the local and provincial elections.

For 2019, the budgets announced by the federal government and the federated entities imply managed expenditure growth. In 2020 and 2021, if there is no change of policy, the structural trend in public expenditure will again exceed real GDP growth.

This situation is due mainly to the drift in social benefits resulting from population ageing. The natural increase in the budgets for pensions and, to a lesser extent, for health care will place a heavy burden on public finances, especially in view of the welfare adjustments. In recent years it has been possible to neutralise the demographic pressure on social security expenditure, in particular by strict control of spending on health care, the 2015 index jump, and the fall in unemployment.

5.4 Debt

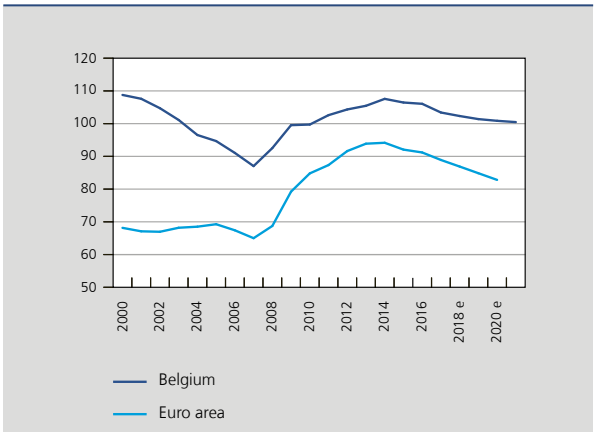
The modest reduction in the debt expressed as a percentage of GDP, expected during the projection period, will gradually slow down towards the end of that period.

In 2018, the debt ratio is estimated at 102.3 % of GDP, representing a 1.1 percentage point decline against the previous year. After that, the debt ratio should continue falling but much more slowly, and is forecast at 100.5 % of GDP in 2021. The favourable impact of the primary balance will gradually fade over the projection period, so that the 2018 surplus will become much smaller in 2019 and 2020, and disappear in 2021.

This picture contrasts with the EC forecasts for the euro area, where the debt ratio will decline faster, so that the discrepancy in relation to Belgian public finances will increase.

CHART 9 CONSOLIDATED GROSS DEBT OF GENERAL GOVERNMENT

(in % of GDP)



Sources: EC, NBB.

6. Differences compared to the previous projection exercise

Although GDP growth – particularly from next year – has again been adjusted downwards slightly, the broad outline derived from the economic context of the forecasts remains unchanged compared to the situation in June. However, larger adjustments were made in respect of prices and the labour market.

The outlook for the very near term has barely changed. According to the latest figures, economic activity growth was in line with expectations in the second quarter of this year, but fell somewhat short of the June forecast and the NAI's initial estimates in the third quarter. On the basis of the Bank's short-term models, among other things, and certain leading indicators that point to a degree of resilience in the Belgian economy, the expected growth for the final quarter has remained unchanged, so that annual growth in 2018 will be only just below the spring forecast, putting it at 1.5 % in round figures. However, combined with the revised assumptions on the growth of Belgium's export markets, the slightly modified pattern for growth in 2018 is a factor in the small adjustment to the 2019 growth figure.

Inflation measured by the harmonised index of consumer prices (HICP) was revised upwards for both this year and next. That is due mainly to energy prices, which are traditionally a major cause of volatility in HICP inflation. Energy inflation was affected by the steeper than expected rise in oil prices on the international markets up to the autumn, but also by specific domestic factors which exert an upward influence on electricity prices. From the spring of 2019, and as a result of the expected moderation of oil prices, the expected inflation lies closer to the June estimates. However, taking account of recent, lower than expected observations and the gradual, albeit incomplete, pass-through in prices of this exercise's somewhat stronger rise in labour costs, the underlying price increase over the projection period will be a little steeper than expected in the spring forecasts.

Estimated unit labour costs have indeed been revised upwards, particularly in 2019, even though the relevant indicators show that the negotiated wage increases will again be smaller than expected in the short term, and more particularly below the available 1.1 % margin that stems from the wage norm for 2017-2018. Against that backdrop, the technical assumptions for negotiated wage adjustments have also been revised for the coming years compared to the June estimates. In contrast, the estimate for the wage drift has been adjusted upwards slightly, and – owing to the delayed impact of inflation via the indexation effect – inflation is predicted to drive up nominal wage growth, particularly next year. Taking the projection period as a whole, labour costs per hour worked have been adjusted downwards by roughly 0.5 percentage point overall, compared to the spring forecast. Nevertheless, unit labour costs have been adjusted upwards because labour productivity is likely to fall well short of previous expectations, particularly in 2018.

While economic growth in the coming years looks set to be slightly less dynamic than was forecast in June, the growth of the volume of labour or domestic employment is stronger again, especially in the short term. That results in lower growth of labour productivity over the projection period as a whole. The estimated number of hours worked per person remains more or less unchanged. The more positive assessment for the labour market is due partly to observations in the first three quarters of the year, showing that job creation exceeded expectations, but it is also due to a technical adjustment : with effect from the present exercise, the Bank has detailed data from the Regions on the number of jobs created under the subsidy scheme. That volume is evidently considerably greater – and in particular, is rising more sharply – than was assumed in June. After adjustment for this factor, however, the underlying trend in the residual volume of labour in the private sector is less dynamic than in the spring forecasts, in line with the lower expectations regarding economic activity and in accordance with the finding that pressures on the labour market are still increasing, as is evident from the published vacancy and unemployment figures. According to the latest findings, the harmonised unemployment figures are again considerably lower than expected, and are likely to remain relatively flat up to the end of the horizon.

Conclusion and risk factor assessment

The Eurosystem's autumn forecasts again show that Belgium and the euro area have passed the peak of the current business cycle, and indicate a steady weakening in the expansion of activity from 2018. This year, the Belgian economy will grow by a further 1.5 %, followed by 1.4 % in 2019 ; thereafter, growth continues to decline to 1.2 % in 2021, as a result of the slower growth of business investment and a negative contribution from net exports. Throughout the

projection period, Belgium thus lags well behind the average growth rate for the euro area, which comes to 1.9 % for this year. In both Belgium and the euro area, domestic demand is the main factor supporting growth in the years ahead.

TABLE 8 COMPARISON WITH THE ESTIMATES OF OTHER INSTITUTIONS
(in %)

Institution	Publication date	Real GDP growth				Inflation (HICP, unless otherwise stated)			
		2018	2019	2020	2021	2018	2019	2020	2021
Federal Planning Bureau[1]	September 2018	1.5	1.5			2.0	1.9		
Belgian Prime News	September 2018	1.6	1.5			2.1	1.9		
IMF	October 2018	1.5	1.5	1.5	1.5	2.2	1.8	1.8	1.9
EC	November 2018	1.5	1.5	1.4		2.3	2.1	1.6	
Consensus Economics	December 2018	1.5	1.5	1.3		2.1	1.9	1.8	
NBB	December 2018	1.5	1.4	1.3	1.2	2.4	2.0	1.6	1.8

(1) Economic budget for 2018-2019. The inflation rates are the NCPI figures.

From 2019 onwards, these growth estimates are therefore slightly lower than the latest forecasts by other institutions. In its projections, the Bank was able to take account of the GDP and labour market figures for the third quarter of 2018. In comparison with those other institutions, it also had more recent economic indicators for the final quarter of this year, which currently present a fairly sturdy picture overall.

In the medium term, the situation depends largely on developments in the international environment, and especially the trade flows resulting from the economic activity on Belgian export markets. Despite the much weaker than expected performance in the past few quarters, a gradual recovery is predicted for 2019. The main uncertainties surrounding this forecasting exercise also concern trade, as protectionist tendencies have become evident in the past year which could curb the growth of world trade. For the time being, the impact on Belgium and the euro area seems to be fairly minor and is exerted mainly via indirect channels, but a further (direct or indirect) increase in trade barriers or an unexpectedly substantial effect caused by the existing measures is a clear downside risk factor for these forecasts. Mounting tension on the financial markets, e.g. as a result of internal political uncertainty for some major Belgian trading partners, could also have an adverse effect on the real economy. Finally, there is the possibility that geopolitical tensions intensify and lead to (further) disruption of international trade flows or higher commodity prices. If these risks materialise, it could prove necessary to revise the framework in which these estimates were produced.

On the domestic front, the risks to growth also seem to be predominantly downside risks. There is still great uncertainty over the demand components. For instance, it is possible that business investment will moderate more slowly than assumed in the current baseline scenario. Just as in the June estimates, the current forecasts are based partly on the ratios and patterns of such investment in past economic cycles. However, Belgian business confidence is still fairly robust at present, and financing conditions remain accommodative, suggesting that investment could remain strong for longer. In addition, in view of the recent weaker than expected figures, there is again the risk that the growth of private consumption will recover less strongly or more slowly than predicted at present. Also, a technical assumption is currently used to give a macroeconomic interpretation to the wage margins for the coming years (2019-2020 and 2021), but that is very likely to differ from the real margin. Finally, given the clear deterioration in the budget balance, the next government may need to take measures that could curb domestic demand.

Annex

PROJECTIONS FOR THE BELGIAN ECONOMY: SUMMARY OF THE MAIN RESULTS

(percentage changes compared to the previous year, unless otherwise stated)

	2017	2018 e	2019 e	2020 e	2021 e
Growth (calendar adjusted data)					
Real GDP	1.7	1.5	1.4	1.3	1.2
Contributions to growth:					
Domestic expenditure, excluding change in inventories	1.1	1.1	1.5	1.5	1.4
Net exports of goods and services	0.6	0.8	0.0	–0.2	–0.2
Change in inventories	0.0	–0.4	–0.2	0.0	0.0
Prices and costs					
Harmonised index of consumer prices	2.2	2.4	2.0	1.6	1.8
Health index	1.8	1.8	2.1	1.6	1.9
GDP deflator	1.7	1.1	1.9	1.5	1.7
Terms of trade	–0.9	–1.7	–0.3	0.0	0.0
Unit labour costs in the private sector[1]	1.5	2.0	2.5	1.9	2.2
Hourly labour costs in the private sector[1]	1.4	1.8	3.0	2.5	2.9
Hourly productivity in the private sector	0.0	–0.2	0.6	0.7	0.7
Labour market					
Domestic employment (annual average change in thousands of persons)	64.5	57.9	40.2	30.4	24.3
Total volume of labour[2]	1.5	1.4	0.9	0.7	0.5
Harmonised unemployment rate (in % of the labour force aged 15 years and over)	7.1	6.3	6.3	6.3	6.3
Incomes					
Real disposable income of individuals	1.4	1.2	2.1	1.4	1.5
Savings ratio of individuals (in % of disposable income)	11.5	11.7	12.2	12.0	12.0
Public finances					
Primary balance (in % of GDP)	1.6	1.5	0.6	0.4	0.0
Budget balance (in % of GDP)	–0.9	–0.8	–1.6	–1.7	–2.0
Public debt (in % of GDP)	103.4	102.3	101.4	100.9	100.5
Current account (according to the balance of payments, in % of GDP)	0.7	–0.1	–0.4	–0.6	–1.0

Sources: DGS, EC, NAI, NBB.

(1) Including wage subsidies (mainly reductions in payroll tax) and targeted reductions in social contributions.

(2) Total number of hours worked in the economy.

How accurate are the National Bank of Belgium's macroeconomic projections ?

G. Minne
T. De Keyser
G. Langenus

Introduction

This article assesses the track record of the macroeconomic projections that are regularly produced by the National Bank of Belgium (NBB)[1]. While these projections also support the Bank's analysis and understanding of the Belgian economy, they are specifically tailored to inform monetary policy for the euro area in the context of a joint exercise with the European Central Bank (ECB) and the other national central banks of the Eurosystem.

According to its mandate, the objective of the ECB's monetary policy is to maintain price stability, which is operationalised as reaching an inflation rate close to but below 2 % in the medium term. Attainment of this target is monitored by means of a two-pillar strategy consisting of monetary and economic analysis. The monetary analysis specifically focuses on the money supply growth rate, while the latter takes a broader view and assesses whether the current and future macroeconomic developments are in line with the ECB's objective. In this connection, the regular macroeconomic projection exercises conducted by the Eurosystem institutions constitute a key input for the ECB Governing Council's economic analysis. The projections are independently prepared by the staff of the participating institutions and the Governing Council typically takes note of them in the monetary policy decision-making process.

In practice, two large-scale projection exercises are undertaken each year in a coordinated procedure by the ECB and the national central banks. They are finalised in June and in December. The results are published for the euro area and the individual euro area countries. Between those two exercises, smaller-scale intermediate updates are provided by the ECB – with some involvement from the national central banks – in March and in September. These updates are also published under the responsibility of the ECB but only cover developments at euro area level. In addition, some national central banks, such as the Banque de France and the Banco de España, also provide updates for the outlook of their national economies in March and September.

As regards the coordinated exercises in June and in December, the euro area outlook is derived in a bottom-up manner from the projections for the different individual countries made by the national central banks. However, joint ownership of the aggregate results is ensured by various coordination procedures that include peer reviews of the country results, common international and financial assumptions, as well as a trade consistency module. The latter ensures that intra-euro area trade flows are projected in a consistent manner. In addition, common projection guidelines are to be followed, notably as regards the extent to which announced fiscal policy measures can be taken into account.

(1) We would like to thank our ECB colleagues and especially A. Page, G. Kontogeorgos and K. Lambrias for the use of a large database of the Eurosystem projections.

The projection exercises give the outlook for a broad range of macro variables in the current and the next two to three[1] years. Apart from growth and inflation, projections are made for the demand components, the labour market, public finances, the current account, etc. This is important as an assessment of the inflation projections, for monetary policy purposes, requires a correct view on the drivers of inflation and, hence, the broader developments in the economy. In that connection, it should be stressed that not just the numbers of the projections are important, but also the economic story behind these numbers. That is why the publication of the projections – both by the ECB for the euro area results and by the national central banks for the individual country results – typically takes the form of a comprehensive article that describes the outlook in detail[2].

Turning to the specific projections for Belgium, the NBB uses both a set of econometric analytical models and experts' judgement to elaborate the macroeconomic outlook. As regards the former, the workhorse econometric model is Noname (Jeanfils & Burggraeve, 2005), a quarterly, medium-scale, neo-Keynesian model for the Belgian economy. This model is driven by intertemporal optimisation behaviour of representative agents and covers the most important macroeconomic aggregates. It favours a "story-telling approach" and delivers projections that are consistent with economic theory. However, other complementary tools, that provide a more detailed and granular approach, are used for the public finances projections, as well as for the inflation projections, in particular for the short term. In addition, the short-term estimates for GDP growth are anchored to two specific nowcasting models – BREL (Piette, 2016) and R2D2 (Basselier *et al.*, 2017) – that use a very broad range of indicators, including information from surveys and high-frequency hard data, such as on turnover and retail sales. Several groups of experts specialised in different fields are involved in the forecasting process and analyse thoroughly the details and figures derived from econometric models. Expert judgement, that may modify pure model forecasts, is part and parcel of our projection approach.

This article reviews the performance and the reliability of the macroeconomic projections for the Belgian economy since 2001, as produced by the NBB twice a year. It uses a database that includes projections that were released by national central banks and some major international institutions but also the different vintages of data published by the National Accounts Institute (NAI) for the macroeconomic variables on which these projections were based. The article specifically evaluates the forecast errors – defined as the difference between projections and actual values, notably in comparison with other institutions. Further statistical tests are also used to detect an over- or underestimation bias in the NBB projections and to evaluate their directional accuracy. We mostly focus on the projections for GDP and the demand components but provide results for inflation and employment as well. Given the specific rules regarding the public finances projections[3], we do not extend the analysis to the outlook for government deficit and debt.

The findings in this article should be interpreted with some caution : a number of caveats should be mentioned explicitly. First, the period considered is necessarily rather short, especially when sub-sets of the available data are considered, which may limit the statistical significance of the results. Second, the average forecast performance over the whole period is significantly affected by the sharp unexpected decline in economic activity during the great recession. This is not an idiosyncratic feature of the Eurosystem projections. As argued by Alessi *et al.* (2014), the forecast performance during the financial crisis was notably worse than before it but remained comparable to that of other central banks and forecasters. Third, methodological or operational statistical changes can influence the results to the extent that statistics on the (final) outcomes are not produced using the same methodology as the one that applied at the time of the projections. Despite those limitations and notwithstanding the fact that past performance is not necessarily indicative of future results, the findings in this article may be used to fine-tune forecasting approaches.

The remainder of this article is organised as follow. The next section focuses on the NBB projection errors for Belgian GDP growth while the second one compares the forecast accuracy of the NBB with those of other institutions. This is followed by a section that brings together different statistical tests to characterise the projection errors. The fourth section then analyses forecast accuracy in greater detail, namely by looking into the forecast errors for the different components of aggregate demand, as well as those that are caused by the common Eurosystem assumptions. The fifth section compares the forecast accuracy of the Belgian GDP projections with those for the euro area. The sixth and seventh sections then briefly analyse the projection errors for inflation and employment, respectively. The last section concludes and reiterates the key findings.

(1) In the December exercise, the year t+3 is added to the projection period. All the other projections cover the period up to year t+2.

(2) The first article in this Economic Review describes the December 2018 projection results for Belgium.

(3) In accordance with the projection guidelines, fiscal measures are only incorporated if they are already specified in sufficient detail and likely to pass the legislative process. As in most countries, the budget cycle still mainly has an annual frequency, which implies that the public finance projections, in particular for the last few years covered, do not always correspond to a 'most likely' scenario. They only describe the outlook in the absence of additional measures. In reality, such measures can be taken in subsequent budgets, which then modifies the outlook for the budget deficit and public debt.

1. Annual GDP projection errors for Belgium: concept and first assessment

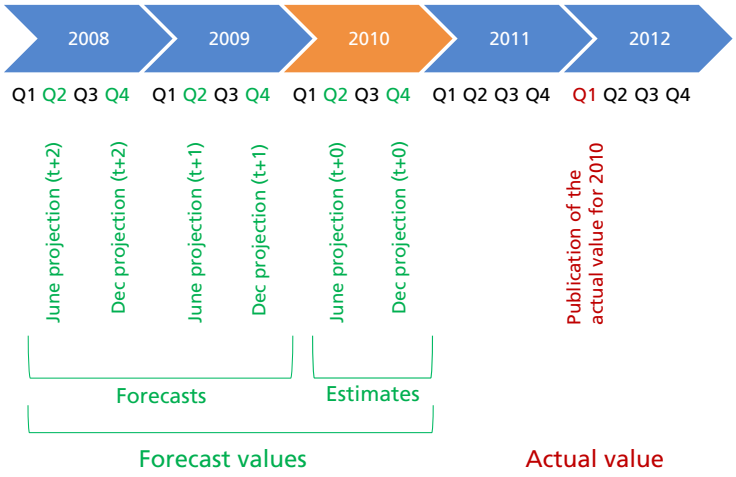
This article focuses on projection errors for Belgium over the years from 2001 to 2017, the period for which published data are available. The main yardstick for measuring projection errors is the *actual value* that the National Accounts Institute supplies for a given time period, less a *forecast value* for that time period. Hence, a negative value attributed to this measure suggests that the variable of interest has been overestimated.

As regards the *actual value*, selecting different vintages of published data can considerably influence the results since published national accounts data can be revised and corrected as more recent and accurate statistics become available. Choosing the final or current statistics as the benchmark typically increases the aforementioned risk that the comparison will be biased by methodological changes in the compilation of the national accounts. Against this background, the actual value for annual data is defined as those data published two years after the year has ended, and, more precisely, the vintage published in the first quarter[(1)]. This choice represents a trade-off between using the first estimates, which are based on relatively little hard data and, thus, potentially subject to significant revisions, and using the most recent releases for the period under review, which might be subject to methodological changes.

The *forecast value* is produced as part of the projection exercise. Projections whose forecast horizon is t+3 are disregarded as they were only introduced in December 2016 (for the requirements of the stress tests for financial institutions), which implies that the evaluation sample is too short. Moreover, it is explicitly acknowledged that projections that are that far in the future come with a very large degree of uncertainty and should be considered more as a technical scenario, rather than an actual forecast. Depending on the forecast horizon under consideration, the forecast consists of the estimated or projected value of a macroeconomic variable for the year for which the forecast was made, the year after or the year after that (i.e. the value up to two years in the future). If one disregards the year t+3, each projection exercise includes two annual forecasts (i.e. t+1 and t+2) and one annual estimation (i.e. t+0) for each variable and, consequently, the variable in each target year has been forecast or estimated six times before the first NAI statistics become available.

CHART 1 NBB PROJECTION EXERCISES FOR THE YEAR 2010

(June and December projections)



Source: NBB.

(1) For the most recent years and quarters, the data availability limits the construction of the error measure and for those cases, the realisation value used is extracted from the most recent available data, as published by the NAI.

A specific example can further clarify the approach. For annual GDP growth in 2010, for instance, the actual value is fixed as the GDP growth for that year published by the NAI in the first quarter of 2012. In order to estimate the maximum (two-year) forecast horizon for GDP growth, we use the growth rate for that year included in the June 2008 (June, t+2) NBB projections. Afterwards, five other projections have targeted the same variable, from the projections published in December 2008 to those in December 2010. As mentioned, forecasts for time periods beyond a horizon of 2 years are disregarded, given their very limited availability, but also because the predictive power of projecting macroeconomic variables that far into the future is low.

Turning to a first analysis of the forecasting accuracy, the mean of the forecast error on GDP growth comes to –0.84 pp for the maximum horizon, which corresponds to the June projection two years before the target year. So, on average, the NBB tends to overestimate GDP growth at this forecast horizon. However, a large part of this bias is caused by the fact that the substantial downturn in the great recession that was not predicted in the years building up to it, neither by the Bank, nor by other forecasters. Excluding the financial crisis (the observations related to 2008 and 2009) would cut the overestimation at longer horizons by about half. For the shorter horizons – i.e. the projections realised in the current year or in December the year before –, the mean error is much smaller and ranges between –0.1 and 0.1 of a percentage point. For the December exercise of the actual year, it falls to just 0.02 pp. This is to be expected, as projections for GDP released in December of the actual year include data, or at least first vintages, that has already been published on quarterly GDP growth for the first three quarters of the target year. Forecast uncertainty is significantly reduced under those circumstances, but not removed altogether due to the unknown fourth quarter figure and data revisions.

TABLE 1 AVERAGE AND ABSOLUTE ERRORS: GDP GROWTH 2001-2017
(in percentage points, annual data in volume)

	t+2		t+1		t+0	
	June	December	June	December	June	December
Average forecasting error						
Mean	**–0.84**	**–0.63**	**–0.45**	**–0.07**	**0.05**	**0.02**
Mean (2008-09 excl.)	*–0.46*	*–0.26*	*–0.10*	*0.17*	*0.05*	*0.02*
Median	–0.37	–0.12	–0.02	0.21	0.10	0.03
Median (2008-09 excl.)	*–0.14*	*0.10*	*0.12*	*0.26*	*0.10*	*0.03*
Absolute forecasting error						
Mean	**1.02**	**0.99**	**1.08**	**0.67**	**0.38**	**0.20**
Mean (2008-09 excl.)	*0.67*	*0.68*	*0.83*	*0.52*	*0.32*	*0.16*
Median	0.59	0.41	0.62	0.56	0.27	0.16
Median (2008-09 excl.)	*0.39*	*0.31*	*0.59*	*0.51*	*0.14*	*0.24*

Sources: NAI, NBB.

Large positive errors can be offset by large negative errors of the same size, resulting in a misleadingly low mean error. It is possible to get round this problem by taking the absolute value of the error and switching to the mean absolute error (MAE). Unsurprisingly, the absolute errors confirm that, as the projection horizon becomes larger, the uncertainty behind the projections increases. The MAE of the NBB projections released in June of the year before and earlier years is approximately 1 percentage point. As regards the shorter horizons, the absolute error comes down to 0.38 and 0.2 of a percentage point for the projections made, respectively, in June and December of the actual year. Again, disregarding the observations corresponding to the financial crisis results in a significantly lower MAE, particularly for longer horizons.

The projection for GDP growth in 2009 released in December 2007 gives an illustration of the importance of the errors caused by the great recession. The absolute error of this forecast worked out at 4.9 percentage points (the forecast

value for GDP growth was 2.3 % while the actual value was –2.6 %). Depending on the horizon, dropping the crisis years from the evaluation sample would reduce the MAE for the entire sample period by 15 % to 35 %. The MAE for the two-years-ahead December projections tripled during the crisis, compared to the pre-2008 figures. Strikingly, in the period 2008-2010, the MAE is first driven by large negative forecast errors due to the unexpected drop in economic activity, but during the recovery phase also by positive forecast errors due to the slightly stronger-than-expected pick-up in growth.

CHART 2 PROJECTION ERRORS: GDP GROWTH

(in %, data in volume)

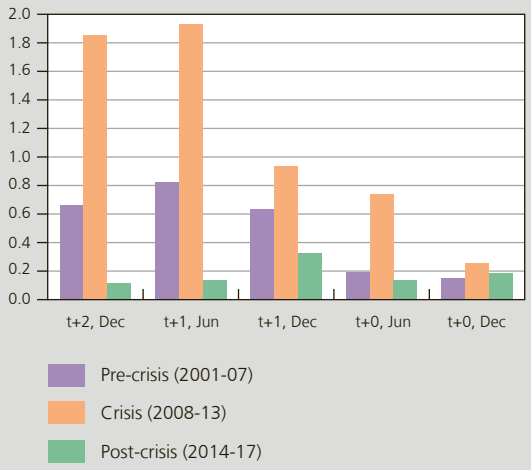
Sources: ECB, NBB.

Calculating the median error can suggest a "typical" forecast error that is not affected as much by outliers in the evaluation sample and, in this case, by the bias introduced by the great recession. When ranked by size, the median of the absolute forecast error falls in the middle of the dataset. Results confirm that, in general, as horizons lengthen, forecast uncertainty increases. However, for horizons beyond a year, the forecast error does not continue to get bigger (as is evident from chart 2). The gap between the median and the mean absolute error widens as the horizon lengthens due to the outliers related to the financial and sovereign debt crises.

All in all, the great recession had a profound effect on the average forecast performance. Against this background, it is worthwhile taking a look at how the projection accuracy has varied over time. To this end, we consider three sub-samples to assess the forecasts, even though this reduces the statistical significance of the evaluation due to the lower number of observations. The crisis-related sub-sample incorporates not only the great recession period itself, but also the consecutive recovery and the European debt crisis. The pre-crisis sub-sample covers the period from 2001 to 2006, while the post-crisis sub-sample spans the years from 2014 onwards. The MAE tends to be lower in the post-crisis period for projections made one or two years ahead and the fact that forecast errors tend to be smaller in recent years is also visible from chart 1. The interpretation of those figures, however, is not straightforward: it does not necessarily mean that the more recent projections are of any better quality. The post-crisis GDP growth rate is significantly lower and less volatile than the pre-crisis growth rate and this needs to be taken into account in the interpretation of the results when comparing the different periods[1]. For the shorter time horizons, the difference between the pre-crisis and post-crisis forecast error appears to be smaller.

CHART 3 IMPACT OF THE CRISIS ON PROJECTION ACCURACY: MEAN ABSOLUTE ERROR FOR THE GDP GROWTH RATE

(in percentage points, data in volume)



Sources: ECB, NBB.

(1) A measure of forecasting error scaled by the standard deviation could be considered as a valid tool in theory, but in this case the low number of observations in the post-crisis sub-sample (only four) makes it difficult to use the standard deviation as a benchmark.

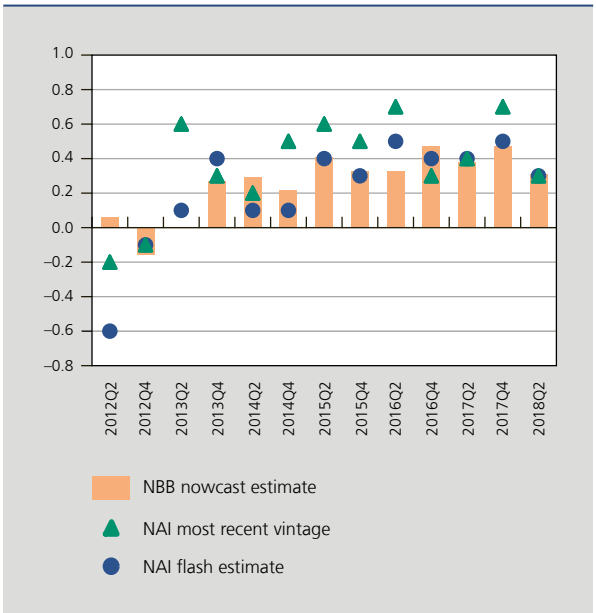
Accuracy of nowcasting models

In addition to the main macroeconometric model, specific tools are used to estimate GDP growth in the short run in the context of the Bank's twice-yearly macroeconomic projection exercises. This is mostly because a broader dataset of high-frequency indicators, consisting of both certain hard data and survey information, is available for nowcasting or short-term estimates. Duly taking these data into consideration is likely to improve forecast accuracy. In practice, the first quarter for which no NAI releases for GDP are available at the time of the projection (this is either the second, for the June projections, or the fourth quarter of the year, for the December projections) is estimated on the basis of short-term indicators and expert judgment. In 2015, the methodology for short-term estimates was revamped and since then, specific formal nowcasting models have been routinely used, even though expert judgment still plays a role, in particular when the estimates from the different models diverge. We specifically use a bridge model with predictor selection, called BREL (Piette, 2016), and a dynamic factor model (Basselier *et al.*, 2017), referred to as R2D2 in its current version, to support our short-term estimates of quarterly GDP growth.

In this box, we briefly look into the accuracy of these estimates using two evaluation benchmarks. The first one is the first quarterly (the so-called 'flash') estimate for GDP, published by the NAI about 30 days after the end of each quarter. The second is the latest vintage of GDP growth for that quarter, which incorporates all currently available information and hence can significantly deviate from the first estimate due to data revisions by the NAI. It should be noted that the current statistics used here are by no means final. GDP growth continues to be revised for figures dating back several years.

QUARTER-ON-QUARTER GDP GROWTH: NBB NOWCAST AND FIRST AND CURRENT NAI STATISTICS (2012-2017)

(seasonally and calendar adjusted volume data, in %)



Sources: NAI, NBB.

A comparison for the recent period shows that the NBB nowcasts tend to be quite close to the NAI flash estimate, while the deviation (i.e. the forecast error) with respect to the most recent NAI statistics can be somewhat more important (as the latter can be quite different from the first NAI statistics). The average forecast error with respect

to the flash estimate is about zero over the period under scrutiny. This implies that the nowcast of the NAI flash estimate of quarterly GDP growth is unbiased, as no consistent over- or underestimation is found. The accuracy of the estimates can be judged by considering the average absolute forecast error over the period. The nowcast generally turns out to be very accurate, with the flash estimate having an average absolute error below 0.13 of a percentage point. Looking at two different sub-periods, the accuracy of the estimates seems to have improved significantly from 2015 onwards, even when no account is taken of the outlier related to the flash estimate for the second quarter of 2012. This could suggest that bringing in the new models has improved the nowcasts, at least with respect to the NAI flash estimate.

When compared to the most recent data vintage, the nowcasts turn out to have a slight downward bias. On average, growth has been underestimated by 0.09 percentage point. The accuracy of the forecasts is also slightly worse, as the average absolute error rises to nearly 0.2 percentage point. Errors have again become smaller in recent years, although this may also be partly due the fact that these quarters have been less subject to statistical revisions.

Overall, the specific nowcasting procedures used in the context of the twice-yearly macroeconomic projections seem to produce satisfactory results, especially when compared with the NAI flash estimate. The clear improvement in forecast performance after 2015 suggests the nowcasting models that were introduced back then are fairly accurate.

2. Comparing GDP different institutions' growth projections for Belgium

This section compares the NBB's forecasting performance for annual Belgian GDP growth with other institutions' results, using the officially published projection figures. The maximum horizon considered in the comparison is the forecast released in the fourth quarter two years ahead of the target year[1]. Projection errors are constructed following the methodology described in the previous section and both the average error and the MAE are used as a gauge[2]. The reference data for the actual value of the variables under analysis are common for all institutions (corresponding to data published by the NAI).

While comparing the forecast performance, differences in the timing of each institution's publication should be acknowledged, as the available set of information at the time of the projection exercise may differ. Having a more up-to-date information set can be a considerable "advantage" for institutions releasing their results at a later moment in time. To minimise the impact of this, we restrict the dataset to projections published in the second and the fourth quarters, as most institutions conduct a projection exercise then[3]. Nevertheless, the comparison must still be interpreted with some caution, as there will still be some timing differences.

2.1 Comparison with the Federal Planning Bureau

Bearing in mind those caveats, the small sample size and the non-adjustment for any outliers during the sovereign and financial crises, an initial comparison can be made between the NBB's projections and those made by the Federal Planning Bureau (FPB). The best basis for comparison is probably the publication by the FPB of the Economic Budget in the second quarter (in place since 2013). As the horizon used by the FPB in this Economic Budget is shorter than in the NBB projections, the comparison is limited to the current and the following year. The comparison of forecast errors between the FPB and the NBB suggests that, over this short period of time, the signs and magnitudes of the forecast errors of the projections released by the Federal Planning Bureau are very close to, albeit slightly larger than, those for the NBB. Overall, the forecasting accuracy of both institutions has tended to be comparable in recent years.

(1) Neither the OECD nor the European Commission conduct projections in the second quarter two years ahead of the target year.
(2) Using the root-mean-square error (RMSE) does not change the conclusions and is less intuitive.
(3) May/November for the European Commission (spring and autumn forecasts), June/November for the OECD (Economic Outlook), April/October for the IMF (World Economic Outlook), June for the Federal Planning Bureau (Economic Budget) and June/December for the NBB (economic projections for Belgium)

TABLE 2 ANNUAL FORECAST ERROR: GDP GROWTH IN 2013-2017

(2nd quarter projection exercise, in percentage points, data in volume)

	NBB		Federal Planning Bureau	
	t+0	t+1	t+0	t+1
	Current year	One year ahead	Current year	One year ahead
Mean error	0.168	–0.163	0.183	–0.177
Mean absolute error	0.168	0.336	0.170	0.368

Sources: FPB, NBB.

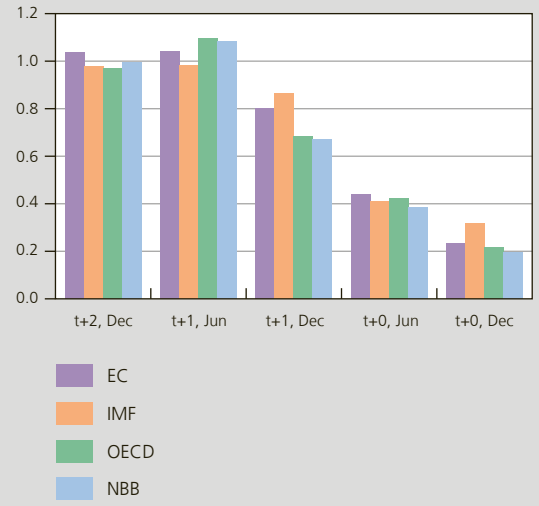
2.2 Comparison with international institutions

The comparison with the other institutions – the OECD, the European Commission and the IMF – can be made on the basis of a larger dataset, both in terms of the evaluation period (2001-17) and projection exercises performed in a comparable timeframe (2nd and 4th quarters).

The results indicate that, for the projections with the shortest horizons – between the 4th quarter of the preceding year and the 4th quarter of the current year –, the NBB's GDP growth projections have the lowest mean absolute error. That being said, differences remain limited and, for example, projection errors for GDP growth estimates produced in December of the actual year (the shortest possible horizon) by all institutions on average do not exceed 0.32 pp in absolute terms. For the longer horizons, the NBB's projections are not better than those of other institutions. The IMF tended to marginally outperform the other institutions for the forecasts produced in the second quarter of the previous year (t+1, June) while the OECD did so for the forecasts produced in the fourth quarter two years ago (t+2, Dec).

CHART 4 ABSOLUTE FORECAST ERROR: ANNUAL GDP GROWTH

(in percentage points, annual data in volume)



Sources: EC, IMF, OECD, NAI, NBB.

However, given the small sample size and the volatility of the underlying errors, the difference in forecasting errors between the institutions is mostly non-significantly different from zero. Overall, the forecast performance appears to be very similar across the institutions.

While comparing averages is informative, important caveats apply. This analysis does not take into consideration, for example, the distribution of the forecast error and therefore the dispersion within the sample. The simple comparison above can be backed up with a test developed by Diebold and Mariano (1995), which assesses the statistical significance of the differences between two forecast series. For GDP growth projections, the conclusion remains robust to the Diebold-Mariano methodology: the NBB forecasts tend to outperform those of other institutions for shorter horizons, while for longer horizons the gap between the institutions is not statistically significant. As regards the NBB's better performance for the shorter horizons, it should be borne in mind that the NBB projections typically come a bit later in the quarter than those by the international institutions and so may be based on a larger and more recent dataset.

3. Additional statistical tests

The forecast errors for GDP growth made by the NBB and the major international institutions can be formally analysed and compared in greater detail by applying standard statistical tests to the sample.

3.1 Unbiasedness

The test of unbiasedness is based on the simple mean forecast errors and aims to detect a systematic tendency to under- or overpredict the variable of interest. The forecast error is regressed on a constant term, as is common in the literature and in similar analyses[1]. The test is performed in a recurrent manner for the projections with a horizon of 0, 1 and

TABLE 3 ADDITIONAL TESTS OF FORECAST ERRORS FOR BELGIAN GDP GROWTH
(annual data in volume)

	Unbiasedness test[1]			Median test[2] (in %)		
	t+0	t+1	t+2	t+0	t+1	t+2
NBB	0.03	–0.25	–0.73***	66.7*	54.8	37.9
OECD	0.06	–0.37	–0.73***	57.6	45.2	33.3
IMF	0.13	–0.33	–0.70***	69.7**	54.8	48.3
EC	0.08	–0.30	–0.64	60.6	51.6	46.7
	Directional accuracy test[3] (in %)			Comparison with naive projections[4]		
	t+0	t+1	t+2	t+0	t+1	t+2
NBB	87.9***	48.4	55.2	0.97***	0.41**	0.27*
OECD	87.9***	45.2	40.0	0.94***	0.40**	0.29
IMF	84.9***	35.5	58.6	0.91***	0.36*	0.28
EC	78.8***	45.2	53.3	0.92**	0.36*	0.22

Sources: EC, ECB, IMF, OECD, NBB.
The significance level: *** indicates a p-value under 1 %, ** a p-value under 5 % and * a p-value under 1 %
(1) Based on coefficients from regressions over a constant term and on the use of robust standard errors.
(2) Based on the percentage of forecasting errors>0 and the exact binomial test.
(3) Based on the success rate – the share of observations for which the projected direction of change matches that seen in the actual value – and the statistical test is a 2-sided Fisher's exact test.
(4) Based on the difference in pp. between the MAE of the naïve projection (previous year growth fixed by the NAI at the time of the forecast) and the institution's projection and on the Diebold-Mariano test.

(1) The regressions are based on robust standard errors and the null hypothesis is rejected if this constant is significantly different from zero, indicating that there may be a bias in the forecast.

2 years ahead of the target year, i.e. combining the spring and autumn projections. The sign of the coefficient specifies the direction of the bias (negative values indicating overestimation).

For real GDP growth, overall, the constant in the regressions tends to become more negative for longer forecast horizons. This confirms the earlier finding that there was a tendency to overestimate GDP growth between 2001 and 2017, which is heavily influenced by the presence of outliers in the sample, caused by the great recession. On the shorter end, there is no strong bias in the projections. The fact that additional short-term indicators such as business or consumer confidence indicators and the first quarterly figures for GDP growth are integrated into those projections obviously reduces the average bias.

On average, all institutions have over-predicted GDP growth for the two-years-ahead projections, as confirmed by the test of unbiasedness. For shorter horizons, the bias was not significantly different from zero and the NBB's projections had the lowest bias among the four institutions.

3.2 Median test

The median test checks whether the median of the forecast errors is significantly different from zero[(1)]. The key objective is to determine whether the forecast errors have been positive and negative in equal measure while disregarding the size of the error. A neutral forecast exercise is not expected to be systematically in favour of either an overvaluation or undervaluation (i.e. 50 % of the errors are positive).

Overall, the median test shows that the median forecast error remains close to zero and that the signs of the errors are, more or less, equally likely to be positive or negative. However, looking at specific horizons, the forecasts made in the current year often show a positive error. So, these projections have generally tended to be too pessimistic. However, the imbalance is related to a specific period and seems to stem mainly from a persistent under-estimation of the recent economic recovery (2013-2017).

This does not relate to specific errors in the NBB projections as the other institutions exhibit a comparable profile across the forecast horizons under analysis. While more than half of the projections targeting the current year tend to be associated with a positive forecast error, more than half of the projections made two years ahead tend to have a negative forecast error. To some extent, the different institutions are leaning towards an underestimation for the short-term horizons but an overestimation in the two-years-ahead projections.

3.3 Directional accuracy

The test for the directional accuracy does not focus on the value of the forecast but rather on the *change* in the projected variable. In other words, it aims to check whether the predicted direction taken by the variable of interest (increase or decrease of the variable) is the right one rather than measuring the size of the error. The test result is expressed as a "success rate", which is defined as the share of observations for which the projected direction of change in the variable in question matches that seen in the actual figures. For the NBB, the preceding year projections or the two-years-ahead projections for GDP growth turn out not to be significantly different from 50 %, meaning that the projections do not fare any better at predicting accelerations or decelerations of GDP than a simple flip of the coin. The success rate for the projections for the actual year's GDP growth is much higher: in 87.9 % of the cases, the predicted direction was confirmed by the direction of the actual figure. Reaching strong results for short horizons but a poorer performance for longer horizons is relatively common in similar studies on forecasting performance.

The results of the other institutions show a similar picture, although their success rate seems to be slightly lower, on average, than that of the NBB.

3.4 Performance against a naive projection

Forecast performance can also be tested against a simple benchmark model: a naive projection, such as, for example, the GDP growth figure of the previous year at the time of the projection. The question then becomes: "is the projection

(1) The 2-sided p-values are calculated using the exact binomial test, with the null hypothesis being a perfectly balanced sample between positive and negative errors.

released by the institution more informative of the future than simply taking the growth rate of the previous year?". Even though this type of test is relatively common, the results should be interpreted with caution as naive projections are not conditioned on external assumptions and do not require the baseline projection to follow a consistent economic scenario or to comply with some technical assumptions.

The test results indicate that the projections made by all institutions produce better results than the naive ones. The mean absolute forecasting error of the naive projection appears to be higher than NBB projections for each horizon considered. However, the difference in MAE shrinks with the forecast horizon because the MAE associated with the naive projections is quite stable, whereas the MAE of the NBB is rising. The simple comparison between averages can be backed up with the Diebold-Mariano test, which checks whether the expected difference between the NBB forecast and the naive projection is relatively small. The test results show that the two are not equal and that the mean absolute errors associated with the naive projections tend to be significantly higher than those associated with the NBB projections for every horizon. This conclusion also holds for other institutions for the horizon t+0 and t+1, but NBB projections are the only ones to beat the naive forecast by any significant margin at the t+2 horizon.

4. Aggregate demand components and importance of common Eurosystem assumptions

4.1 Aggregate demand components

As already indicated, a typical projection exercise consists of a complete and consistent economic scenario incorporating notably variables characterising the real economy, public finances, the labour market and price dynamics. More specifically, projection exercises not only include forecasts for GDP but also for the demand components, such as private consumption, investment, etc.

Interestingly, on average, projections for GDP growth tend to be more accurate than projections for major demand components, implying that positive errors made in forecasting certain demand components tend to be offset by negative errors made in forecasting other components. The findings indicate that NBB projections were generally too pessimistic for business investment growth for the shorter forecast horizon but too optimistic about developments in private and public consumption.

As errors for more volatile series (e.g. business investment or exports) are compared to time series that are more stable (e.g. private consumption or GDP), it may be worthwhile controlling for this volatility by scaling the absolute error using the standard deviation of the underlying variable and therefore by constructing the scaled MAE. The more volatile series are marked by a relatively high standard deviation, so using the standard deviation as a scaling factor could give a more comparable indicator of forecast accuracy.

Two conclusions emerge. On the one hand, based on the scaled MAE, both private and public consumption are singled out as variables with a relatively large forecast error. Regardless of the forecast horizon, there is a tendency to overestimate both private and public consumption growth. This is consistent with and may be caused by the errors on real disposable income, which is a measure of households' purchasing power and a key determinant of private consumption. Another variable which tends to be overestimated is public investment.

On the other hand, projections for business investment seem to be among the most accurate in relative terms as the scaled MAE is somewhat lower, especially in the short run. However, the results for the simple average error indicate a tendency to underestimate the variable for shorter forecast horizons. This is partly related to a number of large specific transactions made recently, notably important purchases of investment goods (mostly vessels and immaterial assets) abroad. These specific transactions are difficult to foresee and have significantly boosted investment growth but have not affected GDP growth (as they were offset by imports).

TABLE 4 NBB PROJECTION ERRORS: BELGIAN GDP COMPONENTS

(2nd quarter and 4th quarter projections exercises are aggregated, data in volume)

	Mean Error			Scaled Mean Absolute Error[1]		
	t+0	t+1	t+2	t+0	t+1	t+2
GDP	0.03	–0.25	–0.73	0.22	0.65	0.73
Private consumption	–0.03	–0.27	–0.72	0.69	0.80	1.06
Public consumption	–0.29	–0.58	–0.75	0.77	0.88	1.04
Gross fixed capital formation	0.35	0.13	–0.52	0.41	0.68	0.71
Business investment	0.41	0.42	–0.21	0.44	0.72	0.78
Public investment	–0.49	–0.67	–1.11	0.69	0.75	0.92
Housing investment	0.33	0.06	–0.55	0.67	0.76	0.71
p.m. Real disposable income	*–0.05*	*–0.51*	*–0.84*	*0.70*	*0.75*	*0.92*
Net exports[2]	–0.02	–0.20	–0.16	0.68	1.00	0.83

Source: NBB.

(1) Rescaled based on the standard deviations of the underlying variables.

(2) In percentage points.

4.2 Influence of external assumptions

In line with the Eurosystem projection guidelines and procedures, the NBB's projections are based on set of common external and financial assumptions (with a view to enhancing the consistency of the forecasts across the countries of the euro area). These assumptions are defined commonly by and for all participating institutions.

The contribution to the forecast errors coming from errors in the common assumptions can be approximated using the basic features of the Noname macroeconometric model used for the projections. The projection can in particular be reproduced using the actual values of the variables covered by the common assumptions (oil prices, external demand, interest rates, etc.). It should be stressed that this is only a rough mechanical approximation of the contribution of errors in the common assumptions to the forecast errors, as it assumes, among other things, that the expert judgment added to the model outcomes would have been identical for an alternative set of common assumptions, which in actual practice might not have been the case. In addition, the set of common assumptions has been expanded and refined throughout the years, something that should be borne in mind when comparing their contribution to the forecast errors over time: in principle, a larger part of the error can be traced back to the common assumptions in more recent years, simply because there are common assumptions for more variables now.

The results indicate that if one use conventional Noname model elasticities, forecast errors for Belgian GDP growth are to a large extent driven by the common Eurosystem assumptions for the one-year-ahead and two-years-ahead projections[1]. The part of the error that is not explained by the external assumptions – the residual error – does not constitute the main part of the total error on average. As regards the projections published in June of the preceding year, for instance, the common assumptions, on average, account for about two-thirds of the total forecast error. The longer the projection horizon, the bigger the contribution of the assumptions is.

In the one-year-ahead and two-years-ahead projections, the foreign demand assumptions, in particular, have significantly contributed to the forecast errors. In this connection, one should keep in mind that the forecasts on foreign demand are not only targeting global growth but also its trade intensity and this makes it especially difficult to accurately predict the foreign demand indicator. This assumption seems to have an important impact on the forecast error especially around major turning points in the business cycle (see for instance its contribution to forecast error in 2009). Remarkably, foreign

(1) The current-year projections are not taken into account as the common assumptions are less relevant for the shorter time horizons, that also rely, for instance, on specific nowcasting models that are less directly connected to these assumptions.

demand has been almost persistently overestimated in the last few years, which has led to an overly optimistic view on GDP growth and therefore a negative forecast error between 2012 and 2016. As a consequence, the common assumptions on foreign demand and, more specifically for the Belgian projections, the forecast growth of Belgian export markets have been gradually revised downwards.

CHART 5 EXTENT TO WHICH THE GDP FORECAST ERRORS CAN BE ATTRIBUTED TO THE COMMON EUROSYSTEM ASSUMPTIONS

(Estimated using basic Noname model elasticities)

Sources : ECB, NBB.

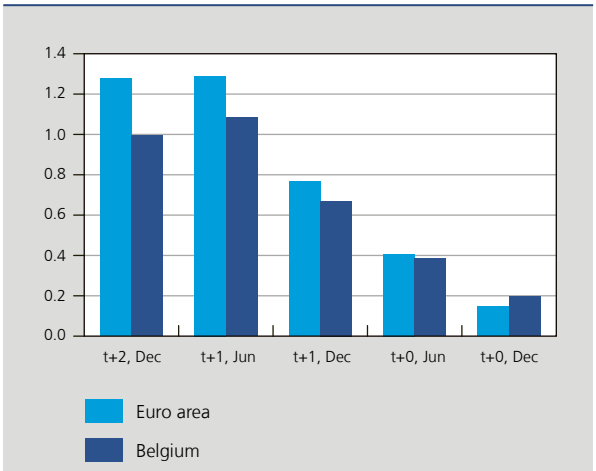
However, despite a relatively large contribution of the foreign demand hypothesis to forecast errors in absolute terms, the most recent years are characterised by low projection errors. Part of this can be attributed to the fact that the latter effect was offset either by the residual or by other variables that turned out to foster GDP growth more than initially expected (e.g. low oil prices). In 2015, for example, compared to what was taken into account in the June forecast of 2014 (t+1, June), oil prices had fallen more than expected and the euro had weakened by more than anticipated against the US dollar. This was unexpected and had a positive effect or contribution on the overall forecast error, indicating that this could have led to an underestimation of GDP growth. However, because actual foreign demand was generally weaker than expected, the overall error was low. While the offsetting contributions of errors in different individual assumptions may simply be down to 'good luck', the offsetting contribution of the residual error, that has typically helped keep the forecasting error low in the one-year-ahead projections for recent years for instance, may suggest that expert judgment was at times used to attenuate the impact of the assumptions (because of perceived risks related to either those assumptions or the mechanically estimated impact of them in the recent period).

5. Projections for the euro area

As is the case for other national central banks' projections, the NBB's macroeconomic projections are integrated into an overall euro area forecast. Formal and informal interactions among the participating institutions ensure that the country aggregate reflects the area-wide scenario and is jointly owned by all participating central banks[1]. Note that, due to the euro area enlargement, more countries are involved in the euro area projection exercises at the end of the period under analysis than at the beginning.

CHART 6 MEAN ABSOLUTE ERROR: ANNUAL GDP GROWTH

(in percentage points, available Belgian obs. & corresponding EA obs., balanced sample)



Sources: ECB, NBB.

The forecast accuracy for Belgian GDP can be compared with that for the euro area GDP. To have an idea of where the Belgian forecast accuracy ranks alongside other member countries, the mean absolute error for euro area GDP growth over the period 2001-2017 can be compared to the corresponding error for Belgian GDP growth predicted by the NBB[2]. The euro area GDP growth forecasts seem to have slightly fewer errors than their Belgian counterparts at the shortest horizon but exhibit a clearly larger forecasting error for longer horizons.

(1) For further details about the Eurosystem/ECB staff macroeconomic projection exercises, see the ECB website (https://www.ecb.europa.eu/pub/projections/html/index.en.html)

(2) One should remain cautious about the comparison between countries when considering an indicator scaled with the standard deviation of the underlying variable as it remains heavily influenced by outliers and in this case by the crisis episodes.

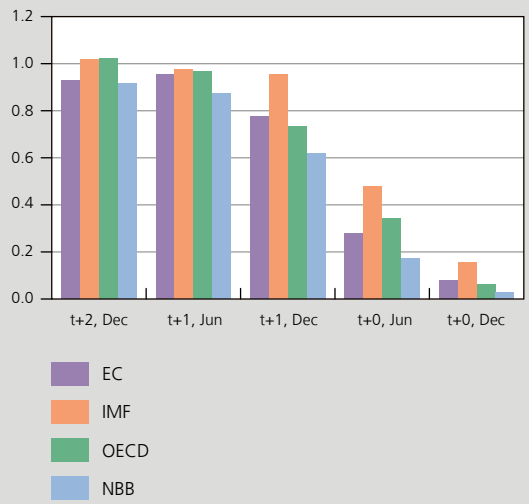
When comparing the forecast accuracy for Belgium and the euro area, it should be kept in mind that forecast errors for the latter can be reduced by the fact that, especially given the decentralised nature of the actual projection procedures, overestimations for certain countries can be partially offset by underestimations for other countries or vice versa. This may in particular be an issue for the shorter horizons as the longer-term projections depend to a greater extent on common assumptions. At the same time, it should be acknowledged that, since the great recession, the volatility in euro area GDP has been somewhat larger than for Belgian GDP. This may imply that euro area growth is more difficult to predict than Belgian growth.

6. HICP inflation

As price stability is the ECB's objective, the accuracy of inflation projections is particularly important. Forecast accuracy for inflation should in principle be better than for GDP and not be compared to it as inflation statistics are available on a monthly basis, which is not the case for GDP. This also implies that small differences in the timing of publication can significantly affect forecast accuracy, in particular for the shorter time horizon, as more recent projections may be based on more monthly statistics.

Bearing this caveat in mind, it should be stressed that the MAE of the NBB inflation projections is typically clearly lower than that in the international organisations' projections, when comparing again the projections produced and published in the second and fourth quarter of each year. This applies to all projection horizons, but the difference is larger for the shorter horizons. For the projection for the current year published in June, the NBB's MAE is only about 40 % of the one associated with the three other institutions and for the December exercise, this even drops to about 20 %.

CHART 7 MEAN ABSOLUTE ERROR: ANNUAL HICP RATE
(in percentage points)



Sources: EC, FPS Economy, IMF, OECD, NBB.

The median test and the unbiasedness test both show that the NBB projections are tilted towards positive forecast errors when the forecasting horizon widens (i.e. a tendency to underestimate inflation, unlike the projections for euro area inflation) and towards zero for shorter horizons. The directional test indicates a relatively high success rate for the nowcasting exercises and confirms the ability to predict turning points to a certain extent. All in all, the inflation projections published by the NBB are quite accurate, particularly for the shorter horizons, both in absolute terms and relative to other institutions.

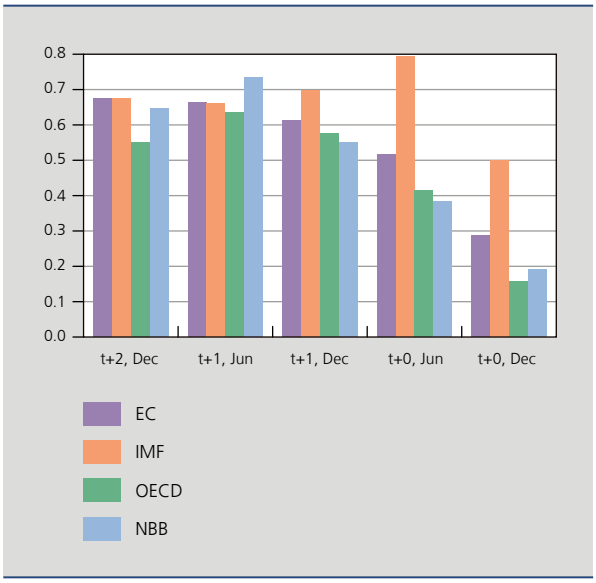
7. Employment growth

Employment is obviously also a key variable in the macroeconomic projections. As before, issues related to the timing of publication play a key role in explaining the differences in forecast accuracy between the institutions.

For longer horizons (t+2, Dec and t+1, Jun), the OECD projections have the lowest MAE. For shorter horizons, the NBB and OECD forecasts tend to be more accurate and are relatively close. From a general perspective, the MAE of employment growth improves more gradually as horizons shorten than those for GDP and errors on employment growth exhibit a somewhat "flatter profile". For the NBB, for example, the MAE for the December projections for the actual year is about one-third of the MAE associated with December projections two years ahead. For GDP growth, the MAE falls to one-fifth.

CHART 8 MEAN ABSOLUTE ERROR: ANNUAL EMPLOYMENT GROWTH

(in percentage points)



Sources: EC, IMF, NAI, OECD, NBB.

The additional tests suggest that the NBB projections for employment growth tend to be positively biased for the current-year and one-year-ahead horizons. This suggests a tendency to underestimate employment growth. Remarkably, the forecast error on employment growth between 2015 and 2017 has been positively biased, while a similar positive bias has not been observed in the same magnitude for GDP forecast at the same time. This suggests that we have recently clearly underestimated the employment intensity of growth. This may be related to a larger-than-expected impact of the labour cost moderation policies, as well as the structural reforms on the labour market. Finally, the directional accuracy seems to be significantly higher for the projections on employment growth than for other macro variables.

Conclusion

This article has assessed the accuracy of the NBB's twice-yearly macro forecasts for Belgium in the context of the coordinated Eurosystem projection exercises that form a key input for monetary policy decision-making in the ECB's Governing Council. A number of general conclusions can be drawn. Absolute yardsticks for projection errors are difficult to establish: how large is an 'acceptable' forecast error? Hence, projection accuracy is best assessed in relative terms, i.e. for different projection horizons, in terms of change over time or in comparison to other forecasts.

The GDP growth projections are obviously more accurate for the shorter horizons than for longer time periods. For the evaluation period considered, the forecast accuracy was significantly reduced by the great recession episode in particular. Disregarding the forecasts for 2008 and 2009 substantially reduces the average and mean absolute errors. The most recent projections, dating from the period after the great recession, tend to be marginally more accurate than the pre-crisis ones but this may simply because GDP growth has recently been less volatile and, hence, easier to predict. Regarding the very short run, GDP estimates for the first quarter of the projection horizon are estimated on the basis of short-term indicators and expert judgment and seem to produce satisfactory results, especially after the introduction of specific nowcasting models. When comparing forecasts that are published around the same time, the NBB projections for Belgian growth tend to be at least as accurate as those in the June Economic Budget prepared by the Federal Planning Bureau. In addition, the accuracy of the NBB forecasts is broadly in line with that of the projections of the major international organisations if a longer forecast horizon is considered, but somewhat better in the case of a shorter-term estimates. The differences in the timing of publication, however, may affect the comparability between institutions and some caution is warranted when interpreting the results.

With respect to the demand components of GDP, the forecast error associated with the aggregate measure of GDP growth tends to be smaller than for the individual components. In other words, any overestimation of certain components is offset by an underestimation of others. Remarkably, private consumption has been regularly overestimated and business investment underestimated. After taking into account the volatility of the underlying variables, private consumption stands out as the variable for which forecasting accuracy should be further improved, in particular for the shorter forecast horizons.

In accordance with the Eurosystem projection guidelines, the NBB projections need to be anchored to a set of common assumptions (regarding the oil price, external demand, interest rates, etc.) determined at the level of the Eurosystem. We show that the forecast errors in the evaluation period can be mostly traced back to errors in these common assumptions, notably related to Belgian export markets. The recent improvement in accuracy of the GDP projections can also be interpreted in this way : the overestimation of foreign demand has been offset more by either other exogenous variables that turned out to be more favourable for growth than assumed (such as the oil price in the 2015-2016 period) or by the residual error, which may be related to expert judgment.

Turning to inflation, the NBB projections clearly outperform those of the international institutions at every projection horizon, but even more so for the shorter term. Finally, while the labour market projections are no less accurate than those made by other international organisations, employment growth has recently been underestimated in the NBB projections. This may be related to a stronger-than-expected impact of the structural reforms and the wage cost moderation policies.

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Productivity slowdown : findings and tentative explanations

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Introduction

For many years now, potential growth has been slowing down in the advanced economies. Growing attention is therefore being paid to the determinants of growth. As the cumulative effects of productivity are the only source of long-term growth, many institutions are concerned about them. For instance, it is striking to see that, in a general context of accelerating technological progress and contrary to what was observed during previous waves of technological change, the latest shifts in technology are failing to be translated into measurable productivity gains.

The objective of this study sheds some microeconomic light on the analysis of the trend in productivity, complementing the macroeconomic analyses that indicate Belgium's position in relation to other advanced economies. This makes it possible to find out more about the sources of productivity growth as well as identify, by means of a series of growth breakdowns, some of the causes of the slowdown that has been at work since the beginning of the 2000s.

This article is structured as follows : the first part examines the various approaches that can be followed to measure productivity. The second part briefly reviews the literature and highlights some of the recurrent findings about the determinants of productivity. The third part puts Belgium's performance into an international perspective, while the fourth gives a series of analyses based on microeconomic data. Based on information from the annual accounts of Belgian firms from the market sector, an estimation of total factor productivity at the individual firm level then helps identify the sources of changes in aggregate productivity growth. It consecutively presents breakdowns by branch of activity and by Region, the different sources of productivity growth and company performance at the top of the productivity distribution as well as the performance of so-called zombie firms. The findings of a multivariate analysis of the determinants of firms' productivity round off this section. Lastly, the conclusions set out all the key messages that emerge from the analysis of the micro data along with some economic policy recommendations.

1. Different concepts for measuring productivity

In practice, there are two distinct concepts for measuring productivity. The first is apparent labour productivity. This is the quantity of value added generated by a worker (either in terms of full-time equivalents, or by hours worked). While this measure has the advantage of being easy to calculate, it only takes the 'labour' input into consideration, neglecting the contribution of capital stock to the firm's production. According to this approach, a company that either produces more for a given level of employment or maintains its current production level by using less labour is more productive.

(*) The authors would like to thank E. Dhyne for his expertise in using and analysing microeconomic databases.

Productivity gains thus depend exclusively on better use of the factor labour. However, value creation not only depends on the number of hours worked or on the number of workers employed in a company. It is therefore preferable to use an indicator that reflects the way in which all the factors of production mobilised by the firm contribute to wealth creation. This is the case with the second concept of productivity, namely total factor productivity (TFP).

The first research paper on measuring TFP was published back in 1957 by Robert Solow. His article was part of a wider range of theoretical thinking on aggregate growth components, among which TFP very quickly proved to be essential. After that, a wealth of writing has put the emphasis on the determinants of TFP and on measuring it.

Conceptually, TFP captures the efficiency with which certain inputs (capital and labour, for example) are transformed into outputs (like value added) (see the methodological annex for more details on how we estimate TFP). It represents the change in value added that cannot be explained by changes in the quantity of capital and labour. If a firm knows its own efficiency level, on the basis of which it makes its investment or human resources choices, TFP is not directly observable by economists, who therefore have to estimate it. Empirically speaking, TFP is measured as the residual of a production function. It is regularly considered as a measure of our ignorance of the growth process.

As a residual, TFP can capture other phenomena than technological efficiency. It will thus partly include effects of measurement errors for both value added and the inputs mobilised to generate it, but since these errors are assumed to be random, their occurrence should not affect aggregate trends. Ideally, productivity should be calculated from data expressed in real terms and not influenced by the firm's pricing decisions. Therefore, a series of firm-level price indices would be required to be able to deflate the nominal variables of the production function correctly. Yet all the economist has, at best, are sectoral deflators. Estimated TFP thus partly captures a firm's relative price changes compared with those charged in its branch of activity, and a sharp rise in prices can thus be wrongly perceived as an increase in productive efficiency, while it may just simply reflect an increase in the firm's market power, for instance. So, a degree of caution is in order when it comes to analysing TFP.

Generally speaking, it appears that trends in TFP and apparent labour productivity are fairly comparable. So, in this article, TFP is used as this concept gives a better idea of the productivity of all the inputs mobilised by companies.

2. Literature review

A broad spectrum of the literature in this area endeavours to bring to light a series of levers aiming to improve corporate productivity. This part outlines some of the features of companies that are frequently considered as conducive to fostering high levels of productivity. Certain factors related to the environment or the regulatory framework can also make a contribution.

First of all, productivity levels of firms that trade with the rest of the world, and which are consequently more deeply integrated into global value chains, turn out to be higher (De Loecker *et al.*, 2012). Company performance is correlated with the presence of foreign firms and with the level of trade conducted with them, although nothing can be said about causality. Effectively, selling abroad involves certain additional costs that only the most productive firms can bear (Melitz, 2003). Through their active presence on foreign markets, exporting firms are confronted with other competitors or different technologies, which, in turn, could also bring productivity gains due to involvement in international trade. However, there is less evidence of learning by exporting than that pointing to self-selection for export. Moreover, it appears that it is the large enterprises that are driving productivity growth, as other firms do not perform as well (Fuss and Theodorakopoulos, 2018).

Innovation and use of new technologies (ICT) are vectors of productivity gains, both directly, for the company that generates them, and indirectly, in benefiting from spillover effects from an innovative environment (Hall *et al.*, 2012, in Skorupinska and Torrent Sellens, 2014). The TFP elasticity of the share of total sales generated by innovations is positive and even greater in the case of a capital-intensive branch or one specialising in high-tech products (Hall, 2011).

The integration of ICT into production should be a major vector for improving productivity. But despite the more intensive development of these technologies, their effects on economic growth are quite hard to identify from a statistical point

of view. This observation, better known as "the Solow paradox" ("You can see the computer age everywhere but in the productivity statistics", Robert Solow, 1987), is recurrent and insists that the decline in productivity growth is concurrent with the development of these new technologies. Since then, a large part of the literature has focused on the effects of new technologies on aggregate growth.

As far as Belgium is concerned, a recent study points up the positive influence of investment in ICT on TFP growth between 2004 and 2013, a period for which the authors have data on this type of investment (Dhyne *et al.*, 2018). According to this research paper, this type of investment may help explain as much as 17 % of the TFP dispersion. The reallocation of IT capital in the Belgian economy has also helped to raise its efficiency over this period. But companies are not all equal when it comes to this type of investment or the resultant profits. The marginal product of IT capital is higher in industry than in services. Besides, large enterprises benefit more from this type of investment.

Next, it appears that staff skill levels and, more broadly, the quality of human capital affects firms' productivity. A skilled workforce is often associated with higher productivity levels (Skorupinska and Torrent Sellens, 2014). Conversely, the integration into the labour market of relatively less-skilled workers, whose productivity is lower, can have a negative effect, although temporary, on aggregate productivity (Walkenhorst *et al.*, 2017).

The general framework in which companies develop will exert some influence on their productivity, too. In particular, laws and regulations have an impact on productivity. It is easy to understand why a high degree of competition should enable the most productive firms to expand their market share ; this is also an incentive for companies to innovate, which can make them more efficient. It has been proved empirically that unfavourable regulations, as measured by the OECD's PMR indicators, can slow down the pace at which the less productive firms catch up with the best-performing countries (Nicoletti and Scarpetta, 2003). A more recent study claims that competition-stifling regulations constrain TFP growth, and especially that of companies near the technological frontier (Bourlès *et al.*, 2013). A lot of analyses generally tend to show that fiercer competition within a branch leads to a rise in its productivity.

Acting in a complementary way, the existence of adequate infrastructure, transport infrastructure for example, is crucial for productivity (Bronzini and Piselli, 2009), since it contributes to efficient allocation of the economy's resources. An analysis devoted to retail trade in the United States in the 1990s argued even back then that an increase in productivity was also determined by the reallocation of resources from less productive establishments towards the most productive ones, notably in companies from the same branch, as well as by firm creation and destruction dynamics (Foster *et al.*, 2006). So, there are several mechanisms through which the economy's efficiency can be improved.

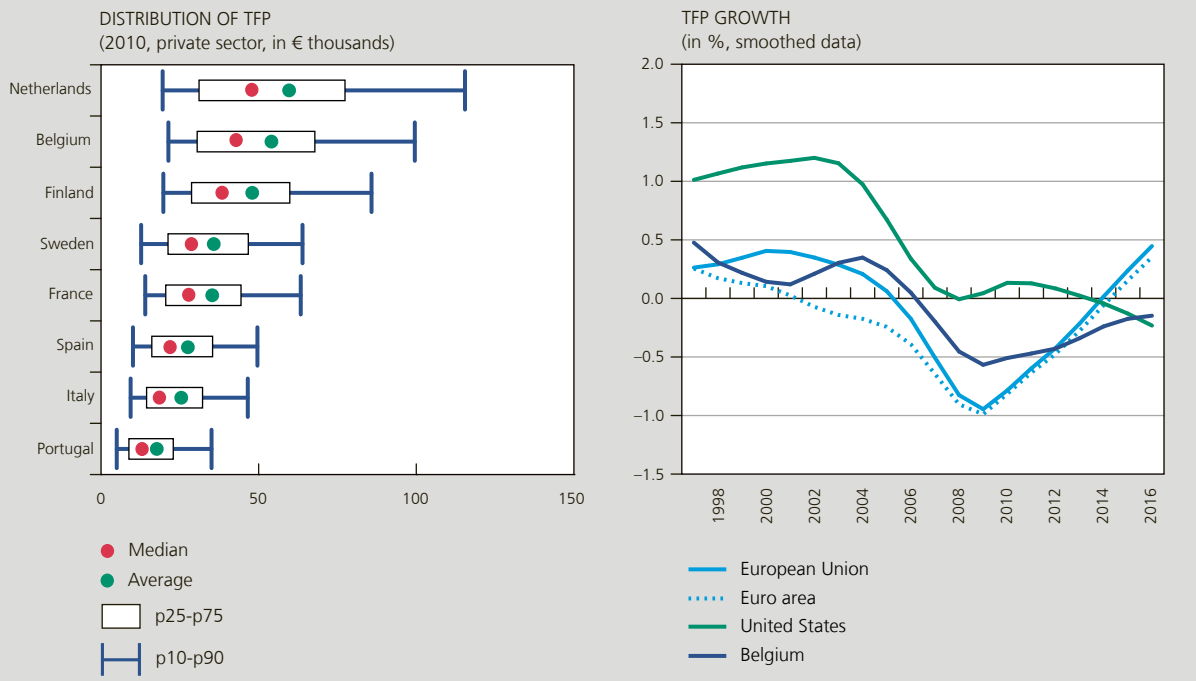
The literature also shows that differences between firms in terms of productivity are relatively persistent over time and higher productivity reduces the probability of firm exit (Farinas and Ruano, 2005). Building up productivity gains over the years is a necessary condition for, but not necessarily enough to ensure, the survival of businesses.

3. International comparison

Data on the distribution of TFP gathered by the CompNet network reveal a high average productivity level among Belgian firms. But they also show that performance varies widely among them. In Belgium, the most productive firms are at the European technological frontier – that is to say, they are the best achievers of their branch of activity at international level – but they sit alongside a large number of companies that perform well below the average for their branch.

Overall, the trend in TFP is quite comparable in Belgium, the EU and the euro area. As early as the end of the 1990s, a slowdown in the trend rate of growth was observed, bottoming out in 2009. When it was at this trough, TFP growth was –1 % in the EU and the euro area and –0.6 % in Belgium. It has been constantly gathering pace since then, but the post-crisis recovery has been less robust in Belgium than on average in the rest of Europe. Since 2012, the growth differential between Belgium and the EU has been constantly widening. According to these figures, TFP growth was even permanently negative in Belgium in 2016, while it wasn't in the European reference zones.

CHART 1 THE MOST PRODUCTIVE BELGIAN FIRMS ARE AMONG THE MOST EFFICIENT IN EUROPE, BUT THERE ARE SIGNS OF A WIDESPREAD SLOWDOWN OF PRODUCTIVITY GROWTH, THAT HAS BEEN MORE MARKED IN BELGIUM



Sources: CompNet, Conference Board.

4. Analysis of Belgian micro data

Aggregate TFP growth can be calculated both on the basis of macroeconomic data and from estimates of productivity at individual firm level, by using microeconomic information disclosed in the annual accounts of companies. It is this approach that will be used in the rest of this article. The sample consists of the annual accounts filed by Belgian firms between 1996 and 2016. In the absence of comparable data for other countries, this analysis is limited to Belgium.

Although the aggregate growth rates obtained using this approach are generally higher than those cited in the last section [(1)], the findings [(2)] confirm the trends pointed up by the macroeconomic data analysis. In line with these data, TFP growth started to slow down well before the financial crisis. It fell back down to its lowest level at the height of the crisis and then started rising again. At the end of the observation period, it was back to its pre-crisis level, but the relatively high growth rate in 2016 was partly due to the exceptionally good performance of a handful of companies that year. This finding will have to be confirmed when data for the year 2017 are available. Nevertheless, on average over the period 2012-2016, TFP growth remained below the average figure recorded between 1997 and 2007.

4.1 Trends by branch and by Region

The available accounting data make it possible to group firms together according to different criteria and thus to measure the performance of certain groups of companies. In this way, the sample of firms can be split up according to branch

(1) The differences between the two approaches arise partly from sampling constraints when estimating a Cobb-Douglas production function using microeconomic data. That means leaving out a series of observations for technical reasons (missing employment figures, negative value added, etc.), while for macroeconomic estimates, these data left out of the micro analysis are absorbed into the aggregate series. The macroeconomic estimates also cover the contribution of other branches of the economy (like the public sector) which have been excluded from the micro analysis.

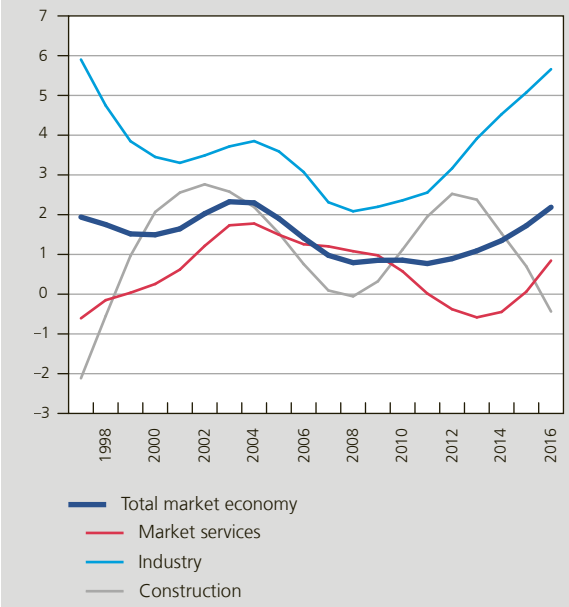
(2) These are smoothed results, given that aggregate growth calculated on the basis of micro data presents a much more volatile profile than the macroeconomic estimates.

of activity. For methodological reasons, observations on firms that have changed branch of activity (defined at NACE 64 level) have been excluded from the analysis for the year in which the change was made.

The slowdown of the productivity growth rate, which could already be observed before the crisis, turns out to be a widespread phenomenon for all branches. This has in fact been noted since 2003 in construction and since 2005 in industry and in market services, the slowdown of productivity growth in this latter branch continued up until 2013. The recovery that emerged at the end of the period will have to be confirmed later.

CHART 2 TFP GROWTH IS HIGHER IN INDUSTRY THAN IN MARKET SERVICES

(TFP growth in %, smoothed data, NACE branches 10 to 82)



Source : NBB.

It is also worth noting that the TFP growth rate in industry is above that of market services and construction for the whole period under review. Industrial firms seem to be capable of improving their production processes more easily than services companies, whose sources of internal productivity growth are traditionally more limited. Similar results were put forward in a study from the Federal Planning Bureau (Kegels and Biatour, 2017), which underlines the high productivity growth rates[1] in industry between 2000 and 2015, and in particular during the post-crisis period. This analysis shows that, on average between 2000 and 2015, the productivity growth rate in industry was more than three times higher than that in market services. These structural differences in productivity growth thus imply that the shift towards the tertiarisation of the economy, which raises the share of services in the total economy to the detriment of industry, weighs down on aggregate TFP growth.

The data also enable a regional analysis of TFP growth to be made. To this end, each firm is associated with a Region on the basis of the last available location[2] of their head office. These findings should nevertheless be interpreted with great caution, given that a very large number of firms set up their head office in Brussels because of its status as a capital Region, without necessarily conducting most of their business there.

(1) In this study, the productivity concept used was apparent labour productivity.
(2) In this way, problems stemming from a firm moving from one Region to another can be avoided.

The breakdown by Region indicates that, in the productivity stakes, Flanders seems to be more rapidly affected by the economic climate than Wallonia. So, the post-crisis recovery began sooner in Flanders (from 2010) than in Wallonia (from 2012 on). Despite this lag of about two years, TFP growth has been quite comparable between these two Regions since 1997.

Productivity growth appears to be relatively less dynamic in the Brussels-Capital Region than in the other two Regions. This can be explained by the predominance of market services in this Region, together with generally negative productivity growth in this branch in recent years.

4.2 Breakdown of productivity growth

Within the same branch or Region, the sources of TFP growth can be very different. More precisely, two sources can be identified.

The first one, referred to as internal growth, consists of an intrinsic rise in productivity within the firm. This dimension captures all decisions taken by the company with a view to boosting its productive efficiency, by improving existing production processes or by developing new processes, by improving the intrinsic quality of its inputs, etc.

The second, called external growth or reallocation of resources, covers all changes in productivity following a transfer of factors of production between firms. It captures the fact that an optimum allocation of resources implies transferring factors of production from less productive firms to more productive ones. So, the best firms can expand while the not-so-good ones shrink, leading to a pick-up of productivity at aggregate level.

This second dimension can itself be broken down into three sub-dimensions:

- intrasectoral reallocation: this is the effect of transferring resources within a branch of activity on aggregate productivity. In order to make a positive contribution to aggregate TFP growth, the most efficient firms in the branch in question need to see their market share increase in comparison to the shares held by their less productive direct domestic competitors.
- entry of new firms/exit of existing firms: to contribute positively to aggregate TFP growth, the new entrants to a branch of activity must be more productive than the average for the firms already there. Likewise, the exit of firms that are less efficient than the average raises their branch of activity's productivity.
- intersectoral reallocation: this is the effect of transferring resources between two branches of the economy. In this case, in order to contribute positively to aggregate TFP growth, this transfer must be in favour of the most efficient branches, i.e. the relative share of more productive branches must rise.

For this analysis, four sub-periods have been determined (namely 1997-2004, 2005-2007, 2008-2011 and 2012-2016), and the contribution of different sources de growth has been calculated for each of these sub-periods. For the sake of clarity of the results, only the sum of the three components of the second dimension is given.

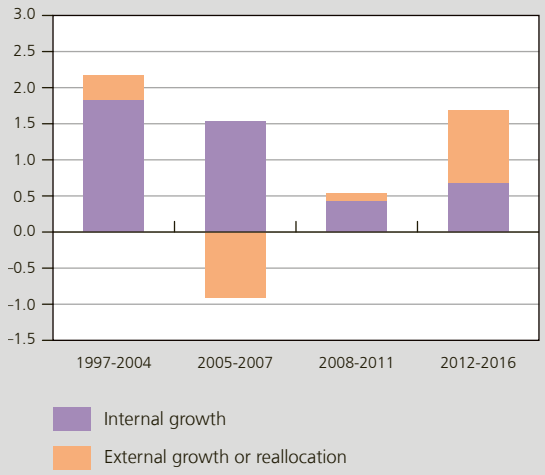
For the major part of the period analysed, the internal component of aggregate productivity growth was the biggest. But its contribution shrank regularly between the first and third observation sub-periods, thus contributing to the decline in aggregate growth before the recession. Between 2008 and 2011, it was roughly four times lower than the level recorded between 1997 and 2004, and it only picked up very slightly at the end of the period. It should nevertheless be noted that the contribution from internal growth has always been positive since 1997.

As for the contribution from the external growth dimension, or reallocation, this is largely attributable to resource reallocation, given that external growth has only a marginal influence on aggregate TFP growth because firm creation and destruction is poorly developed in Belgium.

The source of the slowdown of TFP growth in the immediate pre-crisis period therefore lay mainly in the negative contribution from resource reallocation. Throughout this period, intra- and intersectoral redistributions were both unfavourable. By contrast, during the crisis period, resource reallocation contributed only very modestly to TFP growth; but the contribution from intersectoral redistribution at the time was still negative.

CHART 3 RESOURCE REALLOCATION HAS MADE THE MAIN CONTRIBUTION TO TFP GROWTH IN RECENT YEARS, LARGELY BECAUSE OF A BETTER ALLOCATION OF RESOURCES IN INDUSTRY

(contribution to TFP growth, percentage points, NACE branches 10 to 82)



Source : NBB.

Resource reallocation contributed significantly to the pick-up in growth noted at the end of the period, principally through a better reallocation of intrasectoral resources. So, from 2008, the redistribution of resources within individual branches was on the whole conductive to productivity growth, unlike redistributions between branches (which very often reflect the transfer of resources from the industrial sector to services branches). This positive contribution from a better allocation of intra-branch resources partly reflects some rationalisation of the domestic production network during the recession, which mainly affected the most fragile firms in each branch, an effect that continued after the crisis.

When the sources of growth are split up according to branch of activity, resource reallocation dynamics in industry and market services turn out to be quite different. Since the recession, and more particularly from 2012 onwards, the reallocation of resources towards services has made a very small contribution to TFP growth. Conversely, in industry, the contribution of resource reallocation has been strongly positive since 2012 ; it is even the aspect that has put the most into TFP growth in recent years.

This problem of reallocation in market services is even more acute because the sources of internal growth here prove to be more limited than in industry. Between 2012 and 2016, for example, internal growth was still almost four and a half times lower in market services than in industry. This differential reflects the greater difficulty that services firms have in radically overhauling their processes. However, internal growth in market services companies has shored up aggregate productivity growth across all the periods under review.

4.3 Technological frontier

As already pointed out, productivity gains are not shared out evenly between companies. Firms close to the European technological frontier co-exist with a large number of companies with much lower performance records. Beyond this gap in terms of performance level, it is useful to compare the performance of these two groups of firms in terms of TFP trends.

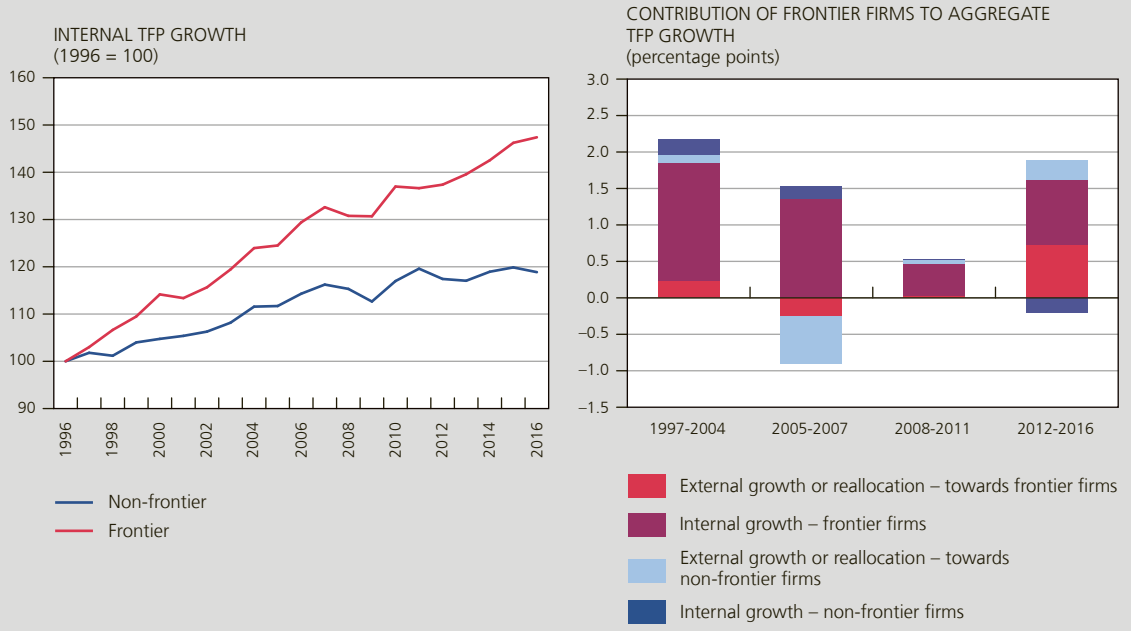
In an optimally functioning economy, firms lagging behind technologically are encouraged to innovate in order to catch up or even overtake the leaders in a branch of activity. If they don't, this lag gets worse over time, and they end up closing down, as their efficiency levels are too low for them to survive in the face of competition from the best firms.

Technological diffusion should therefore enable firms with a technological handicap to close the gap between their position and the efficiency frontier, by accumulating more productivity gains.

To test this, the sample was split into two sub-groups: on the one hand, the group of "frontier firms" and, on the other hand, that of firms lagging behind technologically or "non-frontier" firms. Frontier firms from year *t* represent all firms whose productivity levels are above the 90th percentile of their branch's TFP distribution (at NACE 64 level) for at least year *t* and year *t-1*.

Instead of observing a technological diffusion phenomenon enabling firms lagging behind to catch up with frontier firms, since 1996, on the contrary, the growth performance of the two groups has gradually widened the gap between them. Between 1996 and 2016, TFP growth was almost 29 percentage points higher in frontier firms than in non-frontier firms. This technological disconnect is particularly pronounced in industry.

CHART 4 THE PRODUCTIVITY GAP BETWEEN FIRMS AT THE TECHNOLOGICAL FRONTIER(1) AND THOSE LAGGING BEHIND HAS WIDENED CONSTANTLY SINCE 1996, WHILE THE REALLOCATION OF RESOURCES TOWARDS FIRMS AT THE TECHNOLOGICAL FRONTIER AND THEIR INTERNAL GROWTH HAVE MADE THE MAIN CONTRIBUTIONS TO TFP GROWTH



Source: NBB.
(1) The frontier firm category covers all firms recording productivity levels above the 90th percentile of the TFP distribution for their sector for at least two consecutive years.

The contribution from firms situated at the technological frontier is so big that it offers an almost full explanation for aggregate performance. This contribution is not just the fruit of these firms' internal growth, but also stems from the wider reallocation of resources from non-frontier firms towards frontier firms. This component has been extremely important during the post-crisis period.

A large proportion of frontier firms belong to a foreign group. On average over the period 2010-2015, 11 % of frontier firms were subsidiaries of foreign companies, compared with barely 0.6 % of non-frontier firms(1). Subsidiaries of international groups are therefore over-represented in the most productive segments of the economy. They also play a major role in aggregate productivity growth: on average, 80 % the contribution made by frontier firms to TFP growth (whether positive or negative) comes from foreign frontier firms alone.

(1) The share of subsidiaries of international groups among all firms in Belgium came to 1.6 %.

4.4 Zombie firms

Unlike frontier firms, so-called 'zombie' firms cannot be expected to put up a good performance. According to the OECD, these are companies that have existed for at least ten years and whose operating profits have amounted to less than their financial expenses for at least three consecutive years. These enterprises, which therefore struggle to pay their interest charges, but which nevertheless manage to stay in business, account for no less than 10 % of all firms in Belgium. This percentage, particularly high when compared with that observed in other European countries (according to the OECD, 2 % in France and 3 % in the Nordic countries in 2013), turns out to be quite stable over time. Despite their precarious financial situation, these companies take up a significant part of the resources available in the economy. In the sample of companies used containing data for the period running from 1996 to 2016, these enterprises monopolise around 13 % of total employment and 19 % of the capital available in the economy.

However, this group of firms is very varied : it also includes companies that have good qualities (for instance, some of them are active in international trade, have a high level of human capital or intangible capital, are close to the efficiency frontier, etc.). But, on average, they employ relatively fewer highly-skilled staff (i.e. holders of higher education qualifications) and are less intangible-capital-intensive than non-zombie firms.

TABLE 1 ZOMBIE FIRMS MAKE UP A VERY HETEROGENEOUS GROUP, WITH BOTH GOOD AND BAD FEATURES

	Zombie firms	Other firms
In % of importing firms	26.7	19.4
In % of exporting firms	20.7	14.3
Average % of highly-skilled in total employment (if they employ any)	41.5	49.0
Intangible capital intensity (in € per employee expressed in FTE)	4 741	6 165

Source : NBB.

The estimates of TFP levels show that the average technological handicap between zombie and non-zombie firms is as much as 41 %, after controlling for a set of observed characteristics. It is particularly high for small zombie firms, given that, when weighting companies by their share in total employment, the productivity gap comes down to 11 %, which suggests that the largest zombie firms' performance is closer to that of non-zombies of comparable size. It further appears that 76 % of all zombie firms have never been frontier firms. Likewise, zombie firms suffer from a TFP growth handicap of around 1.8 percentage points in industry and about 1.4 percentage points in market services.

All this begs the question whether it is worthwhile these firms continuing to trade in the Belgian economy without radical restructuring efforts. By mobilising a large share of the resources, companies in poor financial health (which moreover tend to keep the status of zombie firm for a long time) hamper the reallocation of resources towards other firms (from the same branch of activity or other branches). What is more, as they are not confronted with technological progress, workers in these firms suffer from gradual deskilling, which in turn reduces their employability in the medium term.

But caution is the watchword here. Zombie status is not systematically a sign of poor productive efficiency or of a technological lag. This status is solely a reflection of financial variables, so it can for instance apply to firms operating within complex group structures for internal organisational reasons without there being any question of inefficiency or long-term financial fragility.

However, most of these zombie firms record low TFP (growth). Their presence – which, as already mentioned, is greater in Belgium than elsewhere – thus weighs down the aggregate productivity trend, and consequently the growth potential

too. As a result, it could be beneficial for the Belgian economy to reduce the number of zombie firms. There are two possible ways of doing this. On the one hand, these zombie firms can close down, which would enable their factors of production to be allocated elsewhere in the economy. On the other hand, they can restructure with a view to becoming economically viable again.

With a view to estimating the impact, in terms of productivity, of the closure or restructuring of part of these zombie firms, notably those whose performance is below the average for their branch of activity, two simulation exercises were conducted. For that purpose, one sub-group of firms was isolated from the sample. More precisely, these are companies that do not belong to a group, which have been zombies all the time from 2014 to 2016 (meaning that, for five years, their operating profits did not cover their financial expenses), and whose productivity in 2016 was below the average for their branch.

This group comprises 1 250 companies and accounts for 10 % of all zombie firms in 2016. Total employment in this group is 5 845 FTEs. Two scenarios were envisaged : the first involves purely and simply taking these firms out of the sample in 2016 and thus simulates their closure at the end of 2015, while the second involves cancelling out the productivity gap with the average for their branch in 2016.

The analysis reveals that the exit/restructuring of these firms would have inflated TFP growth by 0.1 to 0.2 of a percentage point in 2016. This increase may be considered as a minimum threshold, as it does not take account of the potential effects of redistributing resources among firms. This exercise thus confirms that the closure or restructuring of some zombie firms can have a positive effect on the aggregate productivity of the economy.

4.5 Portrait of productive firms and internal growth levers

Having flagged up the contributions that some sub-populations of firms have made to aggregate TFP growth, attention can now be turned to a range of conditions driving the increase in productivity levels. These include integration into world trade networks and investment in know-how, subjects on which the Bank's own databases provide some information. As there were no observations or not good enough quality records about the skills level of the labour force for the whole sample, the productivity determinant analysis period has been limited to the years 2007 to 2016.

First of all, it appears that there is a link between the company's age and its productivity. Since productivity levels are an important precondition for long-term survival, the group of firms aged over ten years should be relatively more productive than the group of younger firms (selection effect).

Among the companies that are less than five years old, it is the gazelles (i.e. young high-growth firms) that are estimated to have the highest level of productivity, ahead of young medium- or low-growth enterprises. This conclusion is quite obvious, given that the sample of young firms has been broken down largely on the basis of growth in their value added, which is logically reflected in high productivity. Since gazelles only account for around 3.5 % of all young firms (De Mulder *et al.*, 2017), the entire group of young firms should generally tend to post a lower level of productivity than the other two groups of more mature firms.

A high level of productivity would make it possible for a firm to trade directly with the rest of the world. In comparison with companies that neither import nor export, the level of productivity of importing or exporting firms would be respectively, 39 % and 10 % greater. Moreover, importing and exporting at the same time is something that is associated with an even higher level of productivity.

As mentioned in section 2, the existing literature is relatively divided as to the causality of the relationship. While there is a general consensus on the need to reach a certain level of productivity to get involved in trade, there is no clear evidence of any feedback effect from involvement in international trade, and especially in export, on productivity levels (learning by exporting). Earlier research work using Belgian data has generally not revealed any such effects.

Researchers nevertheless agree on the fact that diversifying sources of supply of material inputs by importing from several countries improves companies' performance. The multiplication of sources of supply would enable importing firms to benefit from the best inputs possible, which would boost their productive performance. In our sample, increasing the

TABLE 2 DETERMINANTS OF FIRMS' PRODUCTIVITY
(period 2007-2016)

Explanatory variables	Coefficients[1]	Standard deviation
Age (compared with firms at least 10 years old)		
Between five and ten years	–0.181***	(0.002)
Less than 5 years – Low growth[2]	–0.199***	(0.004)
Less than 5 years – Moderate growth[3]	–0.039***	(0.009)
Less than 5 years – High growth (gazelles)[4]	0.211***	(0.010)
Place in international trade[5] (compared with firms that neither import nor export)		
Exporting firms	0.104***	(0.010)
Importing firms	0.393***	(0.015)
Exporting and importing firms	0.316***	(0.016)
Intangible capital intensity	0.020***	(0.000)
Higher education (in % of total employment)	0.302***	(0.003)
Annual binary variables	Yes	
Sectoral binary variables	Yes	
R^2	0.3596	
Number of observations	859 125	

Source : NBB.
(1) A positive coefficient indicates a relatively higher productivity level than that of the reference group. All the coefficients mentioned are significant at the threshold of 1 % (indicated by ***).
(2) Firms which have registered average annualised growth of employment or turnover below 10 % over at least three consecutive years during their first five years in business.
(3) Firms which have registered average annualised growth of employment or turnover between 10 and 20 % over at least three consecutive years during their first five years in business.
(4) Firms which have registered average annualised growth of employment or turnover of at least 20 % over at least three consecutive years during their first five years in business.
(5) As individual figures for international trade in services are only available for a very small sample of firms, unlike data on trade in goods, the analysis of the relationship between productivity and international trade has been limited to manufacturing firms.

number of importing countries is actually favourable (raising the number of source countries by 1 % would push up productivity by 2 %).

Furthermore, the quality of human capital would also have an impact on firms' efficiency. The multivariate analysis reveals that, on average, when the proportion of highly-skilled jobs (workers with higher education qualifications) in total employment is raised by 1 percentage point, the productivity level goes up by 0.3 %.

Lastly, making more intensive use of intangible capital would boost the efficiency of firms, both in industry and market services. Intangible capital covers the whole range of development costs, concessions, patents and licences, know-how and goodwill. It can therefore be considered as a proxy for a firm's innovation level.

Conclusion

The analyses made as part of this study have led to some interesting findings about the trend in productivity in Belgium over the last 20 years.

Belgian firms are still among the most efficient in Europe. However, this positive element should not conceal the very wide heterogeneity among the population of Belgian companies. All the advanced economies, including Belgium, have seen a general slowdown in productivity growth since the start of the 2000s. But it has been more pronounced in Belgium than in the EU.

Over the period under analysis, TFP growth was higher in industry than in market services, which, given the shift in economic activity towards the services sector, weighs on aggregate productivity growth. Revitalising the economic fabric in that sector could therefore prompt a reallocation of resources more favourable to growth.

Moreover, it appears that productivity gains are almost entirely attributable to firms at the technological frontier, so they turn out to be very unequally distributed across the Belgian economy. Technological diffusion is inadequate.

So, what can be done to boost growth ? The wide variations in the performance of individual firms show that there is no single blueprint for generating high productivity levels. There are many factors which may influence a firm's efficiency, whether they be firm-specific or macroeconomic.

First of all, firms need to make use of all the internal growth levers. For example, apart from the aspects listed above, firms may become more efficient by investing in staff training (Konings and Vanormelingen, 2011). Greater integration in the domestic production network, particularly by outsourcing secondary tasks such as support activities, may similarly help to enhance productivity (Dhyne and Duprez, 2017). Setting up best managerial practices can likewise be a major source of productivity growth.

There are also other ways of boosting productivity : stimulating entrepreneurship, and especially the entry of new, high-potential firms and the exit of less efficient firms, is relevant to improving productivity. That is particularly important for market services, where there is less scope for internal growth.

Secondly, an appropriate regulatory framework is also important for facilitating the entry of potential competitors or the exit of inefficient firms, as well as to enable existing firms to develop and put in place favourable conditions for enhancing efficiency. More competition can be an additional incentive to innovate too, with a view to maintaining efficiency levels.

Overall, Belgium needs to keep its appeal, from an international point of view, in order to attract as much foreign direct investment as possible, a factor driving the spread of technology. High-quality infrastructure contributes to this attraction while enabling a more efficient allocation of resources within the Belgian economy. Likewise, efficient health care and education systems, guaranteeing a quality and healthy workforce, are still vital assets for the sustainable development of our economy. Last but not least, greater technological diffusion is the best guarantee of our long-term prosperity by avoiding polarisation of our society. All these various levers will have to be used simultaneously and in a complementary way to boost productivity and to keep Belgian firms at the forefront of the European business world.

Methodology

1. Data used

For the 1996-2016 period, the database provides data on Belgian companies that file annual accounts with the National Bank of Belgium (NBB). These were combined with information gleaned from VAT returns and figures for foreign trade (both imports and exports).

The basic annual account data do not always reflect a full calendar year and have been annualised where needed to arrive at data that capture the twelve-month period from 1 January up to and including 31 December, making them comparable between companies and from one year to the next. Where the time series was incomplete, a linear interpolation was carried out if the missing period did not exceed two years.

Our analysis focuses on private sector companies and has ignored NACE sectors 84 through 99 (non-market services). Other companies left out of the equation because of their special characteristics included those in sectors 01-03 (agriculture, forestry and fisheries), 05-09 (extractive sectors) and 64 (financial services). Too few observations made it impossible to arrive at sufficiently accurate total factor productivity (TFP) estimates for sectors 19 (coking and refining), 36 (water collection, treatment and distribution), 51 (air transport) and 65 (insurance) and these sectors were therefore also stripped out.

In addition, our analysis ignored observations related to companies that switched sectors in the NACE 64 classification, effective from the year of the switch. As noted above, the methodology involved applying a logarithm to the variables, and as logarithms can only be based on strictly positive values, the analysis also excluded observations with added values that were negative or nil, or where the workforce in FTEs was nil.

The adjustments required to estimate TFP at the level of individual companies also impact the broader economy's TFP. Whereas macroeconomic TFP estimates calculate the total added value (or employment) of all companies – i.e. also factor in negative or nil values – microeconomic TFP estimates do not, making for a slight overestimate in the case of the latter. And of course, ignoring certain sectors may also affect the aggregate TFP.

2. Estimating total factor productivity (TFP)

Total factor productivity (TFP) is a general measure of the efficiency of the economic production process. More specifically, TFP reflects how efficiently a number of production factors, such as labour and capital (equipment), are used to arrive at production. This measure may be calculated for the economy at large as well as for regions, sectors, groups of companies or individual companies.

Contrary to labour productivity, for instance, which can be calculated directly as the relationship between the added value achieved relative to the labour input – i.e. the number of workers or hours worked – TFP is not easily determined. Economic analyses typically calculate a production function, to which TFP is added. That is also the case in this article, which uses a Cobb-Douglas production function. For an individual company i operating in sector j in year t, the production function looks as follows:

$$Y_{it} = L_{it}^{a_j} . K_{it}^{b_j} . TFP_{it} \qquad (1)$$

Where Y = the added value (at constant prices)
L = labour input (number of hours worked or employment in FTEs)
K = capital input (capital stock, at constant prices)
a and b = output elasticity of labour and capital

A logarithm applied to this function renders the following linear equation for constructing the econometric estimate:

$$ln\,(Y_{it}) = a_j . ln\,(L_{it}) + b_j . ln\,(K_{it}) + ln\,(TFP_{it}) \qquad (2)$$

Data from company accounts make up Y_{it}, L_{it} and K_{it}. These data concern the added value (code 9800), the workforce in FTEs (code 9087) and the capital stock (codes 20-28) respectively. Added value and capital stock, which are reported in annual accounts at current prices, are deflated by the added value and the fixed capital formation respectively, available at sector level in the national accounts.

To arrive at an estimate of coefficients a_j and b_j, we use the instrumental variables method, an economic technique enabling a better estimate of the precise contribution of the various production factors. After all, the use of production factors labour and capital may also be linked to how efficient the production process is (in that case, the 'explanatory' factors on the right of the equation are connected to one another), which might distort the outcome of an estimate based on a simpler method (such as ordinary least squares).

As soon as a_j and b_j have been estimated (for all sectors and the entire period under review), TFP for each individual company is calculated as the residual of the equation below, derived from a rearrangement of equation (2):

$$ln\,(TFP_{it}) = ln\,(Y_{it}) - a_j \,.\, ln\,(L_{it}) - b_j \,.\, ln\,(K_{it}) \qquad (3)$$

For the individual TFP numbers so derived, we can calculate annual growth, which is then aggregated at, for instance, the level of groups of companies, sectors, regions, or the economy at large. To do so, we use as a weighting factor the share of each company in total added value.

3. Breaking down TFP growth

The year-on-year TFP change for the economy at large can be broken down into internal growth contributions on the one hand and external growth or reallocation change on the other (see for example Van Beveren and Vanormelingen, 2014). Internal growth reflects the more efficient use of production factors within an existing company; external growth is about productivity trends related to starting new companies and the closure of existing ones. Reallocation reflects the impact of shifts in production factors between existing companies, where an additional distinction can be made between companies in the same sector and shifts between sectors.

This can be captured as follows:

$$\begin{aligned}
\Delta\, PTF_t = & \sum_S \overline{w}_{St} \,.\, \sum_{i\in S, i\in C} \overline{w}_{it} \Delta p_{it} && \text{(internal growth)} \\
& + \sum_S \overline{w}_{St} \,.\, \sum_{i\in S, i\in C} \Delta w_{it} \,(\overline{p}_{it} - \overline{p}_{St}) && \text{(intrasectoral reallocation)} \\
& + \sum_S \Delta w_{St} \,.\, (\overline{p}_{St} - \overline{p}_t) && \text{(intrasectoral reallocation)} \\
& + \sum_S \overline{w}_{St} \,.\, \sum_{i\in S, i\in E} w_{it} \,(p_{it} - \overline{p}_{St}) && \text{(entry of new companies)} \\
& - \sum_S \overline{w}_{St-1} \,.\, \sum_{i\in S, i\in X} w_{it-1} \,(p_{it-1} - \overline{p}_{St-1}) && \text{(closure of existing companies)}
\end{aligned}$$

Where wi = the share of company i in the added value of sector S
w_S = the share of sector S in total added value
p_i, p_S = TFP of company i and sector S respectively
C, E and X = existing companies that continue their activities, new companies and existing companies that have closed
Δ = the change between year *t-1* and year *t*
$\overline{\ }$ = the average value for year *t* and year *t-1*

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Is weak productivity growth a fatality ?

N. Cordemans

Introduction

Economic growth in the advanced economies has been relatively subdued since the global economic and financial crisis of 2008-9. This both when compared with growth figures recorded in the years before the crisis and when compared with growth figures recorded shortly after previous crises. To an extent, this unexpected sluggishness reflects shrinking labour productivity growth, which continues to be slow at this time. With productivity gains a key driving force of living standards in the long term, this situation naturally raises concerns.

Against this backdrop, this article attempts to outline recent productivity trends in the major advanced economies. The first section defines what productivity means, while the second delves deeper into the stylised facts for the United States, the euro area, Japan and the United Kingdom. The third and final section sets out a range of factors that have contributed to recent falls in productivity gains, making a distinction between structural and cyclical forces.

1. Productivity : what exactly is it ?

In conceptual terms, an economy's total production of goods and services is underpinned by two fundamental elements : labour volume and labour productivity. The labour volume is the total number of hours worked in the economy and reflects such varying factors as labour force participation, employment rate, regulatory working hours and even the population's age pyramid. Labour productivity, in turn, equals production volume per hour worked and to some extent measures the efficiency of working hours. It depends, for one thing, on the capital intensity of production – i.e. the amount of capital per hour worked – as hourly production per employee can be enhanced by the purchase of equipment and other means of production. A second determining factor is what economists call total factor productivity, or multi-factor productivity. This factor captures the general efficiency with which a country manages to bring together labour and capital to produce, and is informed by such drivers as innovation, the general level of education, management practices, competitiveness, quality of institutions, economies of scale, the regulatory framework within which companies develop and more.

Equation – Labour productivity growth

- $\Delta \frac{Real\ GDP}{Hours\ worked} = F(\Delta capital\ intensity, \Delta total\ factor\ productivity)$

Total factor productivity reflects the level of production efficiency in companies on the one hand and, on the other, how well these resources – i.e. labour and capital – are allocated across companies (IMF, 2017). Companies' production efficiency typically depends on discoveries by innovating firms and by other firms adopting such innovations and best practices. In turn, innovation and the integration of new technologies in the production process require investment

in both tangible assets (buildings, equipment and machinery, infrastructure, etc.) and intangible assets (R&D, education, intellectual property, organisational expertise, etc.). Obviously, then, capital intensity and total factor productivity are closely linked, all the more so because technological progress is partly incorporated in capital: new capital goods integrate new technologies and these new goods are typically more efficient than the old ones. How optimal an economy's resource allocation is depends on its ability to effectively shift such resources to the most efficient sectors and firms. Such efficacy should be part and parcel of a smoothly running financial system as well as an economy's processes of creative destruction and reallocation of resources. These processes should ensure that the least productive companies and sectors disappear and make way for the most efficient firms and the most innovative activities.

An increase in total factor productivity equals real GDP growth that is explained by neither labour nor capital as a factor. It measures residual growth that turns out to be dependent on the degree to which production inputs are used.

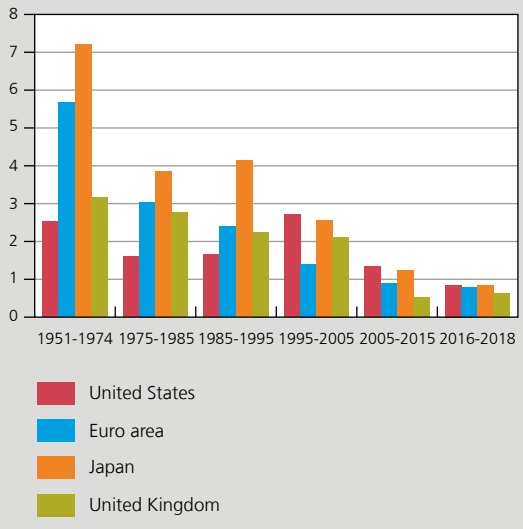
Total factor productivity is a hot issue: in the longer term it is the only recurrent source of economic growth (Van Ark, 2014). Unlike the two factors labour and capital, it does not have any clear physical limitations. Through technological progress and innovation, it is a key determinant of a country's average living standards, and particularly so in societies facing demographic ageing, in which labour volumes grow less rapidly that the total population.

2. Productivity growth in the advanced economies: stylised facts

Following thirty years of prosperity after the Second World War, labour productivity growth in the advanced economies slowed for the first time, and not just in the euro area countries and Japan, which had staged a remarkable economic catch-up after the war. In the United States, too, productivity gains broadly halved between the post-war period and the decade between 1974 and 1984.

CHART 1 LABOUR PRODUCTIVITY

(real GDP per hour worked, average annual growth)



Sources: Conference Board, OECD.
(1) Before 1996: GDP-weighted average for Germany, France, Italy and Spain.

Ignoring some divergence between these economies, the three subsequent decades generally witnessed a new, gradual deceleration in productivity growth. Bucking this overall trend were the productivity gains notched up through the rapid development and spread of information and communications technology (ICT) in the United States between

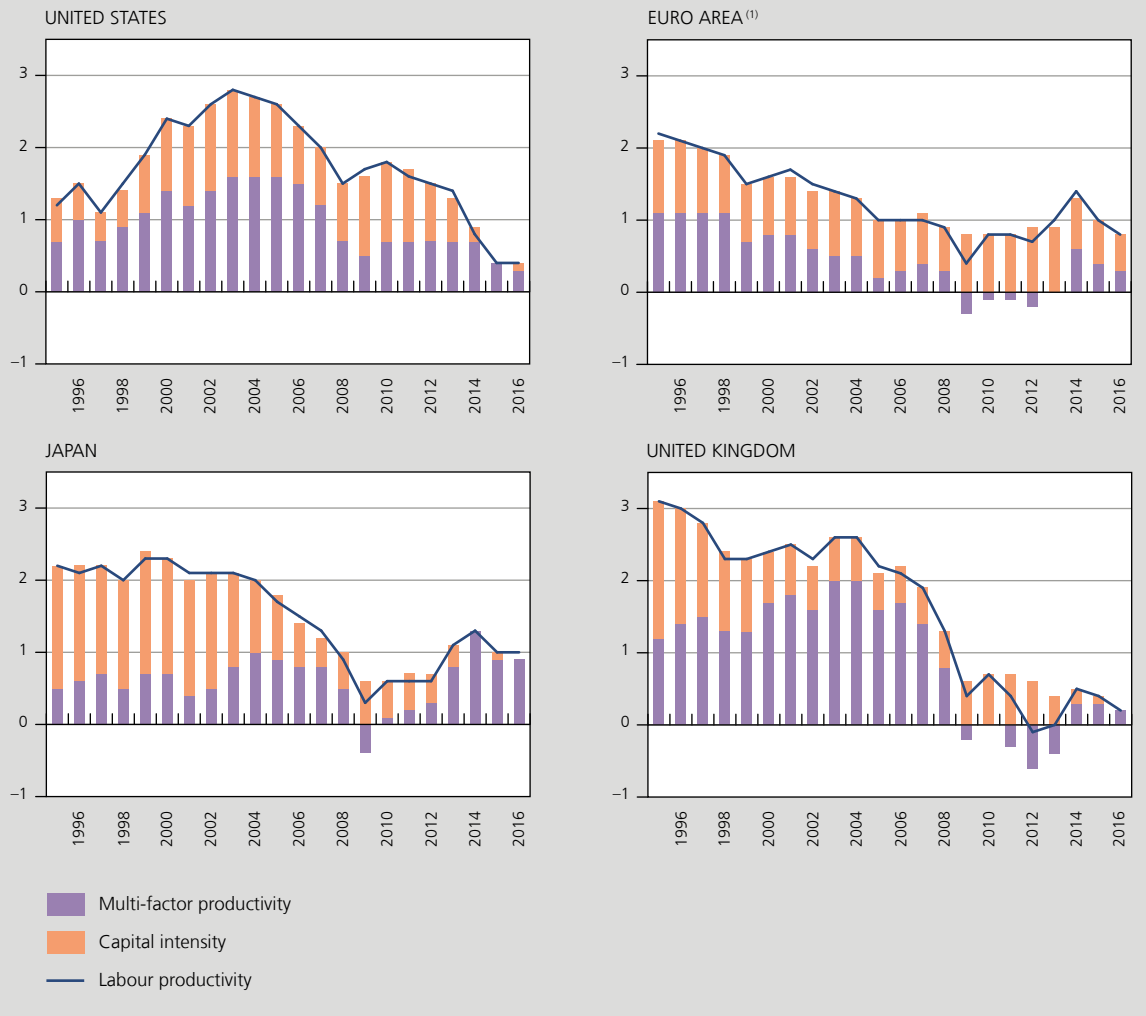
the mid-1990s and the mid-2000s. From 2004, however, these gains gradually evaporated, even before productivity growth lurched down again in the aftermath of the 2008-9 global financial crisis. Compared with the previous decade, the years after 2005 saw labour productivity gains more than halve in the key advanced economies, and productivity has staged only subdued growth since, despite the economic recovery.

A deep dive into the components of labour productivity reveals that contracting gains initially reflected slowing total factor productivity growth, both a persistent and general phenomenon in the advanced economies. That said, both Japan and the euro area have recently shown some tentative signs of recovery.

At the same time, the capital intensity of production went up in the early stages of the crisis. This was a consequence of the reduced number of hours worked due to slowing economic activity and hence an increased amount of capital per hour worked – a much more pronounced phenomenon in the United States and the United Kingdom, as their labour markets tend to be more flexible.

CHART 2 CAPITAL INTENSITY AND MULTI-FACTOR PRODUCTIVITY

(five-year moving average annual growth)



Sources: Conference Board, OECD.

(1) GDP-weighted average for Germany, France, Italy and Spain.

However, since the end of the crisis, capital intensity has plummeted under the joint impact of a cyclical upturn in the number of hours worked and a particularly slow recovery in capital spending compared with previous business cycles (see Section 3). These effects are more notable in the United States, the United Kingdom and Japan, which have seen unemployment come sharply down over the past few years. That said, the former two experienced increased employment in sectors that are not all that productive, which also acted as a curb on total factor productivity growth (OECD, 2018 and Oulton, 2018).

The slowdown in productivity growth in the advanced economies affects most economic sectors and is not linked to the respective shares of these sectors in the overall economy. Generally speaking, though, slowing activity in key sectors such as energy and finance has hit aggregate productivity harder (Goldin *et al.*, 2018).

With productivity growth displaying the same dynamics as compound interest, small percentage changes can have major implications in the long term. Productivity, profitability, wages, aggregate demand, investment and economic growth all come together in a mix that can move from virtuous to vicious. A persistent slowing in productivity growth is, then, a legitimate source of concern.

3. Which factors inform declining productivity gains ?

The recent slowdown in labour productivity growth started before the global financial crisis of 2008-9 and intensified post-crisis. It is therefore relevant to make a distinction between structural factors already at play before the great recession and related cyclical factors. With IT an increasingly important factor in the economy and given the difficulty in accurately measuring its full contribution to GDP, the discussion must also touch on the issue of measuring productivity.

The different forces the literature uncovers typically hold back productivity by curbing innovative power or opportunities to integrate new technologies into production processes. These forces may also hinder smooth allocation of resources to firms or economic sectors. Identifying all factors and mechanisms at play is a complex business and their respective contributions are even more difficult to estimate. This article limits the discussion to the main elements explaining the decline in productivity gains, most of which are complementary and even interrelated.

3.1 Structural factors

3.1.1 Less revolutionary innovations

According to the proposition defended by Gordon (2012), among others, the innovations of the third industrial revolution (1960 to the present day) were less significant than those of the second industrial revolution (1870-1900). In other words, electricity, the internal combustion engine or running water contributed more to rising productivity than computers, the internet or mobile phones.

During the second industrial revolution, inventions included heating and cooling systems, lighting, the telephone, radio, motorcars, aircraft and antibiotics, which dramatically and pervasively changed living standards, communications, trade flows and mobility. These inventions fostered quick productivity gains across multiple decades between 1890 and 1972.

By contrast, the third industrial revolution, characterised by the development of information and communication technology (ICT), arguably spurred productivity only temporarily, and mainly between 1996 and 2004 along with the development and growing reach of the internet. Gordon (2012) claims that the inventions of the 2000s mainly related to entertainment and communication devices. These devices have become smaller and smarter, and offer growing numbers of features, but are less of a major influence on labour productivity or living standards than previous generations' innovations. In other words, the marginal benefit of iPhones is small compared with that of running water, the light bulb or television. Along the same lines, it could be argued that various recent innovations have only modestly enhanced earlier innovations. Electric or driverless cars are clearly less revolutionary than the original motorcar. Today's aeroplanes are more energy-efficient and less noisy, but they do not fly at any greater speed than those manufactured fifty years ago.

According to Bloom *et al.* (2017), return on R&D is declining, implying that it is becoming increasingly difficult to develop new ideas. Drawing on US examples, they argue that research efforts would have to double every thirteen years to keep GDP growth per capita at a constant level.

3.1.2 A new productivity paradox

Robert Gordon, who argues there has been a permanent slowdown in productivity gains, take a contrary view to that of the techno-optimists. The latter believe that the productivity slowdown is mainly due to the fact that GDP measurements fail to factor in massive quantities of information, entertainment and free services available on the internet. They emphasise that the consumer surplus in terms of digital products is exceptionally large and argue that GDP underestimates investment in intangible assets (Wolf, 2015). Techno-optimists reckon that the underlying acceleration of technological progress has not slowed and that the IT revolution will continue to transform economies (Brynjolfsson *et al.*, 2014, and Mokyr, 2013). More specifically, in the years ahead artificial intelligence, robotics, 3D printing and genetics may well provide for significant progress in areas such as mobility, production processes and medical science. As a result, the observed slowdown in productivity gains could well be temporary.

In 1987, the US economist Robert Solow wrote: "You can see the computer age everywhere but in productivity statistics". Between 1970 and 1980, it was obviously difficult to relate productivity gains to ICT developments. These gains became evident only from the start of the 1990s, mainly in the United States. Techno-optimists assume the possible emergence of a new productivity paradox: recent innovations and those currently under development will only have an impact in the years ahead, when the new technologies are mastered and gradually filter through to the wider economy.

3.1.3 Slowdown in the technology diffusion process

Regarding the idea of a new productivity paradox, it looks as if the aggregate slowdown in productivity growth since the start of the 2000s is masking a clear divergence between what the OECD refers to as global frontier firms and laggard firms (OECD, 2016). The best-performing companies continued to post high productivity gains of 3.5 % annually in manufacturing industry during the 2000s. By contrast, less high-performing companies reported a clear productivity slowdown, with productivity gains of around 0.5 % over the same period. The gap is even larger in the services sector, where the best-performing companies, concentrated in the ICT sectors, recorded productivity gains of almost 5 %, while other companies saw their productivity stall in the same period (Andrews *et al.*, 2015).

The differences between companies could partly explain the current paradox between lagging productivity gains and rapid technological advances in some areas (robotics, artificial intelligence, digitalisation, etc.). These may be attributable to a weakening competitive environment and growing winner-takes-all dynamics (Oulton, 2018). These dynamics are a particular hallmark of the digital technology sector, where dominant players often grab the lion's share of the market, leading to dominant positions and profits. These differences may also reflect the obstacles standing in the way of the diffusion of new technologies, notably related to the complexity of these technologies and the outlays and organisational changes that they require.

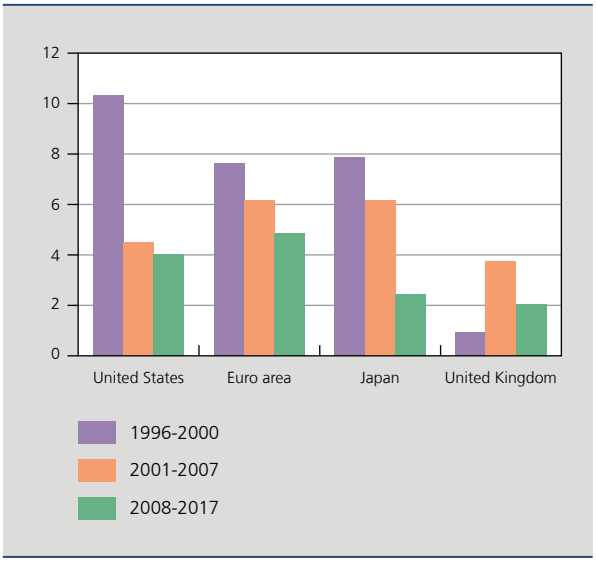
3.1.4 Flagging economic dynamics

In most advanced economies, the pace of growth of investment in intangible assets slowed during the 2000s (OECD, 2015). Such investment typically underpins innovations and encourages the spread of technology and knowledge-sharing between companies and sectors.

At the same time – and possibly in connection with these developments – the number of newly incorporated firms declined, evidenced by the drop in the number of start-ups relative to the total number of companies (ibid.). The decline started before the crisis and continued after its end. New, fast-growing companies, however, tend to play an important role in innovation. Drawing on data for eight European countries (Denmark, Finland, France, Italy, the Netherlands, Norway, Sweden and the United Kingdom), OECD (2015) demonstrated that, between 2002 and 2010, total factor productivity growth would on average have been at least 0.25 percentage points higher if the proportion of new companies had remained at 2002 levels.

CHART 3 INVESTMENT IN INTANGIBLE ASSETS

(average annual growth rate)



Sources: OECD, own calculations.

The literature does not shed any clear light on why economic dynamics are flagging. It does, however, mention several factors, including the ageing population, which arguably account for growing risk aversion; regulatory measures, which may have caused an increase in costs for new market entrants; and the notion that innovation is the prerogative of large, established corporations (Fernald and Jones, 2014).

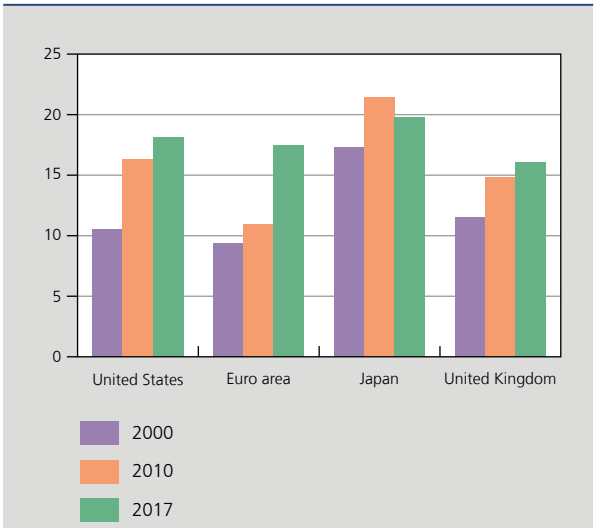
3.1.5 Ageing labour force

Generally speaking, labour productivity shows an inverted U-curve reflecting the age of the workers, with a significant decline after the age of 50 (Castellucci *et al.*, 2016). This change relates to the accumulated experience, the drop in the value of the gained expertise, and age-related trends in physical and mental fitness. A 2010 study by Vandenberghe and Waltenberg focusing specifically on Belgium, for example, shows that the productivity gap between older workers and those in the prime of their lives can be as high as 20 to 40 %.

Since the start of the 2000s, the number of older workers has, however, risen significantly. Relative to the total labour force, their number increased to over 15 % from around 10 % between 2000 and 2017 in the United States, the euro area and the United Kingdom. In Japan, where population ageing has advanced even further, older workers account for almost 20 % of the total workforce. A recent study (IMF, 2017) reveals that the ageing labour force may explain a decline in productivity gains in the advanced economies of between 0.2 and 0.5 percentage points annually in the course of the 2000s.

CHART 4 AGEING LABOUR FORCE

(workers aged 55 and over, in % of the total labour force)



Source: Thomson Reuters Datastream.

3.1.6 Slowing world trade

International trade allows economies to specialise in the production of goods and services in which they have a comparative advantage, and to capitalise on economies of scale and range. International trade also facilitates the spread of knowledge and technologies. And, by fostering competition, it boosts new product development and the implementation of more efficient production processes. In this way, trade supports productivity gains.

World trade growth, however, slowed down sharply in the wake of the global financial crisis. Compared with the levels recorded before 2009, the pace of growth in international trade has, on average, halved since 2012. The slowdown does not just reflect the fragility of the post-crisis economic recovery – it also reflects the waning pace of trade liberalisation over the past few years, increased protectionism as well as the maturation of both global value chains and the integration of China into the world economy (IMF, 2016).

3.1.7 Rising inequality

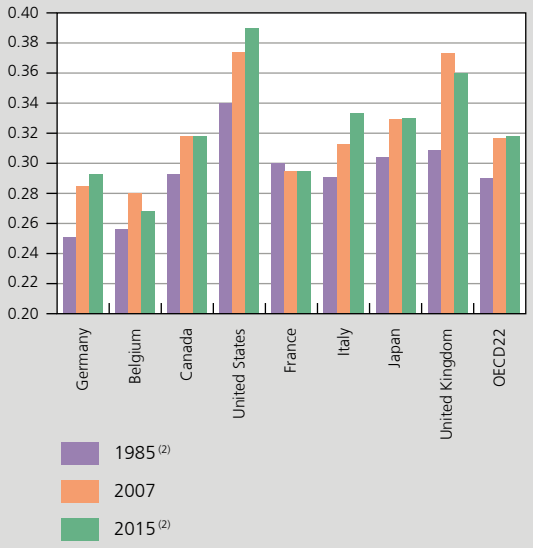
Since the mid-1980s, most advanced economies have shown growing inequalities in income and wealth distribution, particularly the United Kingdom and the United States. These inequalities reflect both a clear rise in the level of the highest income brackets and the fact that median income is growing more modestly; indeed, the lowest income brackets are even stagnating (OECD, 2016). On average, income inequalities in OECD countries as measured by the Gini coefficient have gone up by around 10 %.

These developments reflect several structural trends including technological progress[(1)], automation and globalisation. Technological progress has translated into a premium for the highly educated, while globalisation and international trade have depressed the wages of less educated workers. The lowest income brackets have also been hit harder by the 2008-9 global financial crisis (OECD, 2016). Song *et al.* (2015) have shown that the increasing inequalities in the United States are attributable to growing income disparities between different firms rather than

(1) There is no clear-cut relationship between technological progress and inequality, however. On the one hand, new technologies seem to be exacerbating inequalities as they appear to be boosting demand for highly educated staff and curbing demand for less educated employees. On the other, new technologies may help to reduce inequality, a case in point being ICT developments that reduce the cost of knowledge acquisition and facilitate access to funding. At the same time, current innovations in the services sector (Uber, AirBnB, Deliveroo, etc.) may boost the integration of less educated workers into the labour market.

growing income inequalities within individual firms, corroborating the observation of higher productivity disparities between corporations.

CHART 5 GINI COEFFICIENT OF INCOME DISPARITY [1]
(after tax and transfers)



Source : OECD.
(1) The Gini coefficient varies between zero (fully equal distribution of income among the population) and 1 (fully unequal distribution of income, with all income held by a single person).
(2) Data from 1984 for France and Italy and 2012 for Japan.

The distribution of wealth is around seven times more unequal than the distribution of income (OECD, 2016), implying that, in 2014, over 40 % of the wealth in the majority of OECD countries was in the hands of the wealthiest 10 % of the population. In the United States, the figure was almost 80 % [1]. Despite the economic recovery of the past few years, inequality has remained high, or has even grown.

Inequality is impacting individual opportunities for access to education, new technologies, training and healthcare. It has the effect of lowering the general educational level of a society and the quality of jobs in an economy. Indirectly, it weighs on the distribution of productivity and on aggregate productivity (OECD, 2016).

3.1.8 Slowing growth of human capital

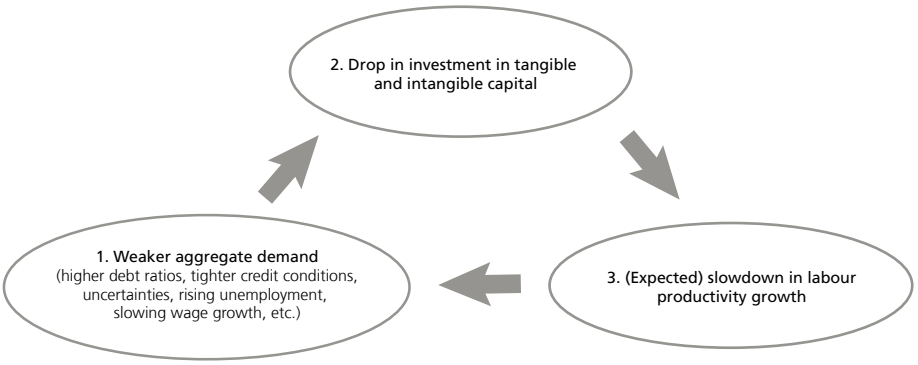
The individual and social benefits of education are high, particularly in terms of productivity and incomes. The secular rise in the level of education seen in the past decades has, for instance, made a significant contribution to productivity growth in the advanced economies (IMF, 2017). Since the 2000s, and in some countries even before then, the accumulation of human capital has been slowing, as evidenced by – among other things – a slowdown in the growth of highly educated people. This deceleration may have contributed to the fall in labour productivity growth by 0.3 % annually (ibid.).

(1) 2016 figures.

3.2 Cyclical factors

The global crisis of 2008-09 set in motion a vicious cycle : (1) in a highly unpredictable economic environment – featuring high debt ratios, rising unemployment and tightening credit conditions – a fall in aggregate demand prevented or dissuaded firms from investing ; (2) in turn, the investment deceleration held down labour productivity by reducing capital intensity and delaying the introduction of new technologies ; (3) lastly, the decline in productivity gains put pressure on consumption and investment, mainly through slowing wage growth and narrowing margins. Although the shock was temporary, its intensity and persistence contributed to long-term total factor productivity losses.

DIAGRAM NEGATIVE FEEDBACK LOOP OF THE GLOBAL FINANCIAL CRISIS



Source : NBB.

3.2.1 Bank credit tightening

During the crisis, banks responded to the increase in perceived risk, balance sheet constraints and funding costs by tightening their lending criteria. Given that smaller firms depend largely or even exclusively on the banking sector for their financing, they were hit harder than large firms, which have easier access to the capital market.

This impact was particularly apparent in the euro area, whose non-financial private sector relies heavily on bank financing, and even more so in the countries hit hard by the sovereign debt crisis between 2010 and 2013. It curbed not just investment by established firms (ECB, 2018) but the incorporation of new firms. However, the largest productivity gains are often generated by new and fast-growing firms. Although credit conditions have eased markedly, the earlier effects of the crisis on the establishment and entry of new firms could have a lasting negative impact on productivity growth (Dumont and Kegels, 2016).

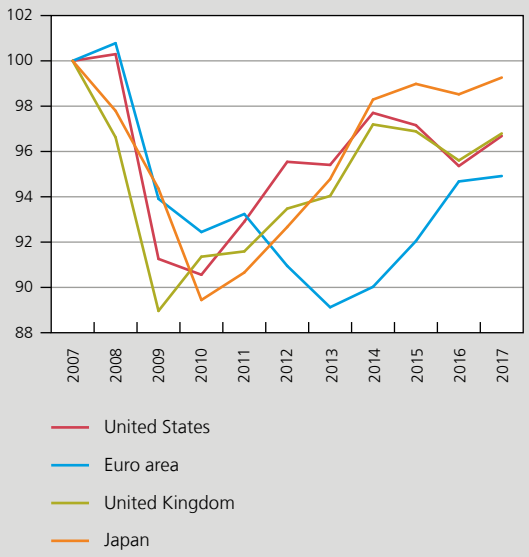
3.2.2 Sharp investment drop

In the face of tightened credit standards and significant uncertainty, the crisis severely weighed on tangible and intangible asset investments. The steep decline in investment had direct implications for capital intensity and impacted total factor productivity indirectly by curbing the adoption of new technologies. R&D cuts curtailed firms' innovation capacity, thereby potentially jeopardising the future growth of productivity gains (IMF, 2017). Given the unpredictable economic climate, firms also shifted their focus to lower-risk but less profitable investment projects (ibid.).

Compared with previous recovery phases, investment rebounded only modestly after the crisis, in particular in tangible assets and in the euro area. This sluggishness is indicative of a persistently uncertain climate and rising debt ratios in the private and public sectors alike. All in all, post-crisis public investment in the advanced economies fell markedly relative to GDP, potentially holding productivity down in the long term (Goldin *et al.*, 2018).

CHART 6 GROSS INVESTMENT IN FIXED ASSETS EXCLUDING HOUSEBUILDING

(in % of GDP, 2007 = 100)



Source : Ameco.

3.2.3 Hysteresis effect and loss of human capital

In the advanced economies, the great recession of 2008-09 drove up the general unemployment rate. Long-term unemployment (12 months or over) also increased, much more distinctly and persistently in the euro area than in the United States, the United Kingdom and Japan. Prolonged periods of unemployment, which erode the skill level among workers, may lead to a loss of human capital. What is more, long-term unemployment increases the risk of poorer professional matching, particularly increased overqualification, as the unemployed more readily accept positions for which they are overqualified. There are evidences that the crisis has deteriorated the matching of labour supply and demand in the euro area (ECB, 2012). Incidentally, in the United Kingdom the percentage of overqualified workers rose significantly against the background of the post-crisis economic recovery (ONS, 2016). Overqualification implies a waste of resources and threatens to exacerbate wage inequalities.

3.2.4 Poor capital allocation between sectors and firms

It would appear that capital misallocation in advanced economies worsened before as well as after the crisis (IMF, 2017).

The accumulation of household debt during the pre-crisis boom in the real estate sector may have slowed productivity growth in some countries, with funds being allocated to projects yielding little or no profit. Compared with other, more productive sectors, the real estate sector used up an excessive portion of available funds. This happened chiefly in the United States, the United Kingdom and some euro area countries, for instance Spain.

At the same time, the crisis may also have affected smooth capital allocation between firms, because non-performing firms continued to mobilise funds, shrinking total average productivity. This is reflected by the growing number of 'zombie firms' recorded since 2007-08 [1]. Zombie firms are non-viable firms that would have ceased to

(1) The OECD defines zombie firms as firms more than ten years old with an interest coverage ratio (EBIT/interest payments) of less than one for three consecutive years. See Adalet McGowan, M., D. Andrews & V. Millot (2017), "The Walking Dead? Zombie Firms and Productivity Performance in OECD Countries".

exist in a normal economic environment but continue to operate thanks to the absence of competitive pressure and the ease with which banks renew their loans ('evergreening'). Some banks tend to extend subsequent loans to borrowers, keeping them from recognising potential losses that would compel them to raise fresh capital. Against the backdrop of an accommodating monetary policy, they can charge low interest rates. The problem is that zombie firms use up labour and capital that could be allocated more efficiently, thereby stifling the growth of healthy firms (Adalet McGowan *et al.*, 2017).

The phenomenon of zombie firms was initially studied for the Japan of the 1990s, where it had contributed to the country's economic stagnation. More recently, however, Japan has been relatively spared from them. The number of zombie firms increased particularly in some euro area countries (Greece, Spain and Italy), where they eventually mobilised up a considerably portion of the available capital (ibid.). Having reformed its banking sector earlier, the United States has produced only few zombie firms.

3.3 Is productivity being mismeasured ?

Against the background of the rapid development of ICT-related goods and services, whose economic gains are particularly difficult to gauge, measurement problems are regarded as one of the factors explaining the slowdown in productivity gains. The underlying idea is that current estimates, which are based on official national account statistics, could underestimate productivity gains.

It is argued that the benefits of numerous recent innovations – smartphones, social networks and all kinds of digital applications – are not apparent from their usage charges, which would explain why only a small portion of these benefits are included in GDP. More specifically, the time saved by shopping or consulting information online is reportedly not taken into account when measuring total income. For example, a study focusing on the United States conducted by Byrne *et al.* (2016) showed that annualised growth in labour productivity was higher when adequately factoring in intangible asset investments, software and IT equipment prices, or even internet access and e-commerce.

Although the debate is still lively and measurement errors are a reality, the available data do not suggest that the productivity slowdown during the recent period can be largely explained by them (IMF, 2017). If anything, measurement problems are more likely to affect productivity levels rather than productivity growth.

It is worth stressing that the issue concerning the social benefit of innovations relative to their contribution to GDP growth is not new and extends beyond the digital economy. Over the years, medical advances have done much to reduce child mortality and mobile phones have helped enhance safety by allowing direct contact with emergency services. However, it is quite possible that the digital revolution has added to the problems of underestimating economic growth (Crafts, 2018).

Conclusion

Productivity growth has been under pressure in all advanced economies since the early 2000s. Many factors have been put forward to explain this state of affairs : structural factors including the less revolutionary nature of recent innovations, obstacles to technology spread, flagging economic dynamics, an ageing labour force, slowing world trade, rising inequality and the slowing growth of human capital. Cyclical factors relate closely to the 2008-9 great recession and include past credit tightening, a sharp investment drop, loss of human capital due to hysteresis effects, and poor capital allocation within the economy.

The big question that many economists are grappling with is whether these are permanent or temporary phenomena. Who is able to predict how productivity gains will evolve going forward ? Such gains will depend on the economic benefits of current and future technological breakthrough while also being influenced by structural trends such as demography. And lastly, they will reflect policy measures taken to encourage investment and the establishment of corporations, to foster competition, reduce inequality, improve access to education and even to smooth the process of creative destruction.

The almost secular slowdown of productivity growth of the past decades suggests that the low-hanging fruit of economic development has now been picked. Growing focus on the environment and fighting global warming might well curb future productivity gains while ushering in growth of greater quality, more sustainable and fairer. In that context, it looks risky to assume a return to the growth percentages of the past. At the level of individual countries, the ability to implement visionary structural change could well make the difference.

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House prices and economic growth in Belgium

P. Reusens
Ch. Warisse (*)

Introduction

The economic and financial crisis of 2008 and the following years has shown the importance of the housing market for both financial stability and economic growth. The subprime mortgage crisis in the United States since 2006 is in fact considered to be one of the triggers of the Great Recession, while the bursting of the housing bubbles in Spain and Ireland set off and propagated an important slowdown in economic activity in the euro area. These two recent episodes demonstrate how closely housing markets and economic activity can be linked.

The literature describes several channels through which house prices can have an impact on economic activity. First, residential property prices can influence private consumption through their effect on the real estate wealth of households, the cost of future housing and mortgage lending. Changes in house prices can also affect investment in new dwellings, which is the main component of residential investment. According to the Tobin's Q ratio theory, higher house prices imply that new dwellings could be sold at a higher price, such that, assuming building costs remain unchanged, investment in new dwellings would become more profitable. Lastly, a significant deviation in property prices relative to their equilibrium level, especially when combined with rapid credit growth, can increase the risk of a banking crisis and in addition lead to much deeper and more protracted recessions.

Empirical studies suggest that the link between house prices and economic activity – through both consumption and residential investment – is typically less strong in the euro area than in the United States and the United Kingdom, albeit that there are also major differences across the euro area. How large are these differences between the countries, what explains them and where does Belgium rank ? Next, was the virtually uninterrupted rise in property prices over the past decades unique to Belgium and what does this mean for the financial stability ? These are the main questions this article sets out to answer. The first section describes household wealth and house prices over the past decades, for both Belgium and a number of other advanced countries. These prices are also compared with their key macroeconomic determinants, as well as their main constituent components, including land prices. The second and third sections analyse the effect of house prices on private consumption and residential investment respectively, for Belgium and several other advanced countries. The fourth section reviews the housing market's potential risks to Belgium's financial stability, drawing on a summary of the key messages from the Bank's macroprudential analysis among other sources. The article ends with a recap of key conclusions.

(*) The authors would like to thank Isabelle Brumagne, Koen Burggraeve, Elianne De Prest, Philip Du Caju, Alexandra Jespers, Geert Langenus, Christophe Piette, Thomas Schepens, Ines Wilms and Marie-Denise Zachary for their useful comments.

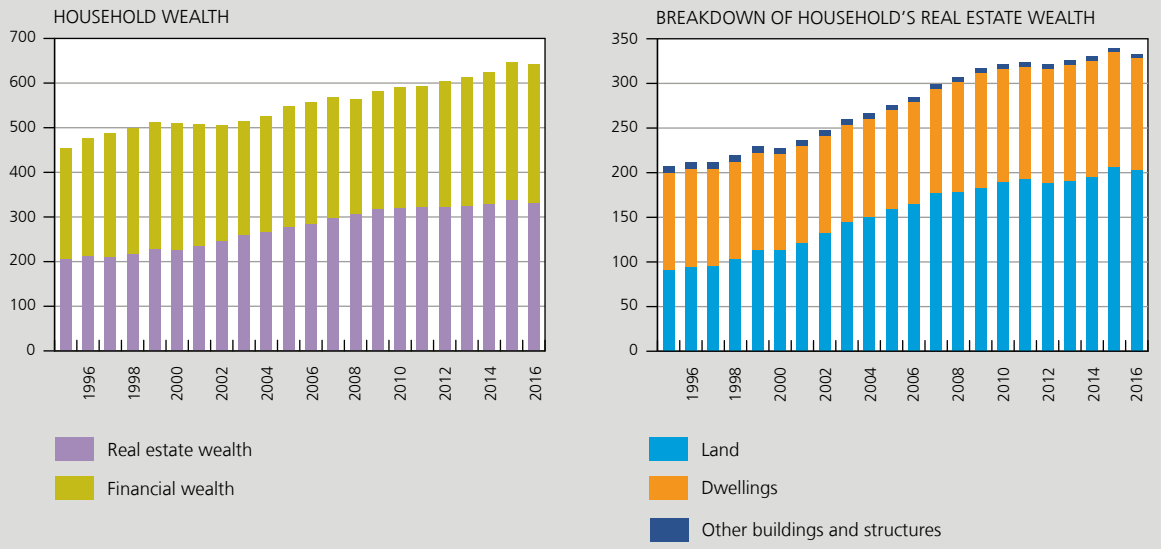
1. Housing market and household wealth

1.1 Household wealth

Household wealth, which consists of both financial and real estate assets, has been growing virtually uninterruptedly in Belgium in the past two decades, up to around € 2,700 billion in 2016, i.e. 645 % of GDP.

These assets are currently mainly held in form of real estate, amounting to € 1,412 billion in 2016 (or 334 % of GDP). Moreover, as a result of their uninterrupted growth since 1995 (the first year for which data is available), real estate assets are the main driving force behind Belgium's household wealth. Real estate wealth has exceeded financial wealth in Belgium since 2003.

CHART 1 HOUSEHOLD WEALTH IN BELGIUM
(as a % of GDP)



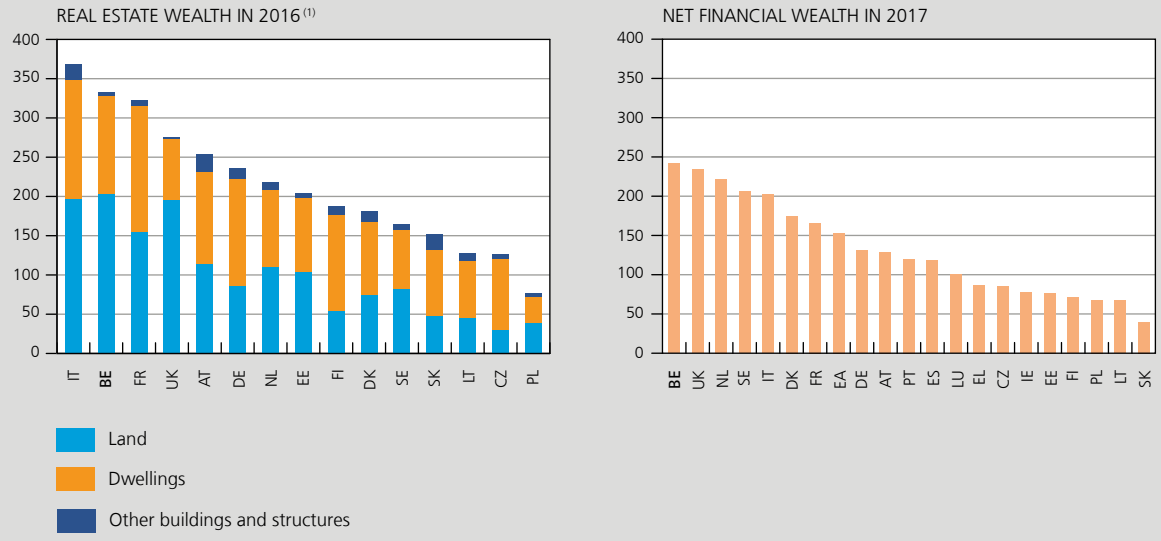
Source : NAI.

Households' real estate wealth breaks down into three types of asset : land, dwellings and other buildings and structures. According to statistics issued by the National Accounts Institute (NAI), land accounts for the largest proportion of property assets (61 %), to the tune of a total € 863 billion in 2016 (or 204 % of GDP). At an average increase of 7 % per annum, land is also the asset category that has contributed most to households' real estate wealth growth since 1995. They mainly include areas on which dwellings (74.2 %) or other types of buildings (6.3 %) are sited, alongside building plots (5 %) and agricultural land (4.5 %). Property assets in the shape of buildings came to € 549 billion (or 129 % of GDP) in 2016 and mainly consist of dwellings. The rise of this latter component since the 1990s is largely attributable to valuation effects, as property prices were on a virtually constant uptrend in the period.

Financial household wealth, by contrast, experienced two major reductions : when the dot.com bubble burst at the start of the 2000s and during the financial crisis in 2008 and subsequent years. However, the value of the financial portion of household assets has since resumed its upward trend against the backdrop of steady increases in financial asset prices, enabling households to make up for the value losses and start locking in new gains from 2013, primarily thanks to their equity portfolios and investment fund units (Baugnet *et al.*, 2017). By 2016, the household financial wealth amounted to € 1,314 billion (or 310 % of GDP).

In terms of both real estate and financial wealth, Belgian households are at the top of the European ranking. That said, only a few European countries release statistics that enable a distinction between the value of buildings and that of land. Among those that provide such data to Eurostat, Belgium ranks second (334 % of GDP in 2016), after Italy (370 % of GDP) and at a level similar to France (327 % of GDP), but ahead of Germany (236 % of GDP) and the Netherlands (218 % of GDP), in particular. Belgium's position in the ranking mainly derives from the value of land held by households, which happens to be the highest for all European countries that publish these statistics. [1] To an extent, the differences between the countries are attributable to specific features, such as the percentage of property owners and population density, this latter factor causes upward pressure on the value of real estate assets, particularly land. Finally, net financial household wealth in Belgium, expressed as a percentage of GDP, is the highest, their outstanding debt remaining limited compared to the significant volume of their financial assets.

CHART 2 HOUSEHOLD WEALTH IN BELGIUM AND A NUMBER OF OTHER EUROPEAN COUNTRIES
(as a % of GDP)



Source: EC.
(1) 2015 data for Austria, Estonia, Lithuania and Poland.

1.2 House prices

Household wealth, then, has staged significant growth in the past decades, primarily on the back of robustly growing asset prices. Regarding real estate wealth, Baugnet *et al.* (2017) estimate the share of valuation effects at nearly two-thirds in its growth since 2008.

1.2.1 House prices in Belgium and the euro area

In Belgium, as in numerous other European countries, house prices have surged in the past decades, particularly since the early 2000s, with prices having more than doubled in nominal terms and risen 1.7 times in real terms. In fact, there have only been two genuine periods of falling prices since reliable statistics became available: one in the first half of the 1980s, when nominal prices contracted by 2.7 % on average per annum and real prices by 7.6 %, and a second,

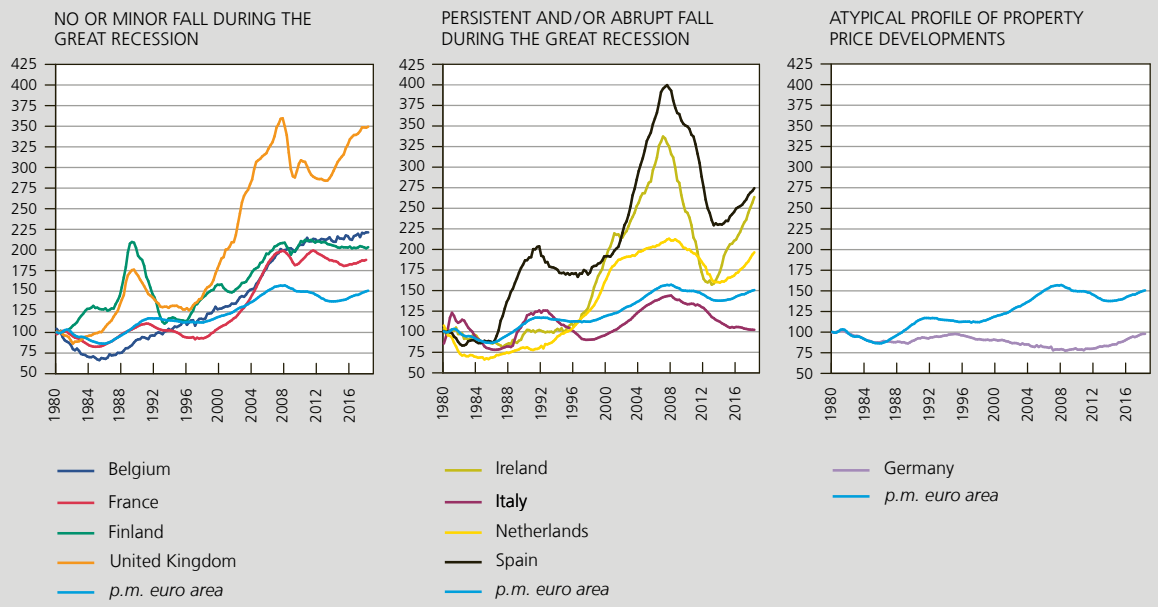
(1) Due caution should be observed when interpreting outcomes, as methods for calculating the value of land in households' real estate wealth may differ from one country to the next. In Belgium, for instance, all types of land are included, which is not necessarily true elsewhere. That said, the effect on Belgium's place in the rankings is not significant, as data reflects most of the land in the possession of households.

period, which was shorter, at the time of the economic and financial crisis, when nominal prices moved down by barely 3 % and real prices by 2 % over a total three quarters.

Property prices in many European countries fluctuated around this upward long-term trend, so that multiple cycles emerged. Undoubtedly, the most notable of the latter was the cycle that began with the upward phase between the second half of the 1990s and 2007, a period that also saw a high level of synchronisation between the European countries, and which ended with the downward correction during the economic and financial crisis in 2008 and subsequent years, a time marked by greater heterogeneity between countries.

CHART 3 REAL PROPERTY PRICES IN BELGIUM AND IN A SELECTION OF EUROPEAN COUNTRIES

(indices 1980 = 100)



Sources : OECD, NBB.

Although house prices in Belgium have clearly been on an upward trend in recent years and have risen more strongly than in the euro area as a whole, they have increased (significantly) faster in a number of European countries, including Spain, Ireland, the United Kingdom and the Netherlands. Granted, these countries also saw more pronounced and persistent downward corrections against the backdrop of the Great Recession a decade ago, but their property prices have been back on the up for a number of years now, and more rapidly so than in Belgium.

With regard to the most recent developments, house price growth has recovered in the euro area since 2014 (see Table 1). The pace of growth broadly matched that in Belgium, except in 2016, when it was clearly higher (3.4 % compared with 1.6 %). The euro area average would appear have been affected by longer price falls in two of its large economies – Italy and France. As noted, Belgium saw house prices rise generally less rapidly than did other key euro area member states, regardless of whether or not they are countries that recorded a correction at the time of the Great Recession. Germany and Austria, for instance, also recorded much higher growth in house prices.

Analyses of property prices, and particularly international comparisons, tend to draw mainly on price indices. Although they provide information about house price trends over time, such indicators do not, however, provide any indication on price levels. Scant available data on average prices per square metre suggests that Belgium typically comes in at around the European average, both in terms of prices charged in major European cities and of average prices by country.

TABLE 1 NOMINAL GROWTH IN EURO AREA PROPERTY PRICES
(in %)

	EA	BE	DE	NL	ES	IE	AT	FR	IT
2013	–2.1	1.3	3.1	–6.0	–9.1	1.2	5.2	–2.1	–6.5
2014	0.3	0.2	3.1	0.8	0.3	16.5	3.5	–1.8	–4.7
2015	1.7	2.0	4.7	3.6	3.6	11.5	4.9	–1.9	–3.8
2016	3.4	1.6	6.0	5.0	4.6	7.5	8.5	1.0	0.3
2017	3.7	3.8	4.6	7.5	6.2	10.9	5.3	3.0	–1.1
2018 (1)	4.2	3.2	5.1	9.3	6.5	12.4	4.5	2.9	–0.4

Sources: OECD, NBB.
(1) First two quarters of 2018 compared with the corresponding period of the previous year.

1.2.2 Determinants of property prices in Belgium

Trends in property prices may be explained by a variety of determinants. This article looks at two complementary approaches, the first of which is based on the idea that a residential property is the sum or combination of different components, specifically its structure and the land it is built on, while the second approach relates price developments to a series of macroeconomic variables.

1.2.2.1 Property prices broken down into building land and structures

The first approach, then, sees a property as a combination of two key elements: its structure, i.e. the building as such, and the land on which it is built. By extension, the price paid for a dwelling can be broken down into the replacement costs of the structure and the price of the building land.

This approach has been adopted by Knoll *et al.* (2017). To this end, they model the real estate sector's production function as a Cobb-Douglas-type with two production factors, i.e. the building land (Z) and the residential structures (X):

$$F(Z_t, X_t) = (Z_t)^{\alpha}(X_t)^{1-\alpha} \qquad (1)$$

in which α is a constant technology parameter with a value between zero and one. (1)

The above allows us to derive the relative importance of the price of the two production factors in long-run property prices growth. The following formula is used to compute the share of land price (p^Z) and that of residential structures (p^X) in house price increases (p^H) between t and t+1.

$$\alpha \frac{ln\left(\frac{p^{X\ or\ Z}_{t+1}}{p^{X\ or\ Z}_{t}}\right)}{ln\left(\frac{p^{H}_{t+1}}{p^{H}_{t}}\right)} \qquad (2)$$

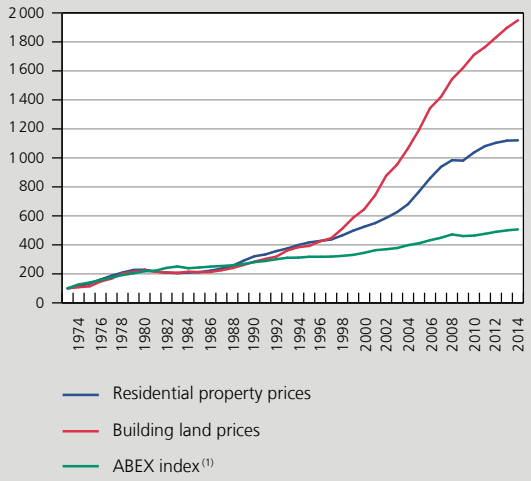
Prices of these production factors cannot be directly observed. The price developments regarding the land on which buildings are sited may be approximated through price trends for building land. To a degree, changes in replacement costs for the building's structure are comparable to changes in construction costs.

(1) Knoll *et al.* (2017) set the value of the parameter at 0.5. However, the outcomes remain robust if the value of the parameter is kept within reasonable limits.

In Belgium, land prices have been rising more robustly than those for dwellings, especially since the 2000s. Between 1973 and 2014[1], nominal house prices multiplied by a factor of 11, compared with a factor of 19 for land prices. By contrast, construction costs as measured by the ABEX index[2] recorded only a fivefold uptick in the same period.

CHART 4 NOMINAL HOUSE AND LAND PRICES, AND BUILDING COSTS

(indices 1973 = 100)



Sources: ABEX, NBB.
(1) Indicator of construction costs.

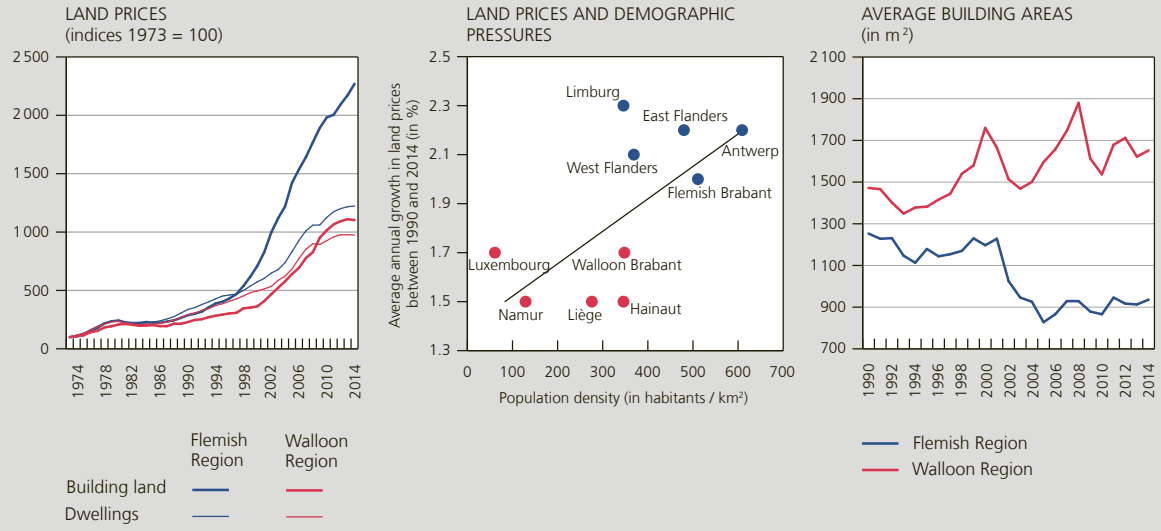
Equation (2) reveals that 73 % of real house prices growth in Belgium between 1973 and 2014 is attributable to the increase in land prices in the period. Therefore, higher building costs accounted for only 27 % of the upturn in house prices, an outcome similar to those arrived at by Knoll *et al.* (2017). They found that, for a total of 14 advanced economies including Belgium, land price dynamics have been the main driver of property prices since the second half of the 20th century. They estimate the share of land price growth in residential property price growth at 81 % between 1950 and 2012. Note that land prices' contribution to higher property prices varies per country, from 74 % for the United Kingdom and 96 % for Finland. Belgium's precisely matches the average, i.e. 81 %.

Belgium nevertheless shows marked differences between its various regions[3], with land prices rising most rapidly in the Flemish Region, i.e. by a factor of 23 between 1973 and 2014, compared with a factor of 11 for the Walloon Region. With the exception of the early 1980s and the period between 2006 and 2011, land prices staged a more pronounced rise in the Flemish Region, most particularly between 1992 and 2003. It was during this time that the growth gap relative to the Walloon Region widened to a record 13 percentage points in 1999 and 2000.

Moreover, the more rapid increase in land prices in the Flemish Region was also reflected in a more pronounced divergence vis-à-vis house price increases from the late 1990s, whereas these two variables developed rather more in parallel in the Walloon Region, although differences were seen here too. Under the same approach than above, the increase in land prices between 1973 and 2014 accounted for an estimated 74 % of the real increase in house prices for the Flemish Region. This percentage worked out at 54 % for the Walloon Region in the same period.

(1) The analysis is restricted to the 1973-2014 period because of data availability. Official statistics on building land prices are no longer available after this date. That said, post-2015 alternative data confirms the outcomes of the analysis below.
(2) The ABEX index measures costs for residential property constructions and is calculated by pulling together the observations of the members of a nation-wide committee. The period covered by the index is very wide-ranging, as its first observation dates back to 1914.
(3) This analysis ignores the Brussels Capital Region, as building land is relatively scarce here and transactions are few, making the available data less than representative and price indicators more volatile.

CHART 5 PRICES AND LAND SCARCITY IN THE FLEMISH AND WALLOON REGIONS



Sources: Statistics Belgium, NBB.

The much higher increase in land prices in the Flemish Region can partly be explained by a higher relative scarcity of land than in the Walloon Region. As a whole, the Flemish Region is indeed more densely populated than the Walloon Region, reducing the available space for building. With the exception of Hainaut and Walloon Brabant, whose population densities are comparable to those in Limburg, all the Walloon provinces are less or much less densely populated than their Flemish counterparts. However, the growth in land prices since 1973 is positively correlated with this variable.

Meanwhile, the regions also saw diverging developments in average acreages for building land. Whereas acreages were relatively similar in 1990, with 1,250 square metres for the Flemish Region compared with 1,470 square metres in the Walloon Region, they have shrunk significantly in the Flemish Region, by 25 % to 940 square metres in 2014, while it increased by 12 % to 1,650 square metres in the south of the country in 2014. The gap between the two regions opened up in 2002, when the average area of building land suddenly dropped in the Flemish Region. A study by ING (Manceaux, 2011) argues that the decrease in land areas in the Flemish Region was caused by the promulgation of a new land use plan (Ruimtelijk structuurplan Vlaanderen) in 1999.

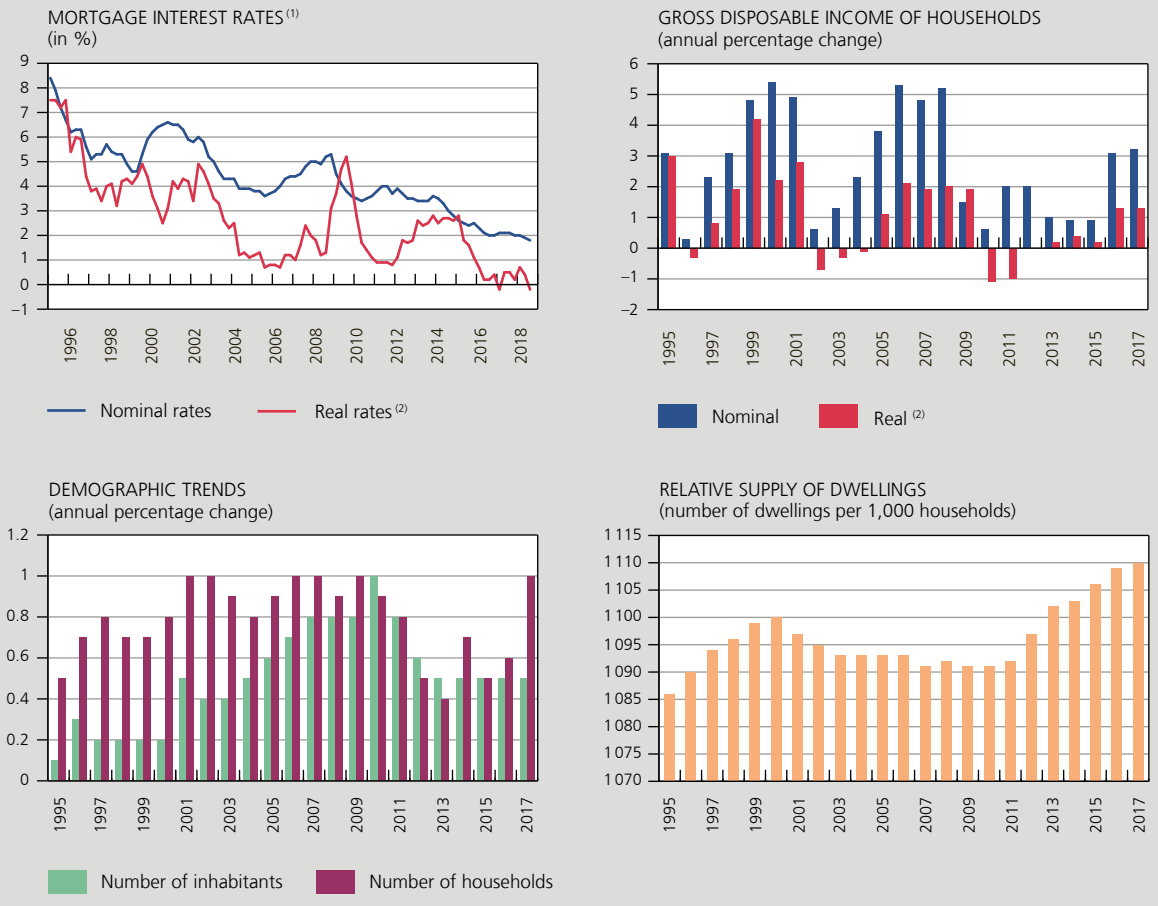
1.2.2.2 Fundamental determinants of house prices

The strong expansion of property prices in Belgium since the 1970s can largely be attributed to changes in a series of fundamental determinants of the housing market, mainly on the demand side (Warisse, 2017). In particular, the sharp downturn in mortgage rates in the past decades, combined with higher household incomes, made homes more affordable (all things being equal). Population growth has undoubtedly also played a role, as demographic pressures accelerated in the wake of the steadily decline in average household size. In addition, tax treatment of real estate changed in such a way that was likely to encourage access to mortgage loans and the demand for housing. With the exception of the devolution to the regions and the resizing of the tax deductibility of mortgage loans ('housing bonus') from 2015 (particularly in the Flemish Region, where such relief cut significantly), changes included the implementation of the housing bonus at the federal level in 2005, tax amnesties dating from 2004 that encourage Belgian households to repatriate funds from abroad – a proportion of which must have been reinvested in residential property –, the reduction of registration fees and, in the Flemish Region, the introduction of their portability.

The impact of demand factors on house prices depends on the extent to which supply adapts to them. If construction activity does not produce an adequate response to a rise in housing demand, pressures on house prices will increase in principle. Housing stock statistics reveal that supply has been typically adapted to demographic trends, with the number of dwellings rising faster between 1991 and 2017 (by 27 %) than the number of households in the same period (22 %). However, three sub-periods can be identified. First, between 1990 and 2000 the housing stock expanded strongly in relation to the number of households. Next, the trend reversed and stabilised up to 2010, implying a reduction in the number of vacant dwellings, which was most likely one of the factors underlying the rise in property prices during that period, particularly between 2001 and 2007. Finally, the latest observations indicate that, since 2011, the housing stock has grown by more than demographics, which might suggest a smaller impact of demand factors on the growth of residential property prices.

Nonetheless, these results concern Belgium as a whole. Although, overall, supply seems to have adapted to the increase in the number of households, the situation may vary considerably from one region to another. In that context, the Brussels Capital Region is an interesting case, as the growth differential between the housing stock and the number of households became clearly negative there between 2007 and 2011. Although the latest observations since 2012 reveal more favourable results, they do not offset past developments. This also suggests that the construction of new homes is not necessarily taking place in the areas where the demographic pressure is greatest, which may be due partly to a more limited supply of building land and generally more stringent planning regulations

CHART 6 DETERMINANTS OF HOUSE PRICES IN BELGIUM



Sources: NAI, Statistics Belgium, NBB.
(1) Average interest rates on new contracts.
(2) Deflated by the private consumption deflator.

in those areas. As indicated in the third section of this article, the price elasticity of housing supply shows a negative correlation with population density as well as with the rigidity of laws and regulations governing housebuilding. In the other two regions, the situation seems less of an issue, at least from an aggregate point of view, with the housing stock expanding more slowly than the number of households only for a short period, i.e. between 2001 and 2006 in the Walloon Region and between 2001 and 2007 in the Flemish Region.

Lastly, other factors have probably stimulated demand for property and so contributed to recent increases in house prices, in both Belgium and elsewhere in Europe. These include the persistent low interest rate environment, which may indirectly influence the housing market by making real estate investments attractive compared to other financial investments, which have seen significant falls in returns.

2. House prices and private consumption

This section outlines the effect of house prices on private consumption. After a brief discussion of the transmission channels, this effect is estimated for eleven advanced countries using an error correction model (ECM) for private consumption.

2.1 Transmission channels of house prices to private consumption

House prices can influence private consumption through their effect on housing wealth, the cost of future housing and mortgage lending.

First of all, higher house prices increase the housing wealth of households, which can result in a positive wealth effect on consumption. The life cycle theory of consumption posits that households spread their consumption across their lifetimes, factoring in their total real estate and financial wealth as well as their expectations on future income flows (Ando and Modigliani, 1963). An expansion of their wealth should therefore have a positive effect on household consumption, as should an increase in the discounted value of future income flows.

However, the positive wealth effect of higher house prices is partly offset by the negative impact on consumption of a higher future cost of housing. Unlike financial assets, houses are not only an element of household wealth, but they also provide housing to the households. The cost of housing consists of rent for tenants and of implicit rent for owner-occupiers, i.e. the rent they would pay if they were renting their own dwelling. As an increase in house prices often also implies an increase in future rents, it can also have a negative impact on consumption via that channel[(1)]. Tenants, who would face higher rent expenses in the future, would cut their current consumption in the face of rising house prices. Also future buyers would reduce their consumption as they would need to save more to buy a particular property. For property owners, by contrast, and in particular for those owning more than a single property, the positive wealth effect resulting from their increased housing wealth would be larger than the negative effect of the increase in the implicit rent on their dwelling. Therefore, an increase in house prices primarily has a redistributive effect on consumption, in the sense that tenants and future buyers would be worse off and would consume less, and that property owners would be better off and would consume more (Cooper, 2016). As the group of future buyers and tenants is largely made up of the younger and future generations and of households with low income and limited wealth, an increase in house prices also implies an inter-generational wealth transfer and increases inequality (Muellbauer and Murphy, 2008).

The aggregate wealth effect of an increase in house prices on consumption is typically considered to be minor as the potential increase in consumption of owners would in part be cancelled out by tenants and future buyers consuming less (Muellbauer, 2007). This aggregate effect depends in part on the characteristics of a country's housing and mortgage market. It is likely to be less positive in countries with a low percentage of homeownership, such as Germany, where the housing wealth is less equally distributed across the population and where a proportion of the real estate is held indirectly by households through pension funds (Catte *et al.*, 2004; Muellbauer, 2007). Also in countries with a low average loan-to-value ratio, in which a large down payment as a percentage of the value of the property is required

(1) However, Berger *et al.* (2017) and Iacoviello (2011) argue that a higher cost of housing would result in a substitution effect in which households opt to live in cheaper homes to be able to maintain their consumption spending levels.

to obtain a mortgage loan, the aggregate effect of higher house prices would be smaller. The reason is that the required down payment in these countries would increase by an amount that corresponds to a larger fraction of the house price increase, such that future buyers would have to save more. Lastly, the aggregate wealth effect would be higher in countries with greater rent controls, as higher house prices would have less of an effect on rents such that tenants would reduce their consumer spending to a lesser extent in these countries (ECB, 2009). While many countries, including Belgium, only restrict rents in existing contracts and do not impose any controls on rents in new rental agreements, other countries, such as Germany, France, the Netherlands and particularly Sweden, also restrict the rents of new contracts (Kholodilin, 2018).

Finally, there exist a financial accelerator mechanism of higher house prices, more specifically through mortgage lending to property owners that want to borrow more for additional consumption spending. As higher house prices increase the home equity, which is the difference between the market value of the property and the remaining mortgage debt, banks could be more willing to extend additional credit with the property as collateral to these property owners. After all, more home equity reduces the credit risk for a bank, as, in the event of a default, it would likely be able to sell the property at a higher price than the outstanding debt. How big a part this financial accelerator mechanism plays in a country greatly depends on the existence and use of home equity withdrawal products, which enable households to obtain additional credit for consumption with the property as collateral, such as the so-called "opeethypotheek" in the Netherlands and the "home equity loan" and "home equity line of credit" in the United States (Calza *et al.*, 2013; Cardarelli *et al.*, 2008; Muellbauer and Murphy, 2008; Cooper, 2016)[1]. In Belgium, however, such home equity withdrawal products are hardly used[2].

2.2 Error correction model (ECM) for private consumption

To arrive at empirical estimates of the effect of house prices on private consumption, we have estimated separate error correction models (ECM) for consumption (C_t) for a number of advanced countries, in which the explanatory variables are the house prices (HP_t), the net financial wealth (FW_t), the household gross disposable income (DI_t) and the short-term interest rate (IR_t)[3]. Our model is comparable to the empirical models in Cardarelli *et al.* (2008), Case *et al.* (2005), Catte *et al.* (2004), Eugène *et al.* (2003), Ludwig and Sløk (2004) and Sousa (2009). The ECM model assumes that there is a stable long-run equilibrium relationship between consumption and its determinants, and that divergences from this equilibrium relationship will lead to gradual adjustments of consumption to this equilibrium.

2.2.1 The long-run equilibrium of consumption in the ECM model

The long-run equilibrium relationship of the ECM model is given by

$$\log(C_t) = \beta_0 + \beta_1 \log(DI_t) + \beta_2 \log(HP_t) + \beta_3 \log(FW_t) + \beta_4 IR_t + \varepsilon_t \qquad (3)$$

where the coefficients β_1, β_2 and β_3 are long-term elasticities representing the percentage effect on consumption of a 1 % increase in respectively disposable income, house prices and net financial wealth. The coefficient β_4 is a semi-elasticity and measures the percentage impact on consumption of a rise in the short-term interest rate by one percentage point. Finally, ε_t is the error term. The long-run equilibrium relationship is estimated using the ordinary least squares estimator.

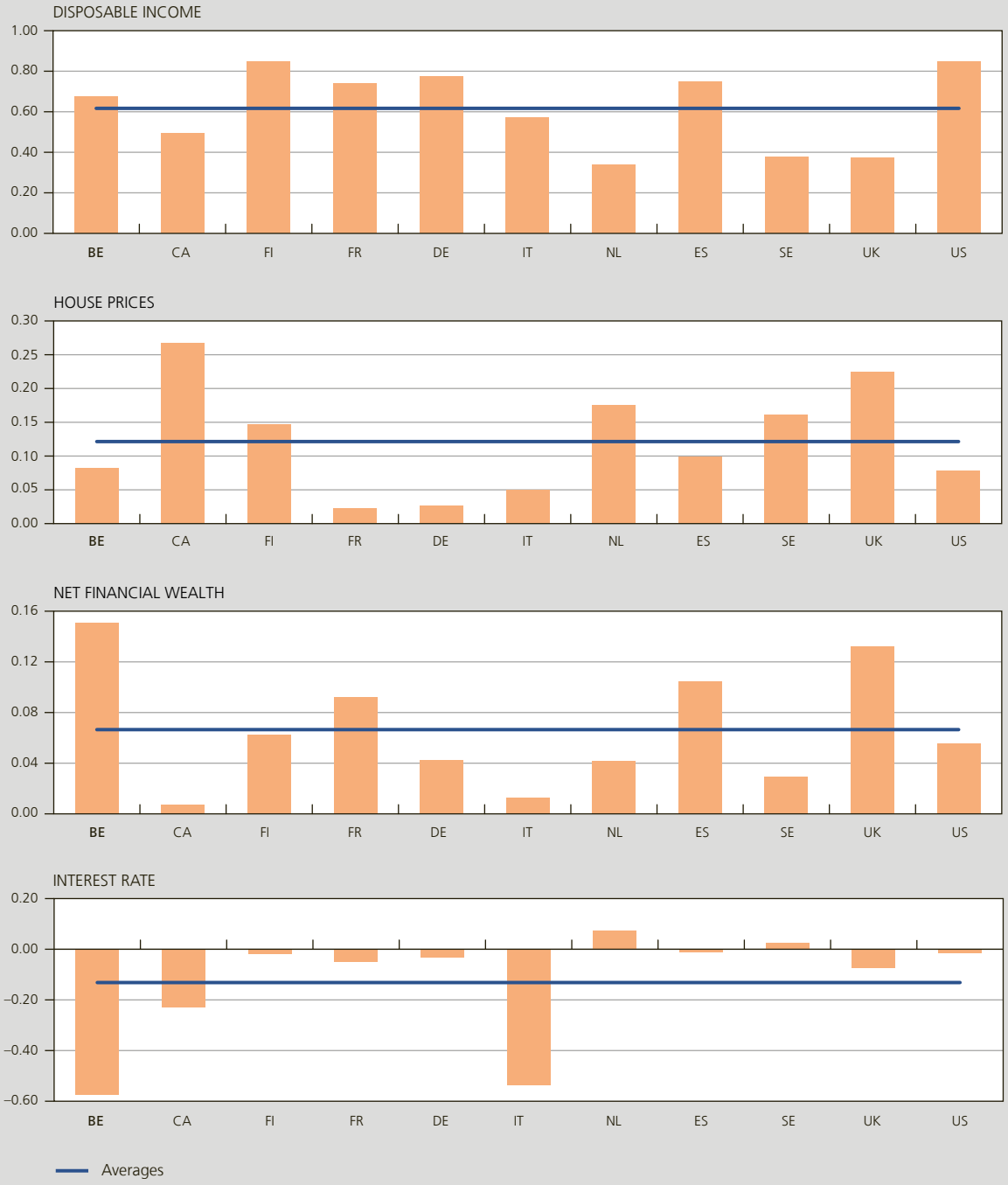
The estimates show that disposable income is an important determinant of consumption in all countries, with estimated elasticity varying from 0.34 (Netherlands) to 0.85 (United States), and with Belgium coming it at 0.68, just above the average. The estimated elasticity of the effect of house prices on consumption is between only 0.02 (France) and 0.27 (Canada) and is relatively low for Belgium (0.08). Net financial wealth has an estimated effect on consumption of only 0.01 for Canada and 0.15 for Belgium, meaning that the effect in Belgium is high relative to the other countries. In part, this may be explained by the high ratio of net financial wealth relative to GDP in Belgium (see Chart 2 in Section 1), as a 1 % increase in net financial wealth leads to a higher absolute increase. Finally, the effect of the

(1) Refinancing their current mortgage loan with a higher principal would be another way for owners to obtain additional credit for consumption.

(2) While in Belgium there exist mortgage loans with a movable purpose, which have the owner's property as collateral and can be used for the financing of a car among other purposes, these loans are hardly used: they accounted for a mere 0.4 % of new loans in 2018 (up to and including October).

(3) ECM models are estimated for the period between 1999 and 2017 (quarterly data) for eleven advanced countries, in particular Belgium, Canada, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden, the United Kingdom and the United States. All variables are deflated by the private consumption deflator, seasonally adjusted – with the exception of the short-term interest rate and the net financial wealth – and expressed as a logarithm (except the short-term interest rate). Lastly, the short-term interest rate is expressed as an annual percentage rate.

CHART 7 ESTIMATED COEFFICIENTS OF THE LONG-RUN EQUILIBRIUM OF PRIVATE CONSUMPTION IN THE ECM MODEL



Sources: Eurostat, OECD, own calculations.

short-term interest rate on consumption for most countries is negative. This could be explained by the substitution effect in which a higher interest rate makes saving relatively more attractive, while the potential income effect of a higher interest rate is not incorporated as the capital incomes are already included in the net financial assets variable of the model (Eugène *et al.*, 2003; Burggraeve and Jeanfils, 2008). The estimated semi-elasticity varies between –0.58 for Belgium and 0.07 for the Netherlands, and so is relatively large for the former in absolute terms.

These estimates should be interpreted with due caution. First, the estimated coefficients have a statistical error margin, as they are estimated using 76 observations for each country. In addition, it is assumed that the determinants of consumption in the ECM model are exogenous and their estimated effect on consumption could be biased by a feedback relationship between consumption and its determinants. Finally, the estimated effects could also be biased by variables that are not included in the model, but that do affect both consumption and its determinants. For instance, a more rapid projected growth in future incomes on the back of a faster expected technological progress could boost current and future consumption, house prices as well as the prices of financial assets such as share prices (Carroll *et al.*, 2011; Croux and Reusens, 2013; Iacoviello, 2011).

The next step was to compare the estimated long-term elasticities of the ECM model with the estimates of other empirical studies. For Belgium, the estimated impact of house prices and financial wealth on private consumption is clearly larger than earlier estimates or hypotheses for Belgium, such as in Eugène *et al.* (2003) and Burggraeve and Jeanfils (2008), both of which identified only a minor effect of net financial wealth and no, or even a slightly negative effect of house prices. That said, the estimates for Belgium were well within the range of estimates reported in studies for other advanced countries and are particularly close to the estimates of Sousa (2009) for the euro area. Finally, the range of estimated elasticities of the ECM model for the different advanced countries was comparable with those of other studies for advanced countries. However, it should be noted that the range of estimated elasticities is relatively wide and that the estimated elasticities for the same country or group of countries partly differ between the studies, which shows that these estimates have a margin of error.

TABLE 2 OVERVIEW OF ESTIMATED LONG-TERM ELASTICITIES OF CONSUMPTION FOR VARIOUS EMPIRICAL STUDIES[1]

	Studies for Belgium			Studies for other advanced countries				
	ECM estimate	Eugène *et al.* (2003)	Burggraeve and Jeanfils (2008)	ECM estimate	Case *et al.* (2005)	Coskun *et al.* (2018)	Ludwig and Sløk (2004)	Sousa (2009)
	Belgium			OECD countries				Euro area
House prices	0.08	–0.01	0.00	[0.02;0.27]	[0.11;0.17]	[0.09;0.19]	0.04	0.05
Net financial wealth	0.15	0.04	0.05	[0.01;0.15]	[–0.01;0.02]	[–0.08;0.06]	0.08	0.13
Disposable income	0.68	0.96	0.95	[0.34;0.85]	[0.29;0.66]	[0.50;0.85]	0.70	0.65
Interest rate[2]	–0.58	[–0.27;–0.14]	–0.30	[–0.58;0.07]	n.	[–0.33;0.39]	n.	n.

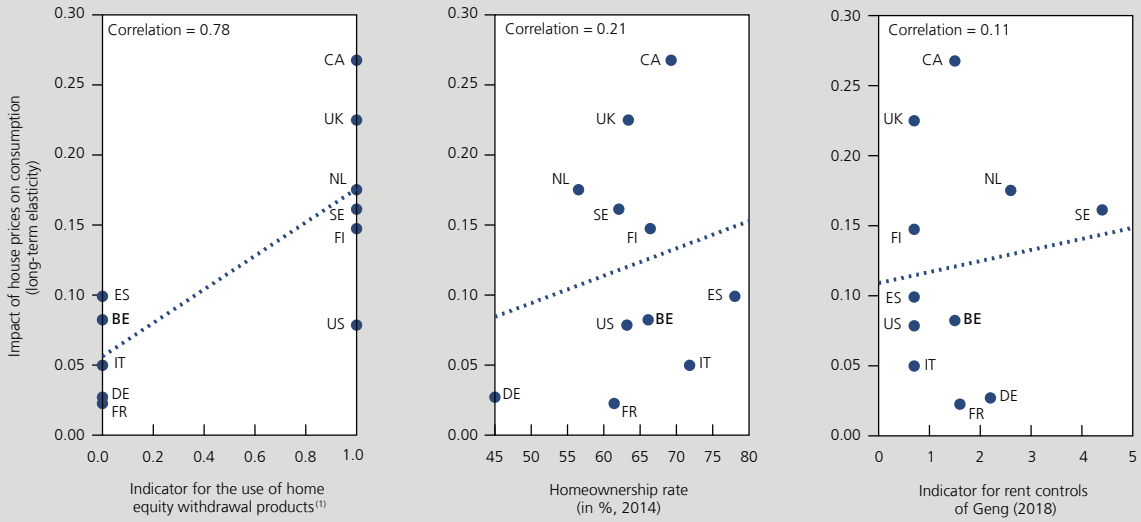
Sources: Burggraeve and Jeanfils (2008), Case *et al.* (2005), Coskun *et al.* (2018), Eugène *et al.* (2003), Eurostat, Ludwig and Sløk (2004), OECD, Sousa (2009), own calculations.

(1) The definitions of the variables in the empirical model differ in part between the various studies. Net financial wealth becomes share prices in Case *et al.* (2005), Coskun *et al.* (2018) and Ludwig and Sløk (2004). Disposable income is replaced by human capital in Burggraeve and Jeanfils (2008). Property prices feature as real estate wealth in Eugène *et al.* (2003) and Sousa (2009). And lastly, the variables – with the exception of the interest rate – are expressed in per capita terms in Case *et al.* (2005), Coskun *et al.* (2018), Ludwig and Sløk (2004) and Sousa (2009).

(2) The estimated semi-elasticity of the effect of the short-term interest rate on consumption.

Finally, we analyse to what extent the estimated impact of house prices on consumption is driven by structural features of the housing and mortgage market, drawing on simple correlations. First, there is a strongly positive connection between the long-term effect of house prices on consumption and the use of home equity withdrawal products. The correlation stands at 0.78 and is statistically significant. What is more, the elasticity of the effect of house prices on consumption is 0.12 higher on average for countries in which such home equity withdrawal products are frequently used (i.e. Canada, Finland, the Netherlands, the United Kingdom, the United States and Sweden) compared with countries in which these products are not or not frequently used (i.e. Belgium, Germany, France, Italy and Spain). Hence, like Cooper (2016), Cardarelli *et al.* (2008) and Kharroubi and Kohlscheen (2017), we find that the elasticity of house prices is highly dependent on the usage of home equity withdrawal products. Next, we find a positive correlation between the the size of the effect of house prices on consumption and the homeownership rate (also identified by De Nederlandsche Bank, 2018, and by Kharroubi and Kohlscheen, 2017), but the correlation of 0.21 is rather small and statistically not significant. Lastly, rent controls play a positive, but very minor and statistically not significant part. The impact of higher house prices on consumption would appear to be a little higher in countries that have strict rent controls, such as Sweden.

CHART 8 CHARACTERISTICS OF THE HOUSING AND MORTGAGE MARKET AND THE LONG-TERM EFFECT OF HOUSE PRICES ON CONSUMPTION



Sources: Calza *et al.* (2013), Eurostat, Geng (2018), OECD, own calculations.

(1) The indicator for the use of home equity withdrawal products is based on Calza *et al.* (2013), with categories "Not used/Limited use" and "Used" changed to a numeric index with respectively 0 and 1 as values.

2.2.2 The short-term consumption dynamics in the ECM model

The equation for the short-term consumption dynamics in the ECM model is given by

$$\Delta\log(C_t) = \alpha_0 + \gamma r_{t-1} + \alpha_1 \Delta\log(DI_t) + \alpha_2 \Delta\log(HP_t) + \alpha_3 \Delta\log(FW_t) + \alpha_4 \Delta IR_t + \delta_t \quad (4)$$

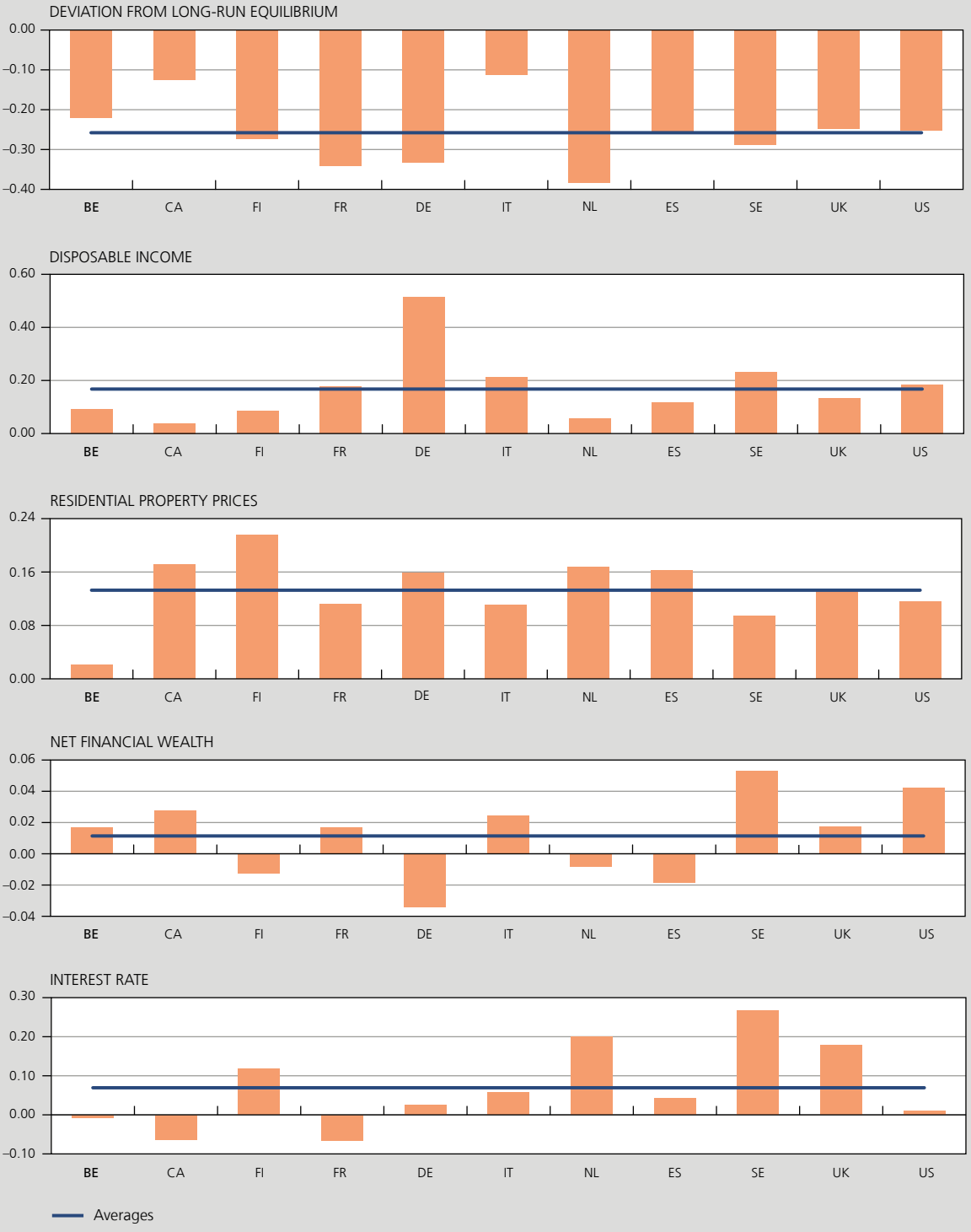
The residual r_{t-1} is the deviation from the estimated long-run equilibrium from equation (3). The coefficient γ is the proportion of this deviation that is corrected every quarter and it hence is a measure of the pace at which consumption adjusts to its long-run equilibrium. Coefficients α_1, α_2 and α_3 are short-term elasticities and represent the percentage impact on consumption of a 1 % increase of respectively disposable income, house prices and net financial wealth. Lastly, coefficient α_4 captures the semi-elasticity of the short-term interest rate and δ_t is the error term.

The estimated coefficient for adjustment towards the long-run equilibrium, $\hat{\gamma}$, is strongly negative and statistically significant for all countries, indicating that the ECM model with a long-run equilibrium for consumption is plausible[1]. In particular, this estimated coefficient varies between –0.11 (Italy) and –0.36 (Netherlands) and it stands at –0.22 for Belgium.

In addition to this important correction mechanism towards the long-run equilibrium, consumption growth in the ECM model is also determined by the short-term dynamics in disposable income, house prices, net financial wealth and interest rate. However, in absolute terms, the estimated short-term elasticities are typically smaller than those in the long term. The estimated short-term elasticity of the effect of house prices on consumption varies between 0.02 for Belgium and 0.22 for Finland, meaning that it is small in Belgium. Compared with the long-term impact, these differences in the estimated short-term effect of house prices on consumption between countries are only to a lesser extent explained by the above discussed features of the housing and mortgage market. The short-term elasticity only has a positive correlation with the indicator for the use of home equity withdrawal products, even if this correlation of 0.37 is relatively small and statistically not significant.

(1) The null hypotheses of a unit root in residuals r_{t-1} is rejected for half the countries reviewed, which is another indication that the ECM model for consumption is a plausible model.

CHART 9 ESTIMATED COEFFICIENTS OF THE SHORT-TERM PRIVATE CONSUMPTION DYNAMICS IN THE ECM MODEL



Sources: Eurostat, OECD, own calculations.

3. House prices and residential investment

This section first discusses the importance of residential investment for the economic cycle. It then moves on to analyse to what extent residential investment is affected by developments in property prices, drawing on the estimated price elasticity of housing supply of Caldera and Johansson (2013). It ends on a discussion of the extent to which the price elasticity of housing supply influences the transmission of housing demand shocks to house prices, housing supply and economic activity.

3.1 The importance of residential investment for the economic cycle

For the most part (on average 56 % in the 2010-16 period), residential investment is composed of investment in new housing construction, but it also includes spending on refurbishments, as well as taxes and legal expenses related to the purchase of a dwelling. In addition, investment in new construction is also the main determinant of the volume growth of the residential investment. For the 1995-2017 period, residential investment's average share of GDP amounted to only 5.6 % on average for the advanced countries under review and 6.2 % for Belgium, compared with respectively

CHART 10 AVERAGE SHARE OF GDP AND VOLATILITY OF RESIDENTIAL INVESTMENT AND PRIVATE CONSUMPTION

Sources: Eurostat, OECD, own calculations.

(1) Volatility relative to GDP is measured as the standard deviation of the annual growth of residential investment and consumption relative to the standard deviation of GDP growth, calculated for the 1995-2017 period.

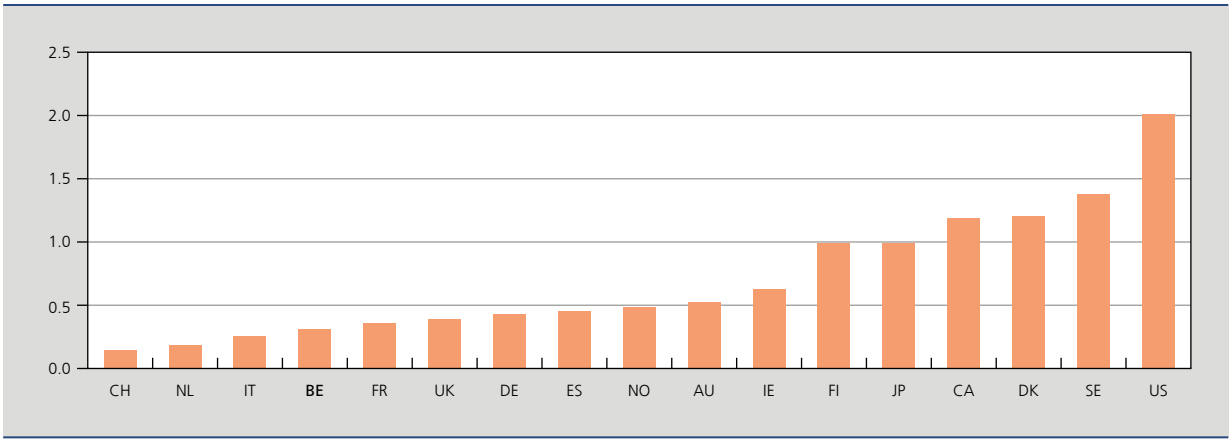
54 % and 53 % for the average private consumption share of GDP. That said, volatility of residential investment growth, measured as the standard deviation of the annual growth rate, is on average 4.1 times higher than the volatility of GDP growth for the group of advanced countries and 3.5 times for Belgium, whereas volatility of consumption growth for most countries (including Belgium) is below that of GDP growth. This means that, despite its low average share of GDP, residential investment can still have a substantial effect on the economic cycle.

3.2 Long-term price elasticity of housing supply

House prices can influence investment in new housing construction. According to Tobin's Q theory, higher house prices imply that new builds can be sold more expensively, making investment in new housing construction – at unchanged building costs – more profitable. However, this effect of higher house prices on the expected profitability of new housing construction could be partly cancelled out by concomitant increases in land prices, which account for a sizeable proportion of the total building costs of a new home and which typically go up when house prices do (see Section 1 and Muellbauer and Murphy, 2008).

The price elasticity of housing supply is the effect of a change in house prices on residential investment. Caldera and Johansson (2013) estimated the long-term price elasticity for various advanced countries using an error correction model (ECM) for residential investment in which not only house prices but also building costs and demographic variables are used as determinants of the long-run equilibrium of residential investment. This estimated price elasticity of housing supply varies markedly between countries: it is low in the West European countries, including Belgium, and very high in the United States and the Scandinavian countries. A 1 % increase in house prices would boost long-term residential investment by 2.0 % in the United States, compared with only 0.3 % in Belgium.

CHART 11 LONG-TERM PRICE ELASTICITY OF HOUSING SUPPLY

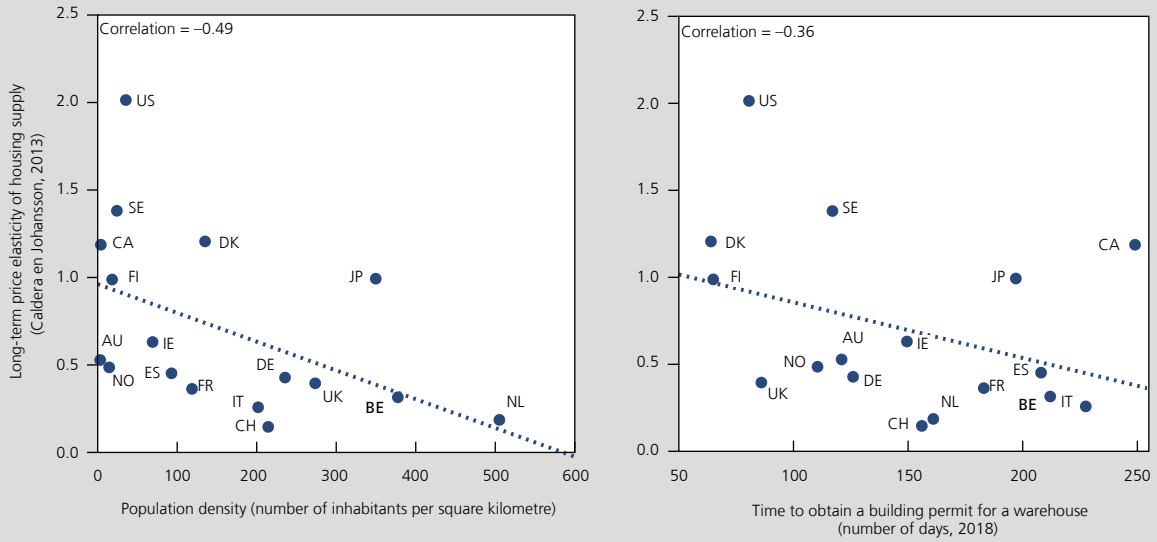


Source: Caldera and Johansson (2013)

The differences in the price elasticity of housing supply between countries can in part be explained by geographical and demographic factors, as well as government policies (Caldera and Johansson, 2013). First, the price elasticity depends on the physical constraints on available building land. Hence, it is smaller for countries with a high population density, where there is less land available for building. In addition, the price elasticity also depends to a large extent on government policies, and particularly spatial planning rules as well as procedures for acquiring a building permit. For example, the price elasticity tends to be lower in countries in which it takes longer to obtain a building permit.[(1)] Hence, the high population density and relatively strict regulation can partly explain the low price elasticity of Belgium's housing supply.

(1) We are using the internationally comparable data from the World Bank Doing Business 2018 on the number of days needed to obtain a building permit for a warehouse as an indicator and we expect this indicator to be highly correlated to the amount of time needed to obtain a building permit for residential property.

CHART 12 DETERMINANTS OF LONG-TERM PRICE ELASTICITY OF HOUSING SUPPLY



Source: Caldera and Johansson (2013), United Nations, World Bank Doing Business 2018

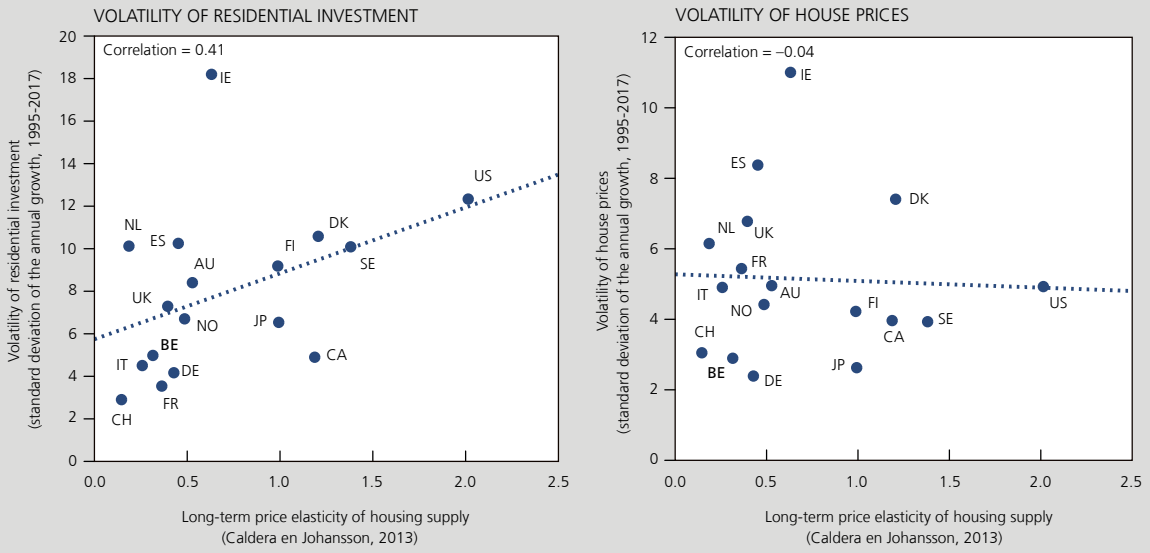
3.3 The price elasticity of housing supply and the transmission of housing demand shocks

The price elasticity of housing supply has an important impact on the transmission of housing demand shocks to house prices, housing supply and economic activity (European Commission, 2011).

In countries with a very elastic housing supply, positive housing demand shocks – e.g. a rise in the number of households or an increase in the disposable income – would predominantly trigger higher housing supply, which would increase residential investment, as well as the employment and value added in the construction industry. Conversely, negative demand shocks would mostly cause downward adjustments to the housing supply in those countries. So, if such shocks were to hit the various countries to the same extent, residential investment should be more volatile in countries with a more elastic housing supply. Our dataset of 17 advanced countries indeed shows a strongly positive correlation of 0.41 between the estimated price elasticity of Caldera and Johansson (2013) and the volatility of the annual growth of residential investment.

Countries with a very inelastic housing supply should see their housing supply respond much less to housing demand shocks, and these shocks would therefore predominantly lead to changes in house prices. Andrews *et al.* (2011) find that in a country with a relatively low price elasticity – i.e. half a standard deviation below the median for the OECD countries – the rise in house prices as a result of a positive demand shock is about 50 % higher than in a country with a price elasticity at the median. Housing demand shocks can therefore also impact economic activity in countries with an inelastic housing supply: while residential investment would change relatively little in response to such housing demand shocks, economic activity would be indirectly affected through their large impact on house prices, which in its turn could affect both consumption (see Section 2) and credit supply (see Section 4). Also the European Commission (2011) states that house prices are more volatile in countries with a very inelastic housing supply. However, a simple correlation measure between the estimated price elasticity and the volatility in house price growth for a dataset of 17 advanced countries shows only a very limited negative correlation, which seems to suggest that house prices are often also influenced by idiosyncratic factors, such as the taxation (see Section 1).

CHART 13 LONG-TERM PRICE ELASTICITY OF HOUSING SUPPLY AND VOLATILITY OF RESIDENTIAL INVESTMENT AND HOUSE PRICES



Sources: Caldera and Johansson (2013), OECD, own calculations.

4. The importance of house prices from a wider macroprudential angle

This final section discusses the importance of house prices from a wider macroprudential angle. The empirical literature on the determinants of banking crises[1] has found an important role for house price bubbles. These are typically defined as the build-up of major divergences in house prices from their equilibrium level and their presence is reflected in a strong overvaluation of real estate. Such house prices bubbles, especially when coupled with rapid credit growth, increase the risk of a banking crisis and they lead to recession that are much deeper and more protracted (Jorda *et al.*, 2015a; Jorda *et al.* 2015b; Ferrari *et al.*, 2015).

The impact of house price bubbles that are coupled with a strong credit growth – both on the risk of a banking crisis and on the depth and length of recessions – is underpinned by a feedback mechanism between house prices, banks' balance sheets, credit growth and economic activity.[2] In the buildup of a house price bubble, the rapid rise in house prices can bolster the profitability and net worth of banks, as higher house prices push up the collateral value of outstanding mortgage loans and hence reduce the losses in the event of default. In addition, higher house prices can also positively impact private consumption and residential investment (see Sections 2 and 3), hence improving economic activity and employment as well as mitigating the risk of default on mortgage loans. In turn, these effects could increase supply and demand for loans, which subsequently could positively affect economic activity and house prices (ESRB, 2016). By contrast, the sharp fall in house prices during the bursting of the bubble reverses this positive feedback loop. Especially when combined with other negative income and employment shocks in the economy, steeply lower house prices would have a negative impact on the collateral value of outstanding mortgage loans, on economic activity, on employment and on default rates on mortgage loans. This would lower the profitability and net worth of banks and might result in higher funding costs for banks, and in extreme cases, in difficulties in obtaining sufficient funding (ESRB, 2016). Subsequently, the reduced credit supply and demand resulting from these effects could lead to further declines in house prices and economic activity (De Backer *et al.*, 2015; Mishkin, 2009; Jorda

(1) Laeven and Valencia (2012) define a banking crisis as the occurrence of major signs of financial distress in the banking system in the shape of substantial losses, important liquidations or major bank runs, coupled with strong banking policy intervention such as extensive liquidity support from the government or central bank and major bank nationalisations by the government.

(2) By contrast, asset bubbles that do not involve a strong credit build-up, such as the share bubbles in 1987 and 2000, are far less of a threat to financial stability, as the repercussions of the bursting of such bubbles are largely confined to a fall in the wealth of households owning such assets and only to a much lesser extent affect the banks' balance sheets (Mishkin, 2009 and Tett, 2013).

et al., 2015b). Furthermore, the feedback loop between house prices, banks' balance sheets, credit growth and economic activity has become more important over the past decades, because the increasing proportion of mortgage loans in the balance sheets of the advanced countries' banks since the second half of the 20th century has made these banks more exposed to the housing market (Jorda *et al.*, 2016).

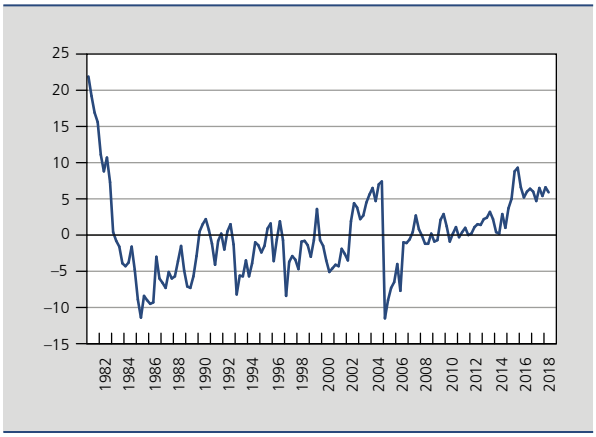
In Belgium, the financial stability risks are closely monitored not only by the National Bank of Belgium (NBB) in its capacity as macroprudential authority, but also by the European Central Bank (ECB) and the European Systemic Risk Board (ESRB). These institutions devote appropriate attention to analysing the housing market, the indebtedness and repayment capacity of households, as well as the extent to which banks are able to cushion unexpected losses on mortgage loans and on loans to construction and real estate companies – aspects of financial stability in Belgium we will briefly discuss below.[1]

4.1 The valuation of house prices in Belgium

As discussed in Section 1, house prices in Belgium have moved up sharply in the past 30 years without any major price correction, even if growth has softened in the past couple of years. However, the estimates of an econometric model that takes into account a range of demand factors – specifically households' disposable income, mortgage rates, demographic trends and the main changes in property taxation – indicate that the strong increase in house prices is largely driven by the dynamics of these demand factors (Warisse, 2017) and that house prices would be about 5.9 % higher than their estimated equilibrium level in the second quarter of 2018. This rather minor overvaluation would seem to suggest an absence of a bubble in Belgium's housing market. This does not mean, however, that there is no risk of falling property prices, more specifically if one of the house price determinants would worsen, for instance if mortgage rates would suddenly shoot up.

CHART 14 REAL ESTATE MARKET VALUATION

(deviation from the equilibrium value, in %)



Source : NBB

4.2 The indebtedness of Belgian households

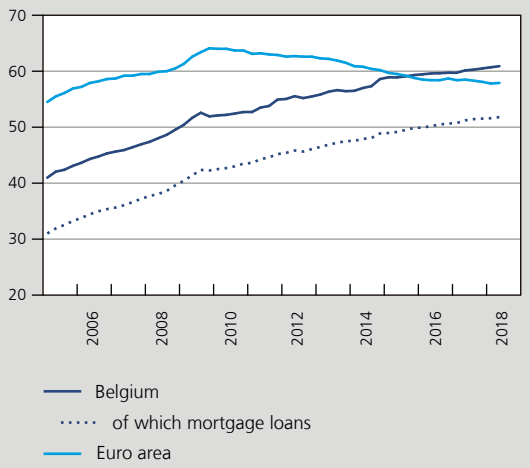
The main reason to remain vigilant to developments in the housing market in the context of macroprudential policy is related to the evolution of Belgian household debt, which mainly consists of mortgage debt. Household debt as a percentage of GDP has increased almost continuously over the past ten years, while it has been decreasing in the euro area since the 2008 financial crisis (Du Caju *et al.*, 2018). Mainly on account of mortgage loans, household debt has exceeded the euro area average since 2015 : it accounted for 60.9 % of GDP by mid-2018, compared with 57.9 % in the euro area. Although Belgian households also have very high financial wealth (see Chart 2), which they could use

(1) For a more extensive analysis of the risks of property prices to financial stability in Belgium, see NBB's Financial Stability Review (FSR, 2018).

to pay off their debts in case of an unexpected drop in income, this wealth is very unequally distributed and a large number of households have only very limited financial assets. The Belgian banks' mortgage portfolios therefore include substantial segments of loans that could result in higher than expected default numbers in the event of a sharp negative economic shock. These vulnerable segments consists of households with hefty monthly loan repayments compared with their monthly incomes and in addition few financial assets. The 2014 Household Finance and Consumption Survey, which provide an update to the 2010 survey findings discussed in Du Caju (2017), showed 14.5 % of mortgage debt to be owed by households that spend over 30 % of their income on repaying their mortgage and whose liquid financial assets cover less than six months of mortgage payments. This percentage is very similar to the 14.6 % for the euro area. Lastly, for a large proportion of these vulnerable mortgages, the value of the house is not much higher than the outstanding debt, implying that banks could incur major losses on the defaulted loans in the event of falling property prices. In particular, 10.9 % of mortgage debt is owed by households that spend over 30 % of their income on repaying their mortgage loans and whose outstanding mortgage debt is over 80 % of the value of the house.

CHART 15 HOUSEHOLDS' OUTSTANDING DEBT

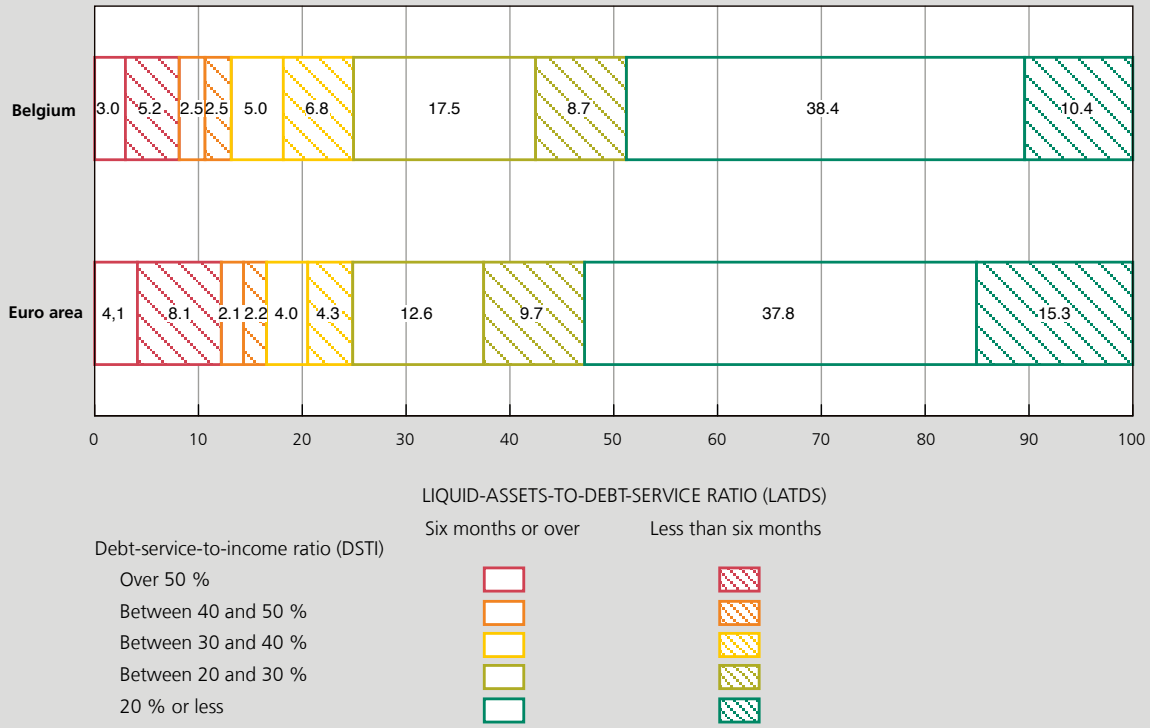
(as a % of GDP)



Sources: EC, NBB

CHART 16 BREAKDOWN OF MORTGAGE DEBT IN 2014, BY DEBT-SERVICE-TO-INCOME [1] AND LIQUID-ASSETS-TO-DEBT-SERVICE [2]

(in % of total outstanding mortgage debt for households)



Source: Eurosystem HFCS (2014).

(1) Monthly mortgage payments divided by a household's gross income.

(2) The value of a household's liquid assets (deposits, bonds, savings certificates, listed shares and mutual funds) divided by the monthly mortgage repayments.

4.3 Minimum capital requirements for mortgage loans

To cover unexpected losses, banks have to meet minimum capital requirements which depend on the amount of their risk-weighted assets. The risk weight for mortgage loans Belgian banks calculate under the internal ratings-based approach [(1)] only amounted to 10 % by the end of 2017, not including the macroprudential measures discussed below. That this is well below the average of 15 % for the European Union can be explained by the fact that credit risk in internal risk models is calibrated on historical credit loss data and that there has been no crisis in the house prices in Belgium in the past decades, as noted in Section 1. With these low risk weights possibly underestimating the systemic credit risk of mortgage loans and given the large proportion of mortgage loans in banks' balance sheets, the National Bank of Belgium has undertaken several macroprudential measures since 2013 to make banks more resilient to unexpected losses in their mortgage loan portfolios. For banks using the internal ratings-based approach, the calculated risk weight for mortgage loans was raised by five percentage points by the end of 2013. In 2018, this measure was renewed and complemented with an additional increase in the risk weight that depends on the risk of the individual bank's mortgage loan portfolio. Together, these measures are expected to result in an increase in the average risk weight of Belgian mortgage loans to 18 % (FSR, 2018).

(1) The risk weights of the assets can be calculated using a standardised approach or using an internal ratings-based approach (IRB); this latter method is used for the vast majority of Belgian mortgage loans.

4.4 Other risks to financial stability posed by Belgian property prices

Aside from the risk pertaining to mortgage loans discussed above, Belgium's property prices also pose other potential risks to financial stability. A large proportion of Belgian bank loans, totalling 11 % of GDP in 2017, has been furnished to construction and real estate companies such as property developers and construction companies, whose creditworthiness is strongly dependent on movements in property prices (FSR, 2018). More particularly, timing differences between the purchase of existing properties or building plots and the sale of the refurbished or newly constructed houses can entail a risk of major losses for project developers in the event of a strong decline in house prices, possibly entailing a risk for financial stability in as far as these activities are financed by debt. Aside from banks, also other financial institutions in Belgium are exposed to property prices. In 2017, 12 % of the assets held by Belgian insurance companies were property-related, while the country's real estate investment trusts saw their portfolios (of mostly commercial property) grow to € 13 billion (FSR, 2018).

Conclusion

This article discusses house prices developments in Belgium and their importance for economic activity, in particular private consumption, residential investment and financial stability. The Belgian results are also compared with those from several other advanced countries.

House prices have been rising steadily in Belgium over the previous decades. Prices only decreased during two periods: a first period during the first half of the 1980s and a second period, which was shorter and where the decline was limited, during the economic and financial crisis of 2008 and subsequent years. The rise in residential property prices also led to a substantial increase in households' real estate wealth, which amounted to more than € 1,400 billion in 2016. A large part of the increase in property prices during the last 45 years can be attributed to the sharp rise in land prices, especially in the Flemish Region, where the relative scarcity of building plots increased, particularly since the beginning of the 2000s. In addition to demographic pressures, which were reinforced by the gradual decline in average household size, the growth in residential property prices was also supported by various macroeconomic factors such as the pronounced fall in mortgage interest rates, which, combined with the increase in household income, all other things being equal, made houses more affordable. Moreover, taxes on real estate generally changed in such a way that they increased access to mortgage credit and housing demand.

House prices can have an impact on private consumption through several channels. First, a rise in house prices leads to an increase in the real estate wealth of property owners, who would consequently consume more. However, this positive wealth effect is partly offset by the fact that higher house prices also lead to a higher purchase price for future buyers, who thus would have to save more to be able to buy a certain dwelling, and to higher expected future rents, which can have a negative effect on the consumption of tenants. In addition, certain credit products that can be used for consumption purposes and that have the residential property as collateral can reinforce the positive effect on consumption of an increase in house prices. The results of an error correction model for consumption, which was estimated for several advanced countries, indicate that the impact of house prices on consumption is mainly large in countries where these credit products are frequently used, such as the Netherlands and the United Kingdom. For Belgium, where these credit products are barely used, the estimated effect of house prices on consumption is smaller, although it is still larger than what was found in previous studies.

House prices can also influence investment in new dwellings, which constitutes the biggest component of the residential investment. Higher house prices imply that new dwellings could be sold at a higher price, such that, assuming building costs remain unchanged, investment in new dwellings would become more profitable. Previous empirical estimates in the literature nevertheless show that, compared with the United States and the Scandinavian countries, the impact of house prices on residential investment is very small in West European countries, including Belgium. This could in part be explained by high population density and the relatively heavy regulation governing procedures to obtain a building permit in these countries. Moreover, housing demand shocks in these countries would mainly lead to adjustments in house prices and only to a lesser extent to fluctuations in economic activity.

Lastly, house prices can also have an influence on financial stability. Earlier empirical studies have in fact shown that house price bubbles, especially when combined with rapid credit growth, increase the risk of a banking crisis and in addition can lead to much deeper and more protracted recessions. According to the current estimates of the NBB's valuation model, house prices in Belgium are only slightly overvalued, which seems to indicate that there is no bubble in the housing market. The main reason for remaining vigilant to developments in the housing market in the context of macroprudential policy is related to the evolution of Belgian household debt, which mainly consists of mortgage debt. This has increased almost continuously over the last ten years, while it has been decreasing in the euro area as a whole. In addition, the mortgage loans contain vulnerable segments – where households have borrowed a relatively large amount in relation to their income and liquid assets – which could result in a higher-than-expected number of defaults in the event of a large negative economic shock. Since the value of the house for a large part of these mortgages is not much higher than the outstanding debt, banks could in that case suffer large losses, especially if there were also a sharp fall in house prices. In this context and in view of the large share of mortgage loans in the balance sheet of Belgian banks, the National Bank of Belgium has taken macroprudential policy measures since 2013 to make banks more resilient to unexpected losses on their mortgage portfolios.

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Does financial market volatility influence the real economy ?

B. De Backer (*)

Introduction

After a quiet period on the financial markets in 2017, there was eventually a resurgence of volatility in February and again more recently in October 2018. Many financial analysts say that these sudden surges could be connected with changing expectations about the pace of normalisation of American monetary policy, and typically coincide with the publication of inflation and employment figures. The financial markets react to the publication of macroeconomic data, and that is particularly true in the present context of international trade tensions. In all probability, there could therefore be further spikes in volatility due to specific events or announcements.

In general, and often rightly, high financial market volatility is associated with stock market crashes, or even economic recessions. Various episodes come to mind, such as the latest financial crisis, the bursting of the dot.com bubble, the Great Depression triggered in 1929, and many others. In principle, high market volatility reflects an increased risk for investment, thus hampering decisions by market players. It could also have repercussions beyond the financial sector, for example if a volatility risk premium adds to the cost of issuing company shares. High or increasing volatility is therefore generally seen as a negative signal from the financial markets regarding the outlook for the real economy.

Conversely, we might ask whether periods of low market volatility presage a favourable economic future. In that respect, it is striking that market volatility was particularly low between 2003 and 2007, but that did not stop the eruption of the latest financial crisis. That observation again drew attention to a hypothesis formulated in 1977 by Hyman P. Minsky : the financial instability hypothesis, which states that economic agents tend to be too optimistic and take more risks if they perceive the environment as presenting little risk, for example if financial market volatility is low. The accumulation of risks resulting from that process could ultimately trigger economic crises.

The article comprises three sections. The first presents the various measures of financial market volatility and sets out their main characteristics. Section 2 examines the historical empirical regularities which reveal the effects of high or low market volatility on the real economy. Section 3 examines market volatility in greater depth in the current context.

(*) The author is grateful to J. Hilgers, P. Ilbas and Ch. Van Nieuwenhuyze for their valuable comments and suggestions.

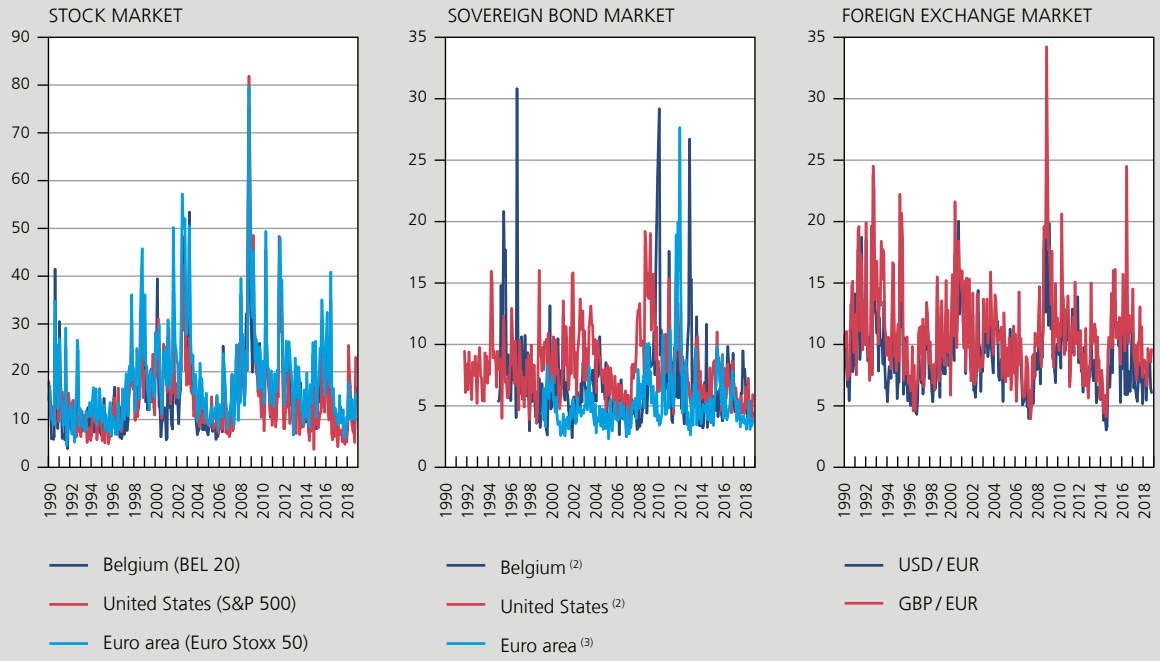
1. What is financial market volatility?

1.1 Measuring market volatility

Financial market volatility is often assessed by measuring "realised volatility". That measurement is taken retrospectively for a given period. For example, imagine that we want to calculate the volatility of a stock market index over a given month, recording the value of the index each day when the market closes. The volatility during that month is calculated simply as the standard deviation of the daily returns. A similar calculation can be carried out for bond market and foreign exchange market returns.

CHART 1 FINANCIAL MARKET VOLATILITY IS OFTEN ASSESSED BY MEASURING "REALISED VOLATILITY" (1)

(in %, annualised monthly volatility)



Sources: Thomson Reuters, NBB.

(1) Realised volatility over one month is calculated in much the same way as a standard deviation: it is the square root of the sum of the squared centred daily returns.

(2) Realised volatility based on prices of ten-year zero coupon sovereign bonds.

(3) Realised volatility based on prices of ten-year zero coupon sovereign bonds with at least an AA rating (S&P) in the euro area.

According to this measure, American and European financial markets have experienced several periods of volatility since 1990 (see chart 1). In the early 1990s, the European exchange rate mechanism crisis generated some volatility on the foreign exchange market. In the late 1990s, there was increased volatility on stock markets and foreign exchange markets against the backdrop of the Asian/Russian financial crisis and the LTCM crisis, and volatility remained fairly high until the dot.com bubble burst at the beginning of the 2000s. During the latest financial crisis, volatility increased rapidly and peaked, either in October 2008 just after the collapse of Lehman Brothers (stock markets and foreign exchange markets), or during the sovereign debt crisis (European sovereign bond market). More recently, stock market volatility was relatively high in 2015 – when the slump in Chinese stock market indices spread to the United States and Europe – and at the time of the Brexit vote in mid-2016. Thereafter, volatility declined sharply up to 2018, when it was rekindled by two corrections on the American and European stock markets in February and October.

The main advantage of this realised volatility measure is that it does not depend on any model. Moreover, the measurement can be refined by observing returns more frequently. Intra-day data are often used to calculate realised volatility day by day (for example, the value of stock market indices is recorded every five or ten minutes).

There are two other volatility measures: "implicit" volatility and "conditional" volatility. It is important to understand these concepts, because this article uses various measures of volatility mainly according to the available data. That said, from a macroeconomic point of view, there is little harm in switching from one volatility measure to another because the same general tendencies are often apparent in the different series.

Implicit volatility is deduced indirectly from a formula using the prices of financial derivatives. In the case of the stock markets, that is often the Black and Scholes formula in which the price of a call and put option depends on the volatility of the underlying asset. Once the financial derivative's price is known, the volatility of the underlying asset can be deduced by inverting the formula. The best-known example of an implicit volatility measure is the one-month VIX index which measures the implicit volatility of the S&P 500 index over the next 30 days, sometimes known as the "fear index".

Conditional volatility measures the estimated volatility on a given date according to the information available up to that date. Conditional volatility measures necessarily depend on models that filter the information. Robert F. Engle was the first to develop this type of model (from 1982), commonly known by the acronym "GARCH" (generalised auto-regressive conditional heteroskedasticity). There are numerous models for conditional volatility.

1.2 Main characteristics of market volatility

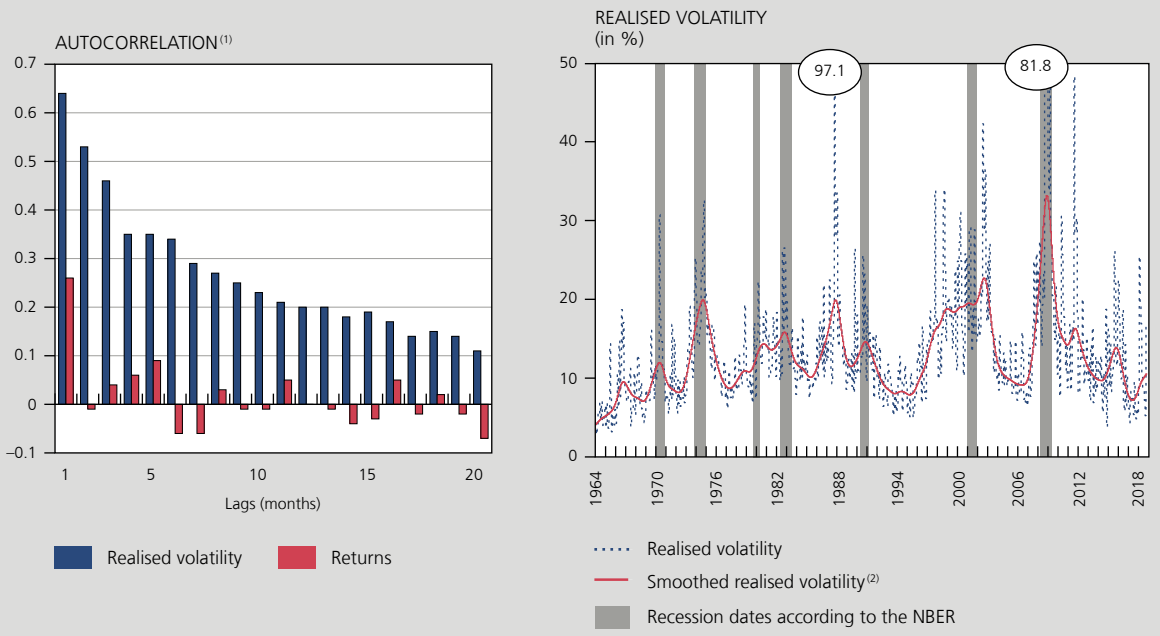
A great deal of research is still needed to gain a better understanding of financial market volatility and thus improve the volatility models. In particular, in the academic world there is no agreement as yet on what precisely determines volatility. However, the existing research provides useful insight into at least three characteristics of market volatility. This section illustrates those three characteristics by focusing on the American stock market, since this is the market on which most analysis has been done, and sufficient data are available to conduct historical empirical analysis. The volatility of the American stock market is assessed via the monthly realised volatility of the S&P 500 index, a measure which does not depend on any model and is based on a broad American index for which daily data are available going back several decades.

The first characteristic is that volatility displays a "long memory", i.e. it is closely correlated over time (strong autocorrelation; see left-hand panel of chart 2). In the sample considered, the volatility of the S&P 500 index during a given month has a correlation of 0.64 with the previous month's volatility (one-month lag). Year on year (12-month lag), the autocorrelation is still significant (0.20). This autocorrelation diminishes as the lag increases, but the decline is gradual and slow. For comparison, the autocorrelation of stock market returns is low. The correlation between the return in a given month and that in the previous month is only 0.26. The correlation is (not statistically different from) zero for lags of more than one month. In addition, a regression of realised volatility and the returns over their first 20 lags accounts for 45 % of the realised volatility and barely 11 % of the returns (R^2 of regressions with a constant).

The "long memory" characteristic implies that volatility can be forecast solely on the basis of past volatility measurements. These forecasts are usually smoothed (with no sudden fluctuations) because they generally represent a weighted average of numerous estimates of volatility in the past.

The second characteristic is that volatility can be divided into a low-frequency and a high-frequency component (see the right-hand panel in chart 2). The low-frequency component varies relatively little over time; it indicates the general trend in volatility. The volatility's long memory is attributable mainly to that component. The high-frequency component is more erratic, often varying as a result of specific events such as the publication of macroeconomic data, (unexpected) economic or monetary policy announcements, or incidents specific to the financial markets. For example, the high-frequency component captures the Black Monday crash of 19 October 1987, when the S&P 500 lost 20 % of its value in a single day.

CHART 2 THE VOLATILITY OF THE S&P 500 FOLLOWS A "LONG MEMORY" PROCESS, BUT SUDDEN SPIKES MAY OCCUR



Sources: Thomson Reuters, NBB.
(1) Estimate based on data from 1 January 1964 to 31 October 2018.
(2) The low-frequency component of the realised volatility of the S&P 500 is estimated using a Hodrick-Prescott filter with a smoothing parameter equal to 500.

This second characteristic indicates that sudden surges in volatility are unpredictable. Fortunately, they are often only temporary, as was the case in February 2018. Generally speaking, sudden increases in the high-frequency component are much more common than recessions as defined by the National Bureau of Economic Research (NBER) in the United States, which suggests that these erratic increases have little connection with major economic developments.

The third characteristic is that the low-frequency component of volatility is potentially subject to occasional regime changes, as it is possible to identify periods in which volatility has been persistently higher. Those periods can be clearly linked to significant events or crises. For example, the low-frequency component increased in 1973 at the time of the oil shock, in the late 1990s at the time of the Asian/Russian crisis and the LTCM crisis, and at the time of the dot.com bubble. The component went up again during the latest financial crisis.

To sum up, these characteristics indicate that, if there is no change of regime – in other words, if no crisis erupts – market volatility is likely to develop relatively smoothly, though temporary spikes due to specific events cannot be ruled out. The fundamental question is whether a rise in the low-frequency component of volatility – i.e. a gradual, sustained rise – could have adverse consequences for the real economy or whether, from the opposite angle, persistently low volatility is risk-free. A number of important lessons can be derived from the historical empirical regularities discussed in the next section.

2. Lessons of the past

Research into the influence of financial market volatility on the real economy is hampered by a potential reverse causality dilemma: could it be that real activity influences volatility? The influence is likely to operate in both directions. Moreover, in some cases fluctuations in volatility and real activity are due to a third factor which affects both variables simultaneously. For example, that is probably what happened in the early 1980s when the US Federal Reserve (the Fed) began to tighten its monetary policy in order to combat runaway inflation. In doing so, the Fed simultaneously curbed real economic activity and created a degree of financial market volatility by influencing asset prices.

These endogeneity and simultaneity issues show how difficult it is to establish the links between market volatility and the real economy. This section therefore begins with a (brief) review of the literature on the subject before presenting the empirical results obtained on the basis of a historical database.

2.1 Review of the literature and stylised facts

Influence of the real economy on financial market volatility

In theory, financial market volatility is influenced by the real economy. That connection is derived from traditional financial theory – the market efficiency theory – whereby the price of a financial asset "at any time fully reflects all available information" (Fama, 1970). Under certain conditions, this assumption implies that a share price is equal to the discounted value of the expected future dividends. Consequently, share price volatility depends on: (1) changes in the economic activity generating dividends, and (2) fluctuations in the discount rate.

Some of the academic literature from the 1980s criticised traditional financial theory and supported the idea that the volatility of stock market indices (especially the S&P 500) was too high compared to dividend volatility. This "excess volatility" was said to indicate the presence of "animal spirits" creating waves of optimism and pessimism on the financial markets without any link to the fundamentals (LeRoy and Porter, 1981; Shiller, 1981a, 1981b, 1981c, 1987 and 1990). The criticism is based on the "general theory" of John M. Keynes (1936) who argued that dealers are bound to have a "preference for immediacy", whereby they devote their intelligence to anticipating what average opinion expects the average opinion to be, hence facilitating self-fulfilling price fluctuations.

This literature was largely rejected by supporters of traditional theory, pointing out that the excess volatility of stock market indices compared to that of dividends can be explained by the volatility of the discount rate (Fama, 1991; Cochrane, 2011). They also protested against the excess volatility tests which can only be conducted with underlying models: if stock market index volatility is considered excessive compared to predicted dividends or consumption trends, it is possible that incorrect or over-simplistic models are used to produce the dividend forecasts or to link the price of financial assets to consumption.

Whether financial market volatility is too high to be attributed to the fundamentals is a question still being debated today. Recently, researchers found that the business cycle had a considerable influence on the low-frequency component of volatility, while sudden spikes in volatility might be due partly to reversals of market sentiment (Adrian and Rosenberg, 2008; Engle and Rangel, 2008; Engle *et al.*, 2013; Corradi *et al.*, 2013; Chiu *et al.*, 2018).

Influence of financial market volatility on the real economy

As regards the opposite connection, i.e. the influence of market volatility on the real economy, there are two different types of study: those that analyse the effects of an increase in volatility and those which examine the effects of a prolonged period of low volatility.

Three transmission channels for increases in market volatility are often mentioned in the literature (Fornari and Mele, 2013; Bekeart and Hoerova, 2014). First, heightened volatility can drive up firms' funding costs. More specifically, investors will be inclined to demand a higher return (a reduction in the share purchase price) if they are unsure whether they can recoup their investment or sell their shares in the future at the desired price. Second, an increase in volatility may lead to postponement of investment projects. According to the "irreversible investment theory" (Bernanke, 1983), there is a trade-off between initiating a project (and making a quick return) and postponing it in order to gather information, e.g. on how the economic environment is changing, so as to arrive at a more accurate estimate of the project's chances of success. Third, an increase in volatility can cause a loss of confidence and the accumulation of precautionary savings. In a risk-averse world, heightened uncertainty over (future) financial assets curbs (current) consumption.

In regard to the effects of a prolonged period of low volatility, there is some relatively old literature that may be relevant if low market volatility is considered equivalent to financial stability (or tranquillity) in general. As long ago as 1977, Hyman P. Minsky described how, in his view, a capitalist economy endogenously generates a financial structure subject to financial crises. In his own words, "stability is destabilising". The basic idea is that long periods of financial stability foster

general optimism and encourage risk-taking. During such periods, profits net of taxes and interest charges are often positive, causing dividends to rise. If optimism prevails regarding the economy's future ability to generate profits, share prices may go up substantially. In addition, the debt level deemed acceptable rises, and growing numbers of market players engage in "speculative" financial activities (which requires constant renewal of the debt), or even Ponzi schemes, while financial intermediaries increase their leverage. According to this scenario, economic agents exhibit procyclical behaviour by increasing their debt burden during calm periods, so that they become more vulnerable in the event of a financial shock.

Minsky's idea has attracted renewed interest since the latest financial crisis, as the period of economic growth and financial stability from 2003 to 2007 seems to have been accompanied by excesses, particularly on the property market in the United States, thus paving the way to the ensuing financial crisis. Brunnermeier and Sannikov (2014) and Bhattacharya *et al.* (2015), among others, updated Minsky's original idea and renamed it the "volatility paradox". In their theoretical models, an environment in which the idiosyncratic risks are (perceived as) low – i.e. a low volatility environment – paradoxically exacerbates the risk of a systemic crisis since the market players are endogenously encouraged to take more risks, thus leading to an accumulation of systemic risks. Those mechanisms were confirmed empirically by Danielsson *et al.* (2018), who built up a historical database to show that periods of low volatility are often associated with abnormally strong credit expansion and increased leverage in the banking sector.

In addition, some recent analyses demonstrated modern mechanisms for risk-taking by financial intermediaries (ECB, 2017; OFR, 2017). For example, as well as taking more risks via the leverage effect and searching for yield, financial intermediaries may reduce the hedging of their positions. But other mechanisms are activated endogenously. For example, the widespread use of value-at-risk (VaR) models may give out the wrong signals in a period of low volatility because a reduction in volatility lowers a portfolio's VaR, thus enabling investors to expand their risky positions without exceeding a pre-set VaR limit. Furthermore, the financial innovations that proliferated before the last crisis (securitisation, credit default swaps, etc.) made it possible to hedge certain idiosyncratic risks, creating an impression of stability from the point of view of individual financial intermediaries without any reduction in the macrofinancial risks.

Stylised facts

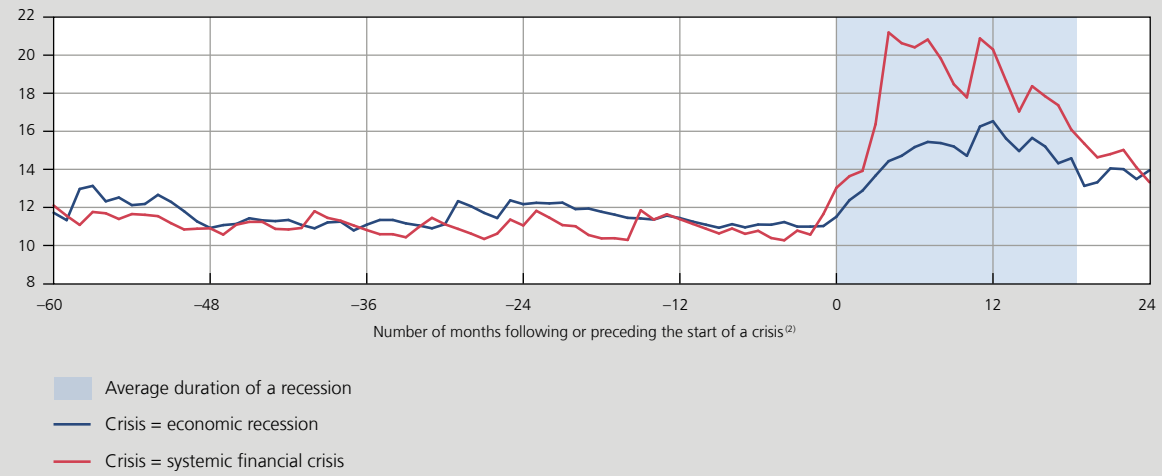
The dynamic of volatility during major economic and financial crises shows that various theories summarised above are relevant. For the moment, the analysis is confined to the United States because that country offers the longest series of asset prices. Robert Shiller supplies the S&P 500 index on a monthly basis since 1871, making it possible to estimate a monthly measure of conditional volatility. The period covers 29 American recessions identified by the NBER and defined as "a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales". The period also covers 6 systemic financial crises identified by Jordà *et al.* (2012) and defined as "events during which a country's banking sector experiences bank runs, sharp increases in default rates accompanied by large losses of capital that result in public intervention, bankruptcy, or forced merger of financial institutions".

These data clearly indicate that the S&P 500 becomes more volatile during crises (see chart 3). The level of volatility is generally higher in the case of a systemic financial crisis than in an economic recession. However, it should be noted that volatility generally increases *after* the start of a crisis. It therefore seems that increased volatility is not usually the source of economic recessions or systemic financial crises, but seems to coincide with the crises and potentially accentuate them.

Conversely, it is clear that crises are typically preceded by lengthy periods of low volatility. That finding tallies with the hypothesis that prolonged periods of low volatility encourage risk-taking and lead to crises. The rest of this section examines in particular how long periods of low volatility influence the emergence of crises, by means of a more refined analysis based on econometric models.

CHART 3 THE VOLATILITY OF THE S&P 500 TENDS TO INCREASE DURING CRISES AND TO BE LOW FOR A LONG PERIOD BEFORE THEY BEGIN [1]

(in %, annualised monthly volatility)



Sources: NBER, Robert Shiller, NBB.

(1) The conditional volatility of the S&P 500 is estimated on the basis of the GJR-GARCH(1,1,1) model with Student distribution. The NBER identifies 29 economic recessions in the United States since 1871. Jordà *et al.* (2017) also identified the dates of 6 systemic financial crises.

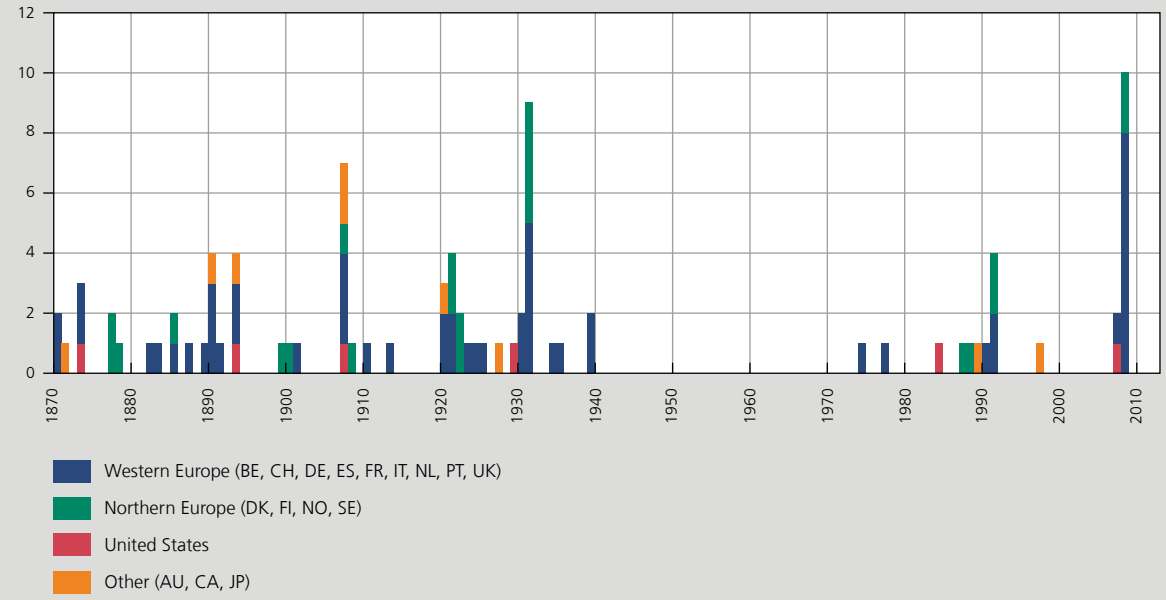
(2) The number of months after (before) the start of an economic recession is confined to the end of the (previous) recession. For the recession beginning in May 1937, only 29 months are taken into account (from January 1935), in order to exclude the volatility due to the Great Depression. For the recession that began in February 1945, only 13 months are taken into account (from January 1944), in order to exclude the volatility due to the war. For the recession starting in July 1990, the volatility due to Black Monday (19 October 1987) is disregarded. For the recession that began in October 1873, only 32 months are taken into account (start of the sample). According to the NBER, the average duration of a recession is 17.2 months.

2.2 Study based on a historical database

Systemic financial crises are the main focus of attention because they are generally more severe than classic economic recessions, and volatility seems to react more strongly to those crises. The historical database of Jordà *et al.* (2017) is an ideal information source since it covers a large number of countries over a long period. More specifically, it contains data on the financial systemic crises affecting 17 advanced economies since 1870, giving a total of 90 crises. The crisis dates used are similar to those reported by Bordo *et al.* (2001), Laeven and Valencia (2008), and Reinhart and Rogoff (2009). The database ensures that the results do not suffer from any lack of observations (on systemic financial crises in particular), or from any bias in favour of certain countries. However, it should be noted that the macrofinancial series in this database are only available on an annual basis.

The time profile of the systemic financial crises identified by Jordà *et al.* (2017) clearly captures the most serious financial crises (see chart 4). The most recent crisis affected 12 economies (out of 17): the United States and the United Kingdom from 2007 plus two economies in Northern Europe and eight in Western Europe from 2008. The database also covers the Great American Depression which began in 1929 (and affected the European economies from 1930 or 1931), the American bank run of 1907 which rapidly spread to the other advanced economies, the chaos of European reconstruction following the First World War, the Nordic banking crisis and the European exchange rate mechanism crisis in the early 1990s, etc.

CHART 4 HISTORICAL PROFILE OF SYSTEMIC FINANCIAL CRISES



Source: Jordà *et al.* (2017).

Predicting the emergence of systemic financial crises on the basis of financial market volatility

First, estimates of realised financial market volatility have to be derived from stock market indices. Since those are only available annually in the database of Jordà *et al.* (2017), it is not possible to estimate the realised volatility for a given year as the standard deviation of the (e.g. monthly) returns. The method used is therefore that of Schwert (1989), whose approach was to regress annual stock market returns on their own lags, to extract the residuals from that regression and to estimate the realised annual volatility as the absolute value of the residuals.

Since the data are only available on an annual basis, the volatility estimates are smoothed (using a three-year moving average) in order to avoid abnormal values. The volatility estimates are then broken down into a long-term trend and a cyclical component using the method of Hamilton (2017), which entails calculating the trend as the projection of volatility on its own lags (while the cyclical component is obtained as the difference)[1].

The following logit model is estimated in a panel:

$$logit\left(I_{i,t}^{SFC}\right) = \alpha I_{i,t-1\ to\ t-5}^{SFC} + \beta\Gamma_{i,t-1\ to\ t-5} + \gamma X_{i,t-1\ to\ t-5} + \nu_t + \eta_i + \epsilon_{i,t},$$

where the dependent variable $I_{i,t}^{SFC}$ takes the value "1" to indicate the starting date of a systemic financial crisis in country i at time t, and the value "0" in other cases. Among the explanatory variables, three measures of volatility are considered in turn in the term Γ. The first is simply realised volatility, denoted by σ. The second is the absolute value of the cyclical component: $|c|$. The third distinguishes between the positive cyclical component (c^+), i.e. where volatility exceeds its trend or takes the value 0, and the negative component (c^-), where volatility is below its trend or takes the value 0. The time indices "$t-1\ to\ t-5$" indicate that the variables are introduced in the form of retrospective moving averages over five years (to capture prolonged periods of low volatility). Introducing the explanatory variables with a lag eliminates the endogeneity problem if it is assumed that the explanatory variables are predetermined. In addition, various control variables are included in the model (vector X) in an attempt to take account of the macroeconomic environment.

(1) For both the Schwert and the Hamilton method, a second-order autoregressive model is recommended by t-tests.

These control variables are the (logarithm of) real per capita GDP, inflation, the change in the public debt/GDP ratio, the current account as a ratio of GDP, and the real short-term interest rate. The elements ν_t and η_i respectively represent fixed effects per decade and per country; $\epsilon_{i,t}$ corresponds to the error term.

The estimation of the first model indicates that the realised stock market index volatility cannot, in itself, explain the emergence of systemic financial crises (see table 1). The effect of a change in the level of volatility is not statistically significant (for a confidence interval of 90 %), regardless of whether the control variables are taken into account. In contrast, the absolute value of the cyclical component of volatility does seem to have predictive power. It therefore seems that if volatility deviates from its trend in either direction, that implies a greater risk of a systemic financial crisis.

The distinction between the positive and negative cyclical components reveals that the direction in which volatility deviates from its trend is significant. On the one hand, the results show that the positive cyclical component of volatility is not particularly good at predicting the emergence of systemic crises, since the 90 % confidence interval of the coefficient includes 0 if we control for the macroeconomic environment. On the other hand, the negative cyclical

TABLE 1 LOGIT MODEL[1]: PROLONGED PERIODS OF LOW VOLATILITY PRESAGE SYSTEMIC FINANCIAL CRISES

Dependent variable: $I_{i,t}^{SFC}$	1	2	3	4	5	6
$\sigma_{i,t-1\ to\ t-5}$	0.78	1.22				
	(1.69)	(1.78)				
$\lvert c\rvert_{i,t-1\ to\ t-5}$			9.38**	10.47*		
			(4.55)	(6.27)		
$c^{+}_{i,t-1\ to\ t-5}$					8.53*	8.52
					(4.67)	(6.03)
$c^{-}_{i,t-1\ to\ t-5}$					−12.07*	−16.20**
					(6.88)	(7.52)
$I^{SFC}_{i,t-1\ \text{to}\ t-5}$	−10.57***	−11.34***	−10.47***	−11.24***	−10.51***	−11.24***
	(2.00)	(2.24)	(1.98)	(2.25)	(1.98)	(2.27)
$\ln(GDP)_{i,t-1\ to\ t-5}$		0.43		0.48		0.39
		(0.75)		(0.86)		(0.85)
$inflation_{i,t-1\ to\ t-5}$		9.30***		9.21***		9.80***
		(3.57)		(3.88)		(3.81)
$\Delta\frac{public\ debt}{GDP}_{i,t-1\ to\ t-5}$		−9.89**		−9.48**		−9.65**
		(4.05)		(4.23)		(4.17)
$\frac{current\ account}{GDP}_{i,t-1\ to\ t-5}$		−5.96		−5.24		−4.88
		(3.84)		(4.30)		(4.38)
$interest\ rate_{i,t-1\ to\ t-5}$		0.03		0.05		0.05
		(0.05)		(0.05)		(0.05)
Number of observations	1 734	1 510	1 683	1 480	1 683	1 480
Pseudo R^2	0.24	0.37	0.26	0.38	0.26	0.39
Marginal effects						
$\sigma_{i,t-1\ to\ t-5}$	0.03	0.05				
	(0.07)	(0.07)				
$\lvert c\rvert_{i,t-1\ to\ t-5}$			0.41**	0.43*		
			(0.19)	(0.26)		
$c^{+}_{i,t-1\ to\ t-5}$					0.37*	0.35
					(0.20)	(0.25)
$c^{-}_{i,t-1\ to\ t-5}$					−0.52*	−0.66**
					(0.30)	(0.31)

Sources: Jordà *et al.* (2017), NBB.

(1) Logit model estimated in a panel over the period 1870-2013. The explanatory variables are included in the form of a retrospective moving average over five years. The robust standard errors are shown in brackets. Fixed effects are included per decade and per country. The confidence intervals of 90, 95 and 99 % which do not include 0 are indicated respectively by one, two or three asterisks.

component is clearly significant, even if the control variables are included in the model. That result is precisely the main conclusion of Danielsson *et al.* (2018)[1]. Depending on the estimated marginal effect, a 1 percentage point fall in the negative cyclical component of volatility increases the probability of a systemic financial crisis by 0.66 percentage point, all other things being equal.

The historical database of Jordà *et al.* (2017) provides an opportunity for testing the Minsky hypothesis in more detail. First, it is demonstrated that periods of low volatility associated with stock market bubbles presage more serious and prolonged economic recessions. Next, periods of low volatility are linked to credit boom periods.

Profile of economic recessions at various levels of market volatility

According to the scheme described by Minsky (1977), financial asset prices may rise steeply during periods of financial stability. If that is so, the higher prices could reflect excessive optimism and increased risk-taking, which could turn against the economy in the long term.

To test this hypothesis, it is necessary to be able to identify stock market bubbles. The strategy used in this article is comparable to the methodology of Jordà *et al.* (2015). Two signals are needed. The first signal is overvaluation that occurs when a stock market index significantly exceeds its long-term trend, estimated with the aid of the Hodrick-Prescott filter[2]. The second is a correction signal: the index has to fall by at least 15 % in three years. A bubble is identified on a given date if: (1) an overvaluation signal is given on that date, and (2) a correction signal is given on that date or in the three preceding years.

The model shows the impact of periods of low volatility on real GDP growth per capita during economic recessions. It is similar to a local projection as described by Jordà (2005). Economic recession years are identified simply as years in which GDP declined[3]. The estimated model is as follows:

$$\Delta_h y_{i,t(p)} = \left(\sum_{i=1}^{I-1} \alpha_{i,h} D_{i,t(p)}\right) + \mu_h + \beta_h^{low}\delta_{i,t(p)}^{low} + \beta_h^{high}\delta_{i,t(p)}^{high} + \gamma_h^{low} d_{i,t(p)}\delta_{i,t(p)}^{low} + \gamma_h^{normal} d_{i,t(p)}\delta_{i,t(p)}^{normal}$$

$$+\gamma_h^{high} d_{i,t(p)}\delta_{i,t(p)}^{high} + \Phi X_{i,t(p)} + \epsilon_{i,t(p)},$$

in which $y_{i,t(p)}$ is the logarithm of the GDP of country i in year t corresponding to peak p, or the moment when GDP reaches a maximum before declining for at least one year. The term $\Delta_h y_{i,t(p)}$ corresponds to the cumulative (percentage) change in GDP during $h = 1, 2, \ldots, 5$ years after the start of a recession. The D_i represent the fixed effects of 16 (of the $I = 17$) advanced economies, and μ_h the fixed effect of the United States, used as the benchmark to estimate the typical path of GDP in a recession. The terms δ^{low}, δ^{normal} and δ^{high} are dummy variables which indicate when volatility is low, normal or high. The variable δ^{low} takes the value 1 when the (five-year average of the) negative cyclical component of volatility is less than its average. Conversely, the variable δ^{high} takes the value 1 when the positive and negative cyclical components exceed their average. The variable δ^{normal} takes the value 1 whenever neither δ^{low} nor δ^{high} is equal to 1. Owing to their colinearity, these three variables therefore cannot be included simultaneously in the model. Consequently, only δ^{low} and δ^{high} are present. However, they can be used simultaneously if they are combined with the dummy variable indicating a stock market bubble. The term $d_{i,t(p)}$ indicates whether or not the year $t(p)$ in country i is associated with a bubble. The vector X contains the same control variables as before (with the exception of GDP which is now the dependent variable).

The results show that a typical economic recession leads to a decline in GDP of around 2 % in the first year (see the line with the term μ_h in table 2). In the second year, GDP expands again but without entirely making good the first year's losses (note nonetheless that μ_h is not statistically different from 0 in the second year). GDP exceeds its previous peak in the third year and continues to rise thereafter.

(1) This result stands up to numerous robustness tests (Danielsson *et al.*, 2018).
(2) The cyclical component of the index must exceed once times its standard deviation. Smoothing parameter is 100 (annual data).
(3) Since the data are annual, this strategy for identifying economic recessions corresponds to the algorithm of Bry and Boschan (1971). Also, a series of years in which GDP declines continuously is considered as a single recession. The same applies if the series is only interrupted for one year.

TABLE 2 LOCAL PROJECTIONS [1]: PERIODS OF LOW VOLATILITY LINKED TO FINANCIAL BUBBLES PRESAGE MORE SEVERE AND PROLONGED ECONOMIC RECESSIONS

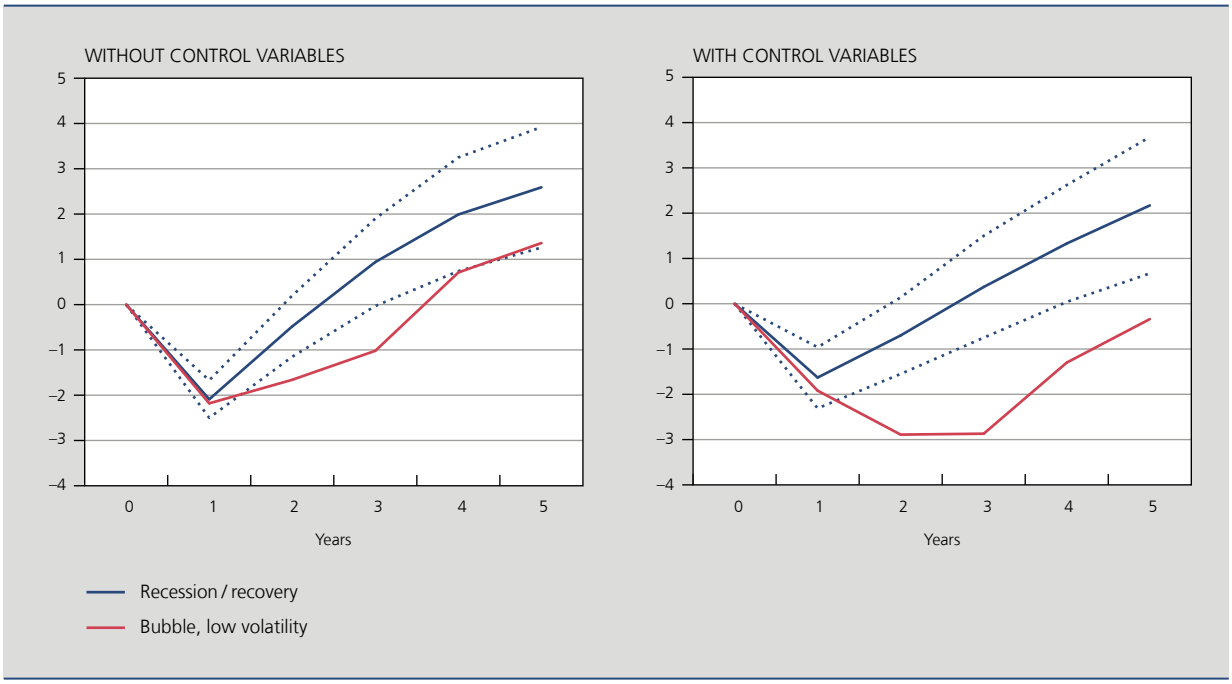
Dependent variable: $\Delta_h y_{i,t(p)}$	Year					Year				
	1	2	3	4	5	1	2	3	4	5
μ_h	−2.09***	−0.48	0.94	1.99*	2.59**	−1.63***	−0.70	0.37	1.32*	2.17*
	(0.40)	(0.66)	(0.94)	(1.22)	(1.30)	(0.66)	(0.82)	(1.09)	(1.26)	(1.47)
$\delta_{i,t(p)}^{low}$	−0.60	−1.42*	−0.67	−0.60	−0.08	−0.37	0.03	0.95	0.58	0.32
	(0.64)	(0.10)	(1.59)	(1.99)	(1.95)	(0.65)	(0.84)	(1.24)	(1.64)	(1.94)
$\delta_{i,t(p)}^{high}$	−0.60*	−1.65*	−1.52	−2.08	−0.64	−0.80*	−1.52*	−0.33	−2.97	−0.41
	(0.56)	(1.20)	(1.73)	(2.25)	(2.44)	(0.66)	(1.47)	(1.40)	(3.21)	(3.72)
$d_{i,t(p)}\delta_{i,t(p)}^{low}$	−0.09	−1.18*	−1.96*	−1.28	−1.23	−0.29	−2.19***	−3.24***	−2.63*	−2.51*
	(0.94)	(1.02)	(1.67)	(2.30)	(2.41)	(0.85)	(0.84)	(1.40)	(1.93)	(2.21)
$d_{i,t(p)}\delta_{i,t(p)}^{normal}$	−0.29	−0.84	−1.05	0.17	0.70	−0.51	−1.24	−1.68	−0.80	−1.40
	(1.14)	(1.78)	(2.50)	(2.93)	(3.23)	(1.50)	(1.74)	(2.38)	(2.73)	(2.91)
$d_{i,t(p)}\delta_{i,t(p)}^{high}$	−0.43	−0.21	0.00	0.83	2.08	−0.07	0.13	−1.20	0.86	1.02
	(0.56)	(1.19)	(1.99)	(3.09)	(3.35)	(0.65)	(1.64)	(2.86)	(4.38)	(4.93)
Control variables	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Number of observations	288	280	269	265	264	230	227	216	212	211

Sources: Jordà *et al.* (2017), NBB.

(1) Model estimated in a panel over the period 1870-2013. The robust standard errors are shown in brackets. The confidence intervals of 90, 95 and 99 % which do not include 0 are indicated respectively by one, two or three asterisks.

CHART 5 LOCAL PROJECTIONS: CUMULATIVE GDP GROWTH IN AN ECONOMIC RECESSION

(in %, confidence intervals of 68 %)



Sources: Jordà *et al.* (2017), NBB.

Periods of low volatility as such, designated by the term $\delta_{i,t(p)}^{low}$, do not appear to exacerbate or prolong economic recessions: the coefficient of the variable is (negative and) significant only in the second year, and the significance vanishes if the control variables are included in the model. However, periods of low volatility linked to financial bubbles presage more severe and prolonged recessions: the coefficients of the interaction term $d_{i,t(p)}\delta_{i,t(p)}^{low}$ are often significant, even if the macroeconomic variables are included in the model. These results may be due to the fact that a low volatility environment does not have any major negative impact on the real economy unless it gives rise to greater optimism or increased risk-taking which may be reflected, for example, in a substantial rise in share prices[1].

The typical path of GDP in a recession with low volatility and a financial bubble is illustrated in chart 5. The blue lines represent the coefficient μ_h and the confidence interval of 68 % around that coefficient (a standard confidence interval for local projections). The red lines represent the sum of coefficient μ_h and the coefficient of the variable $d_{i,t(p)}\delta_{i,t(p)}^{low}$ which indicates low volatility linked to a financial bubble. GDP does not decline noticeably more sharply in the first year, but takes longer to make good the losses. If we consider only the results that take account of the control variables, GDP actually continues to fall in the second year until it is about 3 % below the previous peak. GDP then stabilises in the third year, and only begins to increase from the fourth year.

In view of the lack of significance of the variable $\delta_{i,t(p)}^{high}$, high volatility preceding a recession does not appear to make the recession particularly more acute. Nonetheless, above-normal volatility does seem to predict a sharper fall in GDP at the beginning of a recession. That result could be due to the use of annual data, which implies that increases in volatility generally start a bit earlier than recessions because the increase in volatility may be sudden and substantial[2]. In addition, the interaction variables $d_{i,t(p)}\delta_{i,t(p)}^{high}$ and $d_{i,t(p)}\delta_{i,t(p)}^{normal}$ are not significant, indicating that only financial bubbles accompanied by low volatility are a reliable sign of excessive risk-taking which could ultimately be detrimental to the real economy.

To sum up, periods of low volatility may be harmful to the real economy if they lead to widespread optimism and/or increased risk-taking, generating a financial bubble, for example. But widespread optimism and increased risk-taking may also arise in other ways, such as via excessive credit expansion and debt, as Minsky proposes. In fact, Jordà *et al.* (2015) have already shown in a similar exercise that strong credit growth combined with a stock market bubble and (especially) a property market bubble exacerbates and prolongs economic recessions. These findings therefore suggest a link between periods of low volatility and a credit boom (see next sub-section).

The link between periods of low volatility and a credit boom

The database of Jordà *et al.* (2017) includes the outstanding bank loans to the non-financial private sector. Those series can be used to estimate a model similar to that of Danielsson *et al.* (2018) who link the credit-to-GDP gap to a number of macroeconomic variables. The credit-to-GDP gap is the difference between the credit-to-GDP ratio and its long-term trend[3]. More specifically, the model of Danielsson *et al.* (2018) regresses the positive component of the credit-to-GDP gap on the cyclical components of volatility and on a number of control variables.

The model is estimated four times, for different periods and countries (see table 3). The first two estimates – with and without control variables – consider the longest credit series, namely the series starting in 1880, for 10 of the 17 advanced economies in the sample (Canada, Denmark, Finland, Italy, Japan, Norway, Sweden, Switzerland, the United Kingdom and the United States). The other two estimates consider the credit series from 1950 for all the advanced economies (including Australia, Belgium, France, Germany, the Netherlands, Portugal and Spain). The four estimates produce similar results: the effect of a prolonged period of low volatility is statistically significant, whereas the impact of a prolonged period of high volatility is not. When the credit-to-GDP gap is positive, all other things being equal, a 1 percentage point fall in the low market volatility component increases the credit-to-GDP gap by between 15 and 21 basis points of GDP (depending on the country and period considered). According to these findings, periods of low volatility therefore stimulate lending.

(1) The results stand up to numerous robustness tests, including for the historical periods taken into account. Those tests are not described in detail for reasons of conciseness. Just as in the case of Jordà *et al.* (2015), the results presented are rationalised taking account of specific economic developments observed in certain countries during the two world wars.

(2) For example, an increase in volatility and a decline in GDP may occur at the end of year t. If the increase in volatility is sufficiently sudden, year t will be considered a high volatility year. Conversely, if the decline in GDP is relatively gradual, year t might not be seen as a recession year whereas year t+1 could be.

(3) The long-term trend in the credit-to-GDP ratio is estimated with the aid of a Hodrick-Prescott filter with a smoothing parameter equal to 100 (annual data).

These results are important because credit variables such as the credit-to-GDP gap are in practice widely used as early warning indicators of future financial crises. These credit variables generally obtain the best scores in terms of the "area under the curve" (AUC). This is a statistic measuring the reliability of the signals given by one or more variables by combining correct predictions with incorrect signals. This statistic can also be calculated for low volatility indicators. If the AUC is equal to (i.e. not statistically different from) 50 %, that means that the signals given by the low volatility indicators are just as random as those obtained by tossing a coin. If the AUC were to be 100 %, the signals would be perfect at predicting crises (and the absence of crises).

TABLE 3 PERIODS OF LOW VOLATILITY STIMULATE LENDING [1]

Dependent variable: $credit\text{-}to\text{-}GDP\ gap^{+}_{i,t}$	Data since 1880 for 10 countries	Data since 1880 for 10 countries	Data since 1950 for 17 countries	Data since 1950 for 17 countries
$c^{+}_{i,t-1\ to\ t-5}$	0.19	11.11	6.53	10.46
	(4.62)	(6.35)	(6.35)	(6.71)
$c^{-}_{i,t-1\ to\ t-5}$	–15.06**	–18.02*	–16.00*	–21.20**
	(6.27)	(9.29)	(8.59)	(8.95)
$credit\text{-}to\text{-}GDP\ gap^{+}_{i,t-1\ to\ t-5}$	0.27***	0.22**	0.38***	0.34***
	(0.07)	(0.07)	(0.08)	(0.06)
$\ln(GDP)_{i,t-1\ to\ t-5}$		1.43		2.29**
		(0.87)		(1.00)
$inflation_{i,t-1\ to\ t-5}$		–4.82*		–14.00**
		(2.06)		(5.10)
$\Delta\frac{public\ debt}{GDP}_{i,t-1\ to\ t-5}$		–7.34		–22.69**
		(4.82)		(9.52)
$\frac{current\ account}{GDP}_{i,t-1\ to\ t-5}$		–11.88**		–15.20*
		(4.00)		(7.73)
$interest\ rate_{i,t-1\ to\ t-5}$		0.04		0.08
		(0.02)		(0.07)
Number of observations	956	815	986	963
R^2	0.13	0.16	0.12	0.14

Sources: Jordà *et al.* (2017), NBB.

(1) Model estimated in a panel over the period 1870-2013. The robust standard errors are shown in brackets. The credit-to-GDP gap is the difference between the credit-to-GDP ratio and its long-term trend, which is estimated with the aid of a Hodrick-Prescott filter with a smoothing parameter equal to 100 (annual data). The confidence intervals of 90, 95 and 99 % which do not include 0 are indicated respectively by one, two or three asterisks.

The logit model introduced above serves as the benchmark. The AUC value of the model that only includes the control variables and the fixed effects is equal to 75.83 %. If we also take account of the positive component of the credit-to-GDP gap, calculated using the method of Hamilton (2017) for a (virtually) real-time estimate similar to that of the cyclical component of volatility [1], the AUC increases significantly to 79.69 %. That result proves that the credit-to-GDP gap is reliable as an early warning indicator and is consistent with the estimates of Jordà *et al.* (2012). If we add the negative cyclical component of volatility to the model which already includes the credit variable, the AUC value goes up slightly to 80.02 % [2]. In the light of that result, it does not appear clearly that monitoring financial market volatility as well as credit developments is a better way of anticipating systemic financial crises. That finding is logical to some extent since it was demonstrated that prolonged periods of low volatility tend to lead to a widening of the credit gap. Also, it seems that a crisis is less likely after a period of low volatility if there is no accompanying excessive credit expansion. However, more analysis is needed on that finding (in a future research project). Danielsson *et al.* (2018) consider, for example, that the addition of their measure of low volatility to the credit gap significantly increases the AUC of their logit model. It is also possible that the signals given by the low volatility indicators precede the ones given by the credit variables, so that they could supplement them.

(1) As recommended by Hamilton (2017), a fourth order autoregressive model is used to predict the credit-to-GDP ratio for the next five years. The whole sample is taken into account in estimating the coefficients.

(2) A similar result is obtained if the credit gap is replaced by the financial bubble indicator. In principle, a real-time financial bubble indicator ought to be developed, but for the sake of brevity, we keep the indicator presented in the previous sub-section of the article (which is not calculated in real time). The simple logit model with the financial bubble indicator gives an AUC of 77.92 %, and if the negative cyclical component of volatility is added the AUC only rises to 78.11 %.

3. The current situation in the euro area

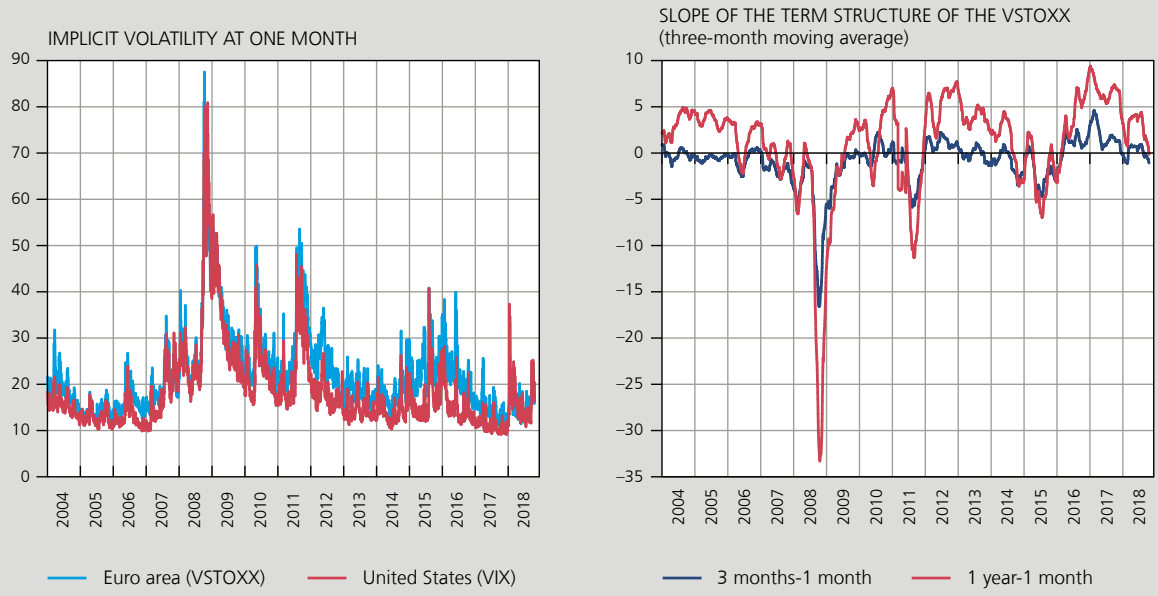
The current situation is analysed from three angles: financial market volatility, the potential materialisation of excessive risk-taking – in terms of financial asset prices and credit developments – and the effects of monetary policy.

Financial market volatility

Mirroring the American volatility measures, the volatility of stock markets in the euro area began to decline after the Brexit vote in mid-2016 (see chart 6). At the end of 2017, the one-month VSTOXX index – which measures the implicit volatility of the Euro Stoxx 50 over the next 30 days – stood at 10 %, a level comparable to the pre-crisis figure. This decline in volatility was probably due in part to the favourable economic situation at that time, and the resolutely accommodative monetary policy stance (see also ECB, 2017).

CHART 6 STOCK MARKET VOLATILITY: CHANGE OF DYNAMIC IN 2018?

(in %, annualised volatility)



Source: Thomson Reuters.

However, in February 2018, market volatility suddenly increased following the publication of inflation and employment figures in the United States. Those figures suggested that the Fed might normalise its monetary policy more quickly than expected, triggering a sharp fall in stock market indices. The one-month VIX and VSTOXX indices jumped to 40 % and 30 % respectively. In the ensuing weeks, the indices gradually declined, dropping to 12 % in May. This episode therefore seems to form part of the high-frequency component of volatility, i.e. an (almost) unforeseeable increase in volatility with no significant impact on the real economy.

In October 2018, there was another stock market correction and a further spike in volatility – the one-month VIX and VSTOXX went up to 25 % and 21 %. This indicates that the markets are still very responsive to specific announcements related to, for instance, monetary policy, trade disputes, political tensions (Brexit, Italy), and the publication of slightly disappointing macroeconomic data. When this article was written, it was too soon to judge the duration of this period of volatility. Consequently, there is a possibility that the year 2018 may mark the transition from relatively calm stock markets to a more turbulent climate.

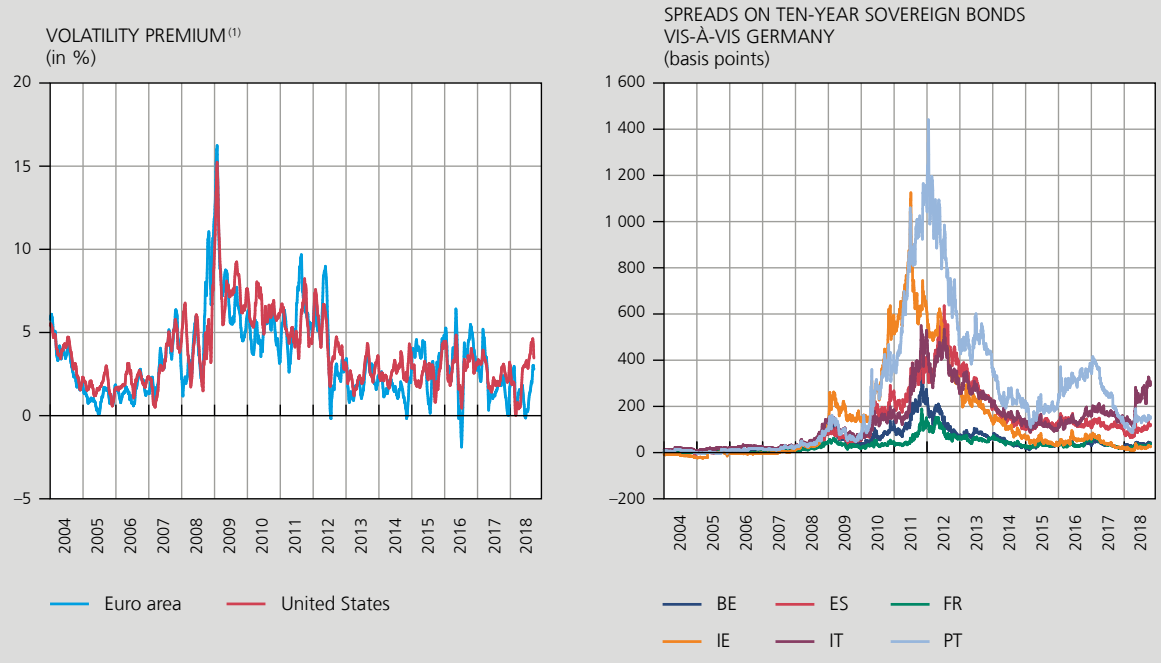
The market volatility dynamics described above are reflected in the term structure of the VSTOXX indices. While market volatility and risk premiums were generally low at the end of 2017, the positive slope of the term structure of the VSTOXX indices probably reflected expectations of increased volatility. In 2018, following the stock market correction in October, the term structure levelled out in view of the sudden rise in the VSTOXX indices for short maturities and the relative stability of the indices for longer maturities. That levelling out indicates that the markets probably do not expect the VSTOXX indices for short maturities to continue rising in the months ahead.

In 2018, the risk premiums for volatility – or volatility premiums – appeared to be heading towards higher values (see chart 7). These premiums are calculated as the difference between the implicit volatility and a forecast of realised volatility. They have to be estimated on the basis of a forecasting model, and the chosen model may affect the estimates, making it more difficult to interpret the movements in volatility premiums. In general, volatility premiums are positive since investors usually assume that volatility will be higher than forecast when pricing a derivative, in order to avoid the risk that their forecast underestimates the realised volatility (risk aversion). Nonetheless, the volatility premiums according to the model used in this article were practically zero at the end of 2017. However, in 2018, the volatility premiums seem to have reverted to more positive values. Higher volatility premiums could be a sign of increased wariness on the part of investors.

Other measures of risk premiums – not based on models – tended to rise in 2018. For example, sovereign spreads in relation to Germany widened slightly in peripheral euro area countries in February 2018 as a result of financial market turbulence. In May 2018, Italian interest rate differentials widened more significantly following the formation of the new government, and that had partial repercussions on some other spreads. Similarly, the premiums on credit default swaps on bank and sovereign bonds and the spreads on corporate bonds also increased in 2018.

Although volatility premiums and certain other risk premiums seemed to be rising in 2018, it is prudent to consider that the low volatility environment may still exist so that risks are still being accumulated. The implicit volatility was

CHART 7 INCREASE IN RISK PREMIUMS IN 2018



Sources: Thomson Reuters, NBB.

(1) The volatility forecasts of the S&P 500 and Euro Stoxx 50 indices recorded over 22 days are based on a model similar to model 8 of Bekaert and Hoerova (2014). That model predicts the realised volatility on the basis of three variables with a 1-month lag: realised volatility, the average realised volatility over one week, and the average over one month. The premiums are obtained as the difference between the one-month VIX/VSTOXX and the predicted realised volatility, and are smoothed by means of a 45-day centred moving average.

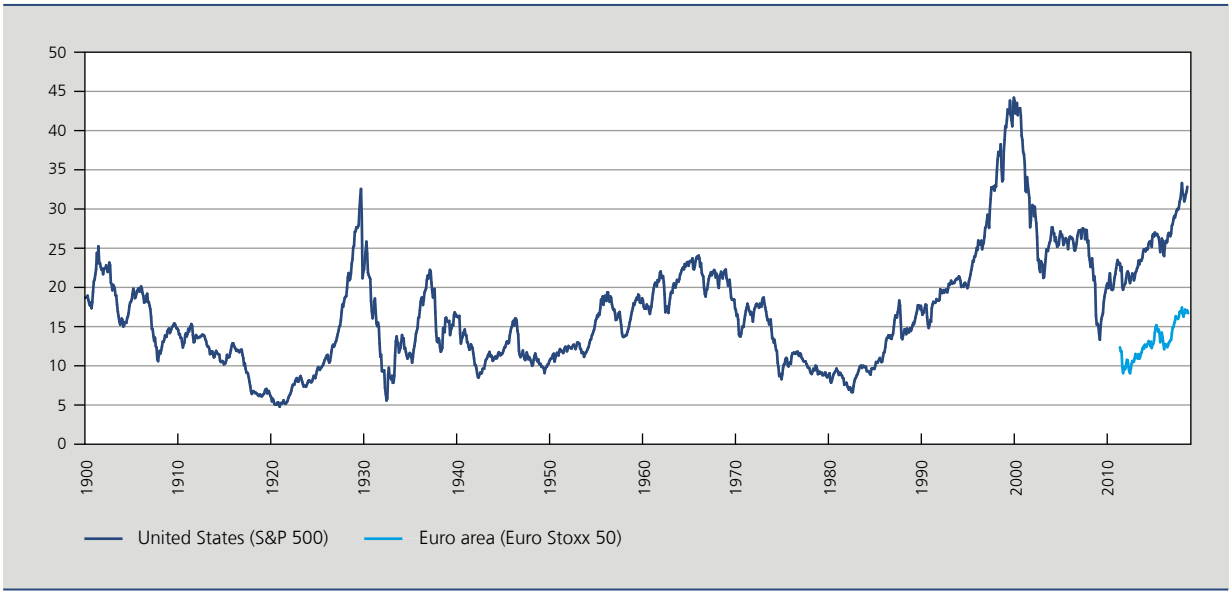
still particularly low prior to the sudden rise in October 2018, an increase which might not be sustained. It is therefore desirable to examine indicators that reveal the existence of optimism and excessive risk-taking.

Asset prices and credit developments

It is not possible to calculate the financial bubble indicator used in the previous chapter because it is not available in real time, as there is no way of predicting whether the stock market indices will fall by at least 15 % over the next three years. Conversely, other indicators which are often used to assess asset prices are easy to calculate. For example, in the United States there has been a noticeable divergence in recent years between share prices and corporate earnings. The S&P 500 price/earnings ratio increased from 15 in 2012 to 24 in 2018 owing to the relatively slow growth of corporate earnings. According to Robert Shiller, the cyclically adjusted price/earnings ratio reached 33 in 2018 (see chart 8). In judging the (fairly high) level of this ratio, it is necessary to be aware that it is comparable to the ratio in 1929, immediately before the Great Depression. In the euro area, the divergence between share prices and earnings in the post-crisis recovery period was not as great. The Euro Stoxx 50 price/earnings ratio has even declined slightly in recent years, dropping to 15 in 2018, while the cyclically adjusted ratio stands at 16.

Apart from share prices, sovereign and corporate bond prices were generally high in 2018. That is largely due to the fall in monetary policy interest rates and the asset purchases made by central banks to support inflation and economic activity following the financial crisis. The banking channel usually passes on this general decline in interest rates in its loans to households and non-financial corporations, stimulating demand for credit and helping to reinvigorate the economy.

CHART 8 CYCLICALLY ADJUSTED PRICE/EARNINGS RATIOS HAVE RISEN IN THE UNITED STATES AND THE EURO AREA SINCE THE LAST FINANCIAL CRISIS (1)



Sources : Robert Shiller, Thomson Reuters, NBB.
(1) Cyclically adjusted price/earnings ratios are calculated as real share prices divided by the 10-year average of real earnings.

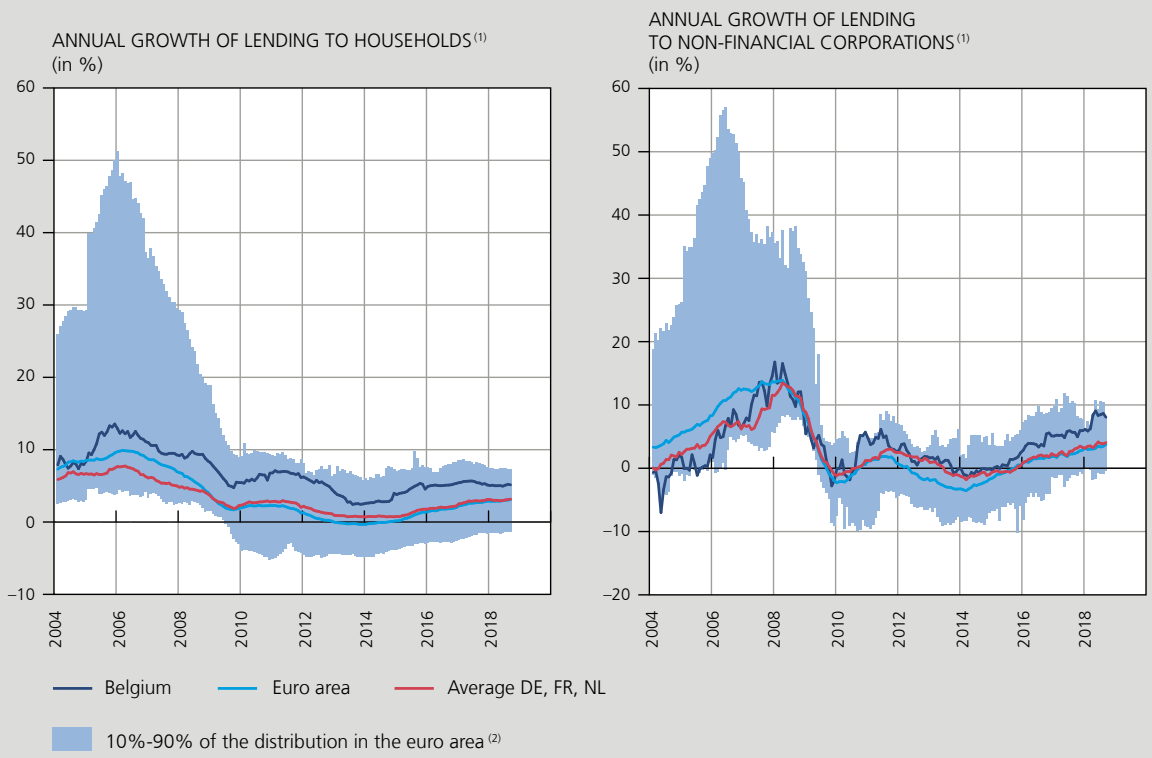
In regard to bank credit, it is noticeable that the pre-crisis period featured relatively strong credit expansion in the euro area (see chart 9). In 2007, the annual average growth rate was about 10 % for households and reached 13 % for non-financial corporations. There were also some clear excesses in certain countries. For example, at the end of 2005, the growth rates for lending to households in Estonia, Ireland and Slovenia stood at 69 %, 27 % and 25 % respectively. The picture was similar in the case of lending to non-financial corporations.

Since the crisis, lending has regained momentum in the euro area, although the expansion is much more reasonable than in the period preceding the crisis. The growth of lending to households increased in the euro area from a slightly

negative figure at the beginning of 2014 (–0.3 % in January) to +3.1 % in September 2018. Over the same period, the growth of lending to businesses increased from –3.3 % to +3.7 %. A similar upward trend can be seen in the statistics on credit-to-GDP gaps.

Although this revival is partly due to the successful transmission of monetary policy, the strengthening of the credit cycle in the euro area still needs to be monitored closely in order to avoid excessive lending in certain Member States. In that connection, some Member States decided to activate a countercyclical capital buffer as part of their macroprudential policy. That buffer is meant to be increased gradually if credit developments tend to indicate an accumulation of systemic risks. The primary intention here is that, in the event of a crisis, the buffer can be reduced in order to release part of the banks' capital. But the buffer may also have the (desirable) secondary effect of slowing credit expansion. The national flexibility of macroprudential policy accorded to the Member States may therefore prove valuable if the credit cycle accelerates in one country while an accommodative monetary policy remains necessary for the euro area as a whole.

CHART 9 CREDIT DEVELOPMENTS IN THE EURO AREA ARE INTENSIFYING



Sources: ECB, NBB.

(1) Lending by resident banks to the resident non-financial private sector. Securitised loans are taken into account. For Belgium, account is also taken of otherwise transferred mortgage loans. The annual growth rates are calculated as the sum of the net credit flows over twelve months divided by the initial outstanding amount of loans.

(2) The growth figures for lending to households in Lithuania are not taken into account before 2009.

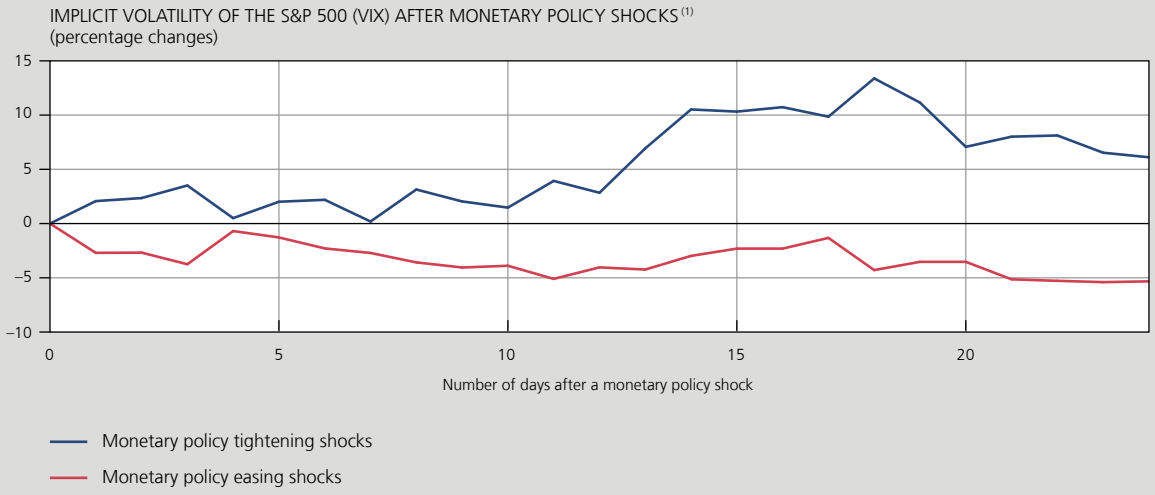
The new Basel III rules which have come into force since the last financial crisis comprise more measures than just the countercyclical capital buffer. They primarily incorporate other capital ratios aimed at improving the banking sector's solvency. Consequently, in the past ten years, there has been a general decline in leverage in the banking sector of the euro area. That is significant, since the procyclicality of leverage effects in the banking sector was named as one of the factors behind the worsening of the latest crisis, if not one of its causes. Adrian and Shin (2014) show that leverage in the banking sector varies with the business cycle and that these fluctuations constitute a means for banks to step up their lending to the economy. Danielsson *et al.* (2018) demonstrate that a prolonged period of low volatility may not only stimulate an increase in lending to the real economy, but may also trigger a rise in the banking sector's leverage ratio.

A decline in leverage in the banking sector is therefore an encouraging sign for macroprudential policy in Europe. However, it must be borne in mind that the downward trend cannot continue indefinitely, and is liable to weaken towards the end of the period for phasing in the new Basel III rules. Moreover, some of the risks could switch from the banking sector to a shadow banking sector which is subject to lower prudential requirements and which could therefore exhibit more procyclical behaviour. According to the limited definition of the Financial Stability Board, the shadow banking sector grew by 14 % between 2010 and 2016 in terms of total assets [1].

Market volatility generally increases following monetary policy tightening shocks

One of the characteristics of the current situation concerns the dynamics of monetary policy. In the United States, the Fed began normalising its monetary policy several years ago and is now about to embark on monetary tightening. It halted its net asset purchases in October 2014 and began raising the target range for the federal funds rate in December 2015. In the euro area, the ECB Governing Council decided in December 2018 to end its net asset purchases. The Governing Council announced that the ECB expects to keep the key interest rates at their current level at least until the summer of 2019; after that, it will raise the key rates if inflation in the euro area continues to converge on a level lower than, but close to, 2 %.

CHART 10 MARKET VOLATILITY GENERALLY INCREASES FOLLOWING MONETARY POLICY TIGHTENING SHOCKS



Source: NBB.

(1) The shocks are derived in the same way as in Rogers *et al.* (2014) and ECB (2017). A shock due to tightening (easing) is assumed to occur if, on the day of an FOMC meeting, the yield to maturity of a one-year American government bond increases (falls) by more than twice the standard deviation of the daily change. Data from January 1990 to October 2018.

In such an environment featuring the gradual withdrawal of the monetary stimulus, or even monetary tightening in the United States, past experience suggests that a (modest) increase in volatility is likely. That prediction is based on analysis of the effects that meetings of the Federal Open Market Committee (FOMC) have had on the financial markets since 1990 (see chart 10). Following a monetary tightening shock, the implicit volatility of the S&P 500 tends to increase by slightly more than 10 % in the two weeks after the meeting. Conversely, following a monetary easing shock, the volatility of the S&P 500 tends to decline slightly.

In view of this finding, it seems that the accommodative monetary policy after the crisis helped to restore calm on the financial markets. During the current normalisation, if greater market volatility is undesirable, any adjustment to monetary policy should be gradual and the market should be able to anticipate it as far as possible.

(1) Sum of the total assets in Belgium, France, Germany, Ireland, Italy, Luxembourg, the Netherlands and Spain.

Conclusion

As regards the historical link between financial market volatility and economic crises, the econometric findings show that prolonged periods of low volatility presage systemic financial crises. Periods of low volatility seem to nurture a degree of optimism among economic agents and encourage them to take more risks. Among other things, that optimism and increased risk-taking may result in a financial bubble and a credit surplus in the economy. The empirical study revealed that: (1) recessions preceded by a period of low volatility associated with a stock market bubble are more serious and prolonged than others; and (2) long periods of low volatility stimulate lending to households and non-financial corporations.

In the event of excessive risk-taking, e.g. if the debt burden of households and firms becomes too large, a classic financial shock such as an interest rate hike could have a serious impact on the economy, for instance if it casts doubt on the sustainability of the debt. If volatility has already been low for a number of months/years, a small and lasting increase in market volatility would therefore be desirable if it enables the economic agents to gain a better understanding of the macroeconomic risks.

In the current situation, it seems prudent to consider that the low volatility environment may still be relevant, since the sudden rise in volatility in October might not persist. If that is the case, then it is necessary to keep a close eye on financial asset prices and credit developments to the extent that they indicate a potential accumulation of systemic risks.

More generally, macroprudential policy has a role to play where the optimism prevailing during periods of low volatility reflects a "this-time-is-different" syndrome. According to Reinhart and Rogoff (2009), "financial professionals and, all too often, government leaders explain that we are doing things better than before, we are smarter, and we have learned from past mistakes. Each time, society convinces itself that the current boom, unlike the many booms that preceded catastrophic collapses in the past, is built on sound fundamentals, structural reforms, technological innovation, and good policy." (p. xxxiv). The trap due to this way of thinking seems perfectly applicable to periods of low volatility. During these periods, the financial markets appear calm, while credit expands steadily and facilitates the funding of investment that promotes economic growth. However, the systemic risks may accumulate and ultimately lead to a crisis. It is therefore during these periods of apparent calm that countercyclical macroprudential policy can take action. Its aim may be twofold: to build up reserves that can be used during crises, and possibly to slow the build-up of risks if they can be identified sufficiently clearly. If macroprudential policy were to succeed in doing that, it could limit the chances of a systemic financial crisis or mitigate its impact.

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Full employment, mismatches and labour reserve

M. Nautet

Introduction

Full employment, a mythical goal of economic policy, has lately become highly topical once again. This article aims to report on the current situation concerning this question in Belgium and in its Regions. For that purpose, it will explain the theoretical concepts associated with full employment. Various indicators will be used to illustrate the mounting tensions on the labour market while presenting them in a broader context so that they may be seen in perspective. The main factors hampering a decline in structural unemployment will then be examined.

Wherever possible, and where relevant, the findings for Belgium will be broken down by Region and compared with those for the main neighbouring countries (Germany, France and the Netherlands) and the Scandinavian countries (Denmark, Finland and Sweden), the latter being regarded as the best performers on matters concerning the labour market.

1. Theoretical concepts

1.1 Full employment, frictional unemployment and NAIRU

The goal of full employment has recently been mentioned by politicians, who link it to a substantial reduction in the unemployment rate, or even – more generally – to the large-scale mobilisation of the population of working age.

According to the economic theory, the term "full employment" refers to a situation where all those who wish to work actually have a job that enables them to use their skills. Full employment can therefore co-exist with a (large) proportion of inactive people within the population of working age, i.e. people who do not wish to work.

Nor does full employment preclude a certain level of unemployment, which in that case is confined to frictional unemployment, resulting from the "natural" time needed to find a satisfactory job in terms of quality, working time and pay conditions. That inevitable time lag is due to the recruitment process itself : submission of applications, selection procedure, etc. The level of frictional unemployment varies over time and from place to place, depending on the speed of the process of matching the labour supply to demand. That depends partly on the level of activity, the quality of the support provided for job-seekers, and the (mis)match between the labour supply and demand characteristics.

Tensions on the labour market may arise on account of a full employment situation, but such tensions may become apparent at a much earlier stage. That is the case where unemployment is persistently lower than the NAIRU

(non-accelerating inflation rate of unemployment), i.e. the unemployment rate that stabilises inflation. Even if unemployment is relatively high, structural factors then prevent it from falling. In that case, the expansion of activity no longer results in declining unemployment but instead leads to an increase in wages, fuelling inflation. In a balanced, full employment economy, the observed unemployment rate and the NAIRU correspond to frictional unemployment.

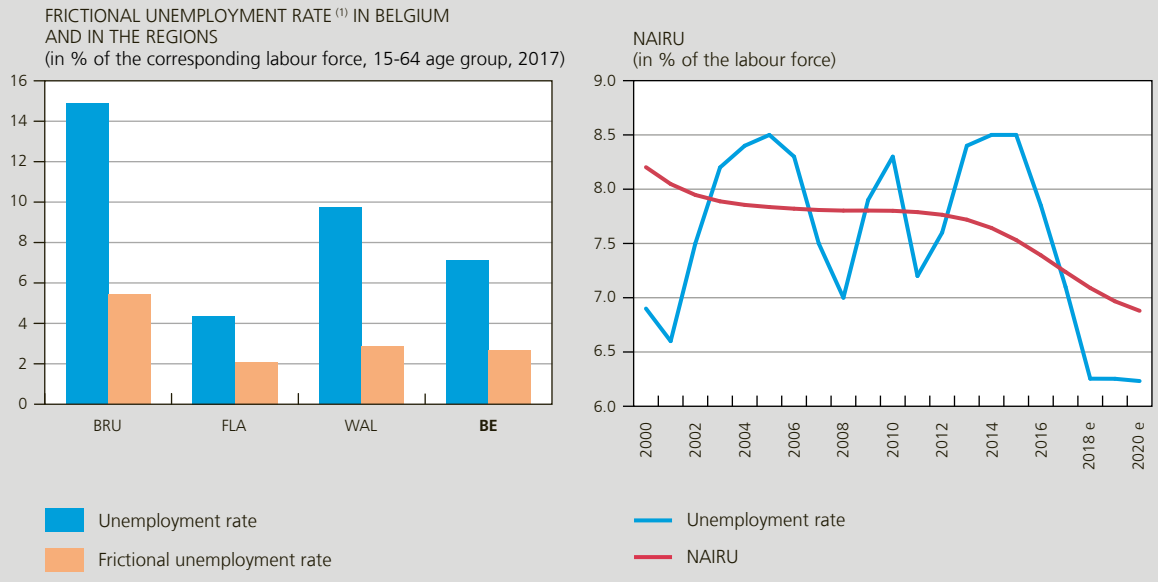
The sections which follow present an estimate of the level of these various concepts of unemployment in Belgium and in the Regions. After that, we shall analyse whether the situation in Belgium conforms to economic theory and whether that situation provides an answer to the ensuing questions: What about labour market tensions? Can we reduce the unemployment rate any further? What are the factors that influence the process of matching the labour supply to demand for labour?

1.2 Estimate of frictional unemployment and the NAIRU

1.2.1 Frictional unemployment

Frictional unemployment results from the "natural" time lag entailed in moving from one job to another or in joining the labour market. That time lag is considered to be relatively short, and becomes still shorter the closer we are to a full employment situation. In the analysis below, it is considered to be less than six months. On the basis of that criterion, since 1995, the frictional unemployment rate in Belgium has ranged between 2 % and 3.3 % of the redefined labour force (i.e. the sum of employment plus unemployment persisting for less than six months). However, there are wide variations between the Regions. According to our estimates, in 2017 [1], frictional unemployment stood at 2.1 % in Flanders, 2.9 % in Wallonia and 5.4 % in Brussels. Factors accounting for these discrepancies include the degree to which the characteristics of the labour supply tally with those of demand, the effectiveness of the public employment services, and the vigour of economic activity. As the actual unemployment rate exceeds the frictional unemployment rate in the three Regions, none of them is in a full employment situation.

CHART 1 FRICTIONAL UNEMPLOYMENT RATE AND NAIRU



Sources: Statbel, NBB.
(1) Estimated on the basis of unemployment lasting less than six months, the time lag considered sufficient to change jobs or to join the labour market.

(1) Latest available year.

1.2.2 NAIRU

Like frictional unemployment, the NAIRU cannot be observed as such. It is estimated on the basis of economic models by various national and international institutions (NBB, OECD, EC, etc.). As their methodologies differ, the resulting estimates also vary from one institution to another. In 2018, the Bank and the OECD estimated the NAIRU at 7.1 %, and the EC arrived at a figure of 6.8 % [1]. By definition, the NAIRU is relatively stable if policy remains unchanged; structural reforms are necessary to change its level. Those reforms may concern the participation of the population of working age, training, a reduction in the unemployment and inactivity traps, or matching the quality of the labour supply to the demand for labour. Thus, in Belgium, the NAIRU has tended to decline, notably as a result of the recent reforms reducing the tax wedge and parafiscal levies on labour incomes and the reforms concerning unemployment insurance [2]. On the basis of the Bank's latest estimates, the unemployment rate (6.3 % in 2018) is below the NAIRU (7.1 %) for the second year running, and is likely to remain there for the next three years.

TABLE 1 ESTIMATED UNEMPLOYMENT RATE AND NAIRU
(in % of the labour force)

	Unemployment rate	NAIRU		NAWRU
		NBB December 2018	OECD November 2018	EC November 2018
2016	7.9	7.4	7.3	7.3
2017	7.1	7.2	7.2	7.1
2018	6.3	7.1	7.1	6.8

Sources: EC, OECD, NBB.

1.3 From theory to economic reality

According to economic theory, the labour supply can be brought into balance with demand for labour by adjusting wages (i.e. the price of the factor labour). In Belgium, the fall in unemployment since 2015 combined with strong demand for labour should therefore have been accompanied by a significant rise in wages. In reality, apart from the inherent rigidity of the wage-setting mechanism in Belgium (negotiated pay increases under sectoral agreements concluded for two years), various measures prevented that adjustment, particularly the wage moderation policy and labour cost reduction measures adopted in order to restore the cost competitiveness of firms. Economic theory was therefore not borne out in Belgium in the recent past, and that is corroborated by some economists (see Dotsey *et al.*, 2017; Haldane, 2017; or Hawksworth and Durham, 2017) who think that the link between unemployment and inflation, as assumed by the Phillips curve, is becoming ever less apparent and that the NAIRU is tending to become less relevant for measuring inflationary pressure.

2. The labour market in Belgium and in the Regions

2.1 Scale of the labour market tensions

The current level of unemployment, which is now lower than the NAIRU, should correspond to a level difficult to reduce without a change of policy. Consequently, job creation should be held back because labour is becoming scarce, as the characteristics of those who are still unemployed do not correspond to firms' requirements. This section aims to report on the above statements and tries to present them in a broader context so that they can be viewed in perspective. To

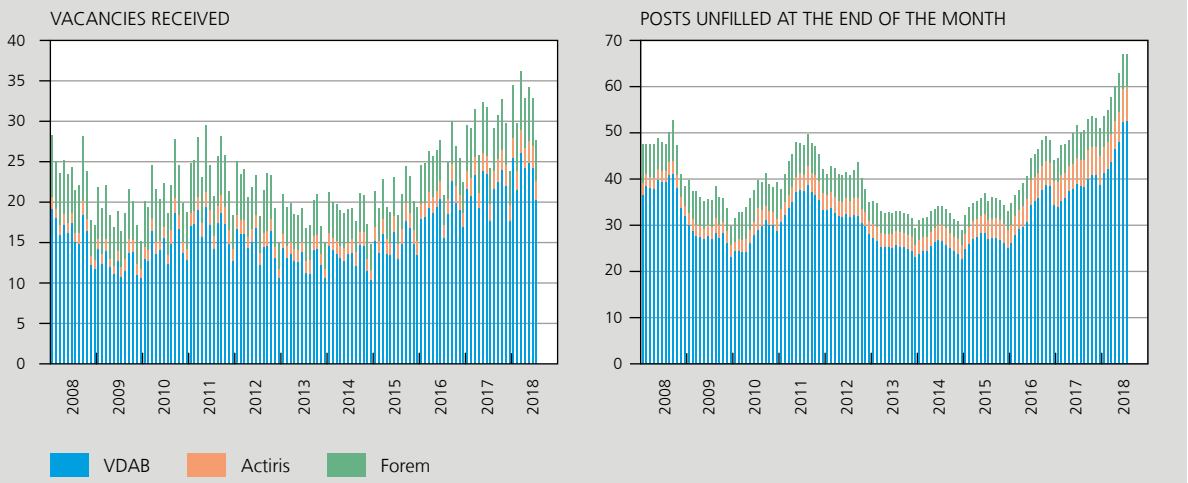
(1) The EC estimates the NAWRU (non-accelerating wage rate of unemployment) instead of the NAIRU.
(2) The OECD, the EC and the Bank have thus revised downward their estimates of the structural unemployment rate, which hovered around 8 % before.

assess the labour market situation and the potential tensions prevailing there, various indicators concerning the labour supply and demand for labour will be examined. Demand for labour means jobs which have been filled and vacancies offered by firms. The labour supply is equivalent to people in work and job-seekers.

2.1.1 Increase in demand for labour

Data obtained from the public employment services show that, since 2015, there has been a steep rise in firms' demand for labour accompanied – logically – by a rise in end-of-month vacancies. In comparison with previous years, the number of vacancies is now at a historically high level, at 64 000 vacant posts at the end of September 2018. However, there is no obvious discrepancy between the trend in the number of unfilled vacancies at the end of the month and the number of offers to be processed, so that we cannot conclude that these posts are more difficult to fill. Contrary to received wisdom, most of the job offers handled by the public employment services require a low educational level or do not specify any educational requirements[1]. In 2017, that was true of 44 % of job offers received in Brussels, 40 % in Flanders and 56 % in Wallonia.

CHART 2 VACANCIES RECEIVED[1] AND UNFILLED[2] IN THE PUBLIC EMPLOYMENT SERVICES
(monthly data, in thousands)



Sources: Actiris, Forem, VDAB.
(1) Only vacancies received via the usual channels, excluding temporary agencies, government support and offers from other partners.
(2) Since the Forem vacancy figures are only available from 2009, the data were retropolated on the basis of the ratio of incoming vacancies to vacancies recorded over the first twelve months of the data's availability.

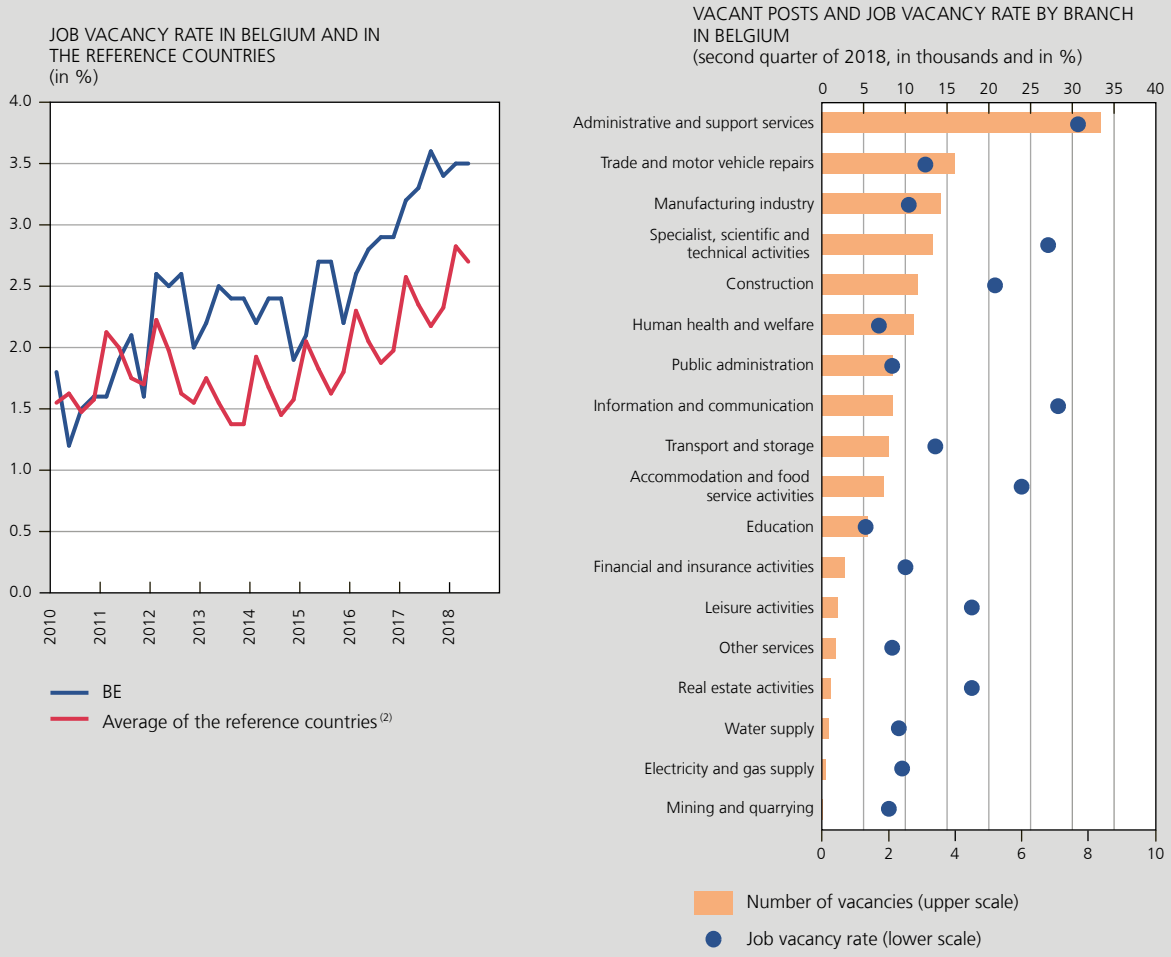
We would point out that the data obtained from the public employment services are not exhaustive[2] and their representativeness also varies from one Region to another, depending on such factors as their market share. It should also be borne in mind that the rise in the number of vacancies handled in recent years is not entirely attributable to the economic situation, because there has been a big increase in the number of public employment service partnerships, and the ease of placing vacancies on line also affects the growth in the number of vacancies recorded.

The Bank's business survey data confirm the dynamism of firms' demand. They also illustrate the growing recruitment problems facing employers. Increasing numbers of firms in the manufacturing sector report a shortage of skilled labour. However, the level of this indicator nonetheless remains similar to that recorded before the 2008 crisis. This indicator is highly significant because it establishes the direct link between the labour shortage and the production capacity of firms.

(1) That does not necessarily mean that the employer is unconcerned about the skill level, but rather that the offer refers to a trade or function.
(2) This only concerns vacancies offered through the usual economic channels, excluding temporary agencies, exchanges between public employment services, and subsidised programmes.

The job vacancy rate[1] measures the proportion of vacancies within theoretical total employment (i.e. the posts filled and the vacant posts). That indicator has also risen since 2015, namely from 2.1 % in the first quarter of 2015 to 3.5 % in the second quarter of 2018. The rise in the vacancy rate is not necessarily a sign of additional recruitment difficulties: when demand increases, the natural delay between matching supply to demand also leads to an increase in unfilled vacancies.

CHART 3 JOB VACANCIES AND JOB VACANCY RATE[1]



Source: Eurostat.
(1) The job vacancy rate measures the proportion of unfilled vacancies in theoretical total employment (vacant and occupied posts).
(2) Finland, Sweden, Germany and the Netherlands. Data for Denmark and France are not available.

The rise in the vacancy rate is not specific to Belgium, but is also apparent in the neighbouring and reference countries. However, since 2012, the job vacancy rate has been higher in Belgium, reflecting not only greater matching problems but also the level of recurrent, very short-term agency work in Belgium, which drives up the level of the job vacancy rate, particularly when the economy is expanding.

This last point also reflects the job vacancy rate in the administrative and business support services branch, which includes temporary employment agencies. That rate was 7.7 % in the second quarter of 2018, compared to an average of 3.5 % for all branches. Next come the information and communication branch and the specialist, scientific and

(1) Eurostat Job Vacancy Survey (JVS).

technical activities branch, where the job vacancy rates are 7.1 % and 6.8 % respectively. If we now analyse the absolute number of vacancies per branch, the administrative and business support services branch is still well in the lead : of the 145 600 vacancies in the second quarter of 2018, 33 400 were reported in this branch, 15 900 in trade and 14 200 in industry. Among the Regions, Flanders has the highest job vacancy rate. That is due to the more dynamic economy and labour market in that Region. Brussels also has a high vacancy rate, mainly because of the greater difficulty in matching the supply to the demand for labour than in the other two Regions. The labour market tensions are therefore not generalised. They concern certain specific segments, i.e. certain geographical areas or particular occupations.

TABLE 2 CRITICAL OCCUPATIONS BY CATEGORY [1]

(number of vacancies received by the public employment services for critical occupations, 2017)

	Brussels	Flanders	Wallonia
Total critical occupations	**8 385**	**141 801**	**63 236**
Technical jobs	855	19 339	20 548
Cleaning staff	0	27 331	2 507
Sales	1 156	17 303	2 983
Medical, social and personal support occupations	848	17 299	2 469
Construction	306	13 075	6 171
Transport and logistics	103	7 495	9 895
Management and communication	517	9 285	6 957
Information technology	1 352	7 951	5 097
Teaching staff [2]	1 013	9 179	n.a.
Administration	1 382	3 640	3 323
Accommodation, food services and tourism	289	5 869	1 587
Craft trades	429	1 632	1 699
Other	135	2 403	0

Sources : Actiris, Forem, VDAB.

(1) The socio-occupational categories are based on the ones used by Actiris.

(2) The Forem survey does not record the number of vacancies for critical occupations in education in the Walloon Region.

In order to provide a more accurate picture of the jobs which are difficult to fill, we use the public employment service analyses of critical occupations [1]. These surveys examine vacancies which are harder to fill than average, and the reasons for those difficulties. Apart from the natural time needed to match supply and demand for labour, structural factors may affect the process. For instance, both the quantity and the quality of candidates may be inadequate. That last inadequacy may be due both to the choice of subjects studied and to the quality and content of the training provided for newcomers to the labour market. Recruitment problems may also be due to a lack of mobility or a lack of interest in occupations which are low paid, low status or physically demanding.

Some of the occupations thus identified appear as critical occupations year after year, in all three Regions. Nonetheless, there are some regional features. In Flanders, the number of critical occupations is highest for cleaning staff, technical occupations, sales and health care or personal support. In Brussels, the main critical occupations concern administrative and sales posts and IT jobs. In Wallonia, the critical occupations are in technical occupations, transport, logistics,

(1) The methodologies used by the three public employment services are fairly similar : they combine a statistical approach (number of vacancies, percentage filled, time taken to fill vacancies) with qualitative criteria (opinions of employment advisers and firms). Each public employment service adapts the criteria and thresholds to suit the specific characteristics of the labour market in its own area.

construction and management. The Forem analysis also identifies the occupations most affected by a shortage of candidates (a purely numerical shortage). They are technical occupations, transport, logistics, and IT.

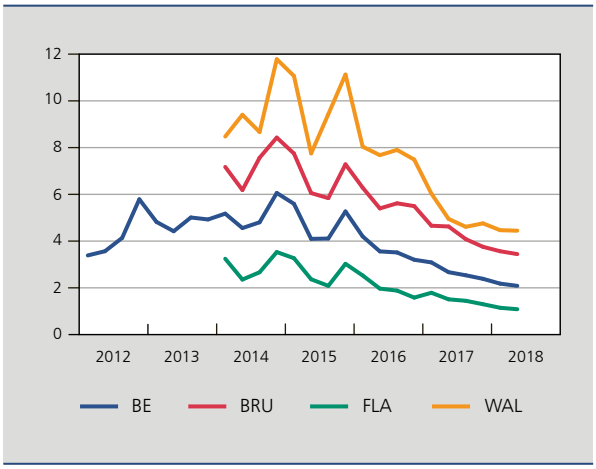
In order to remedy the lack of skilled workers, the training provided by the public employment services is geared to these job types as far as possible, although it is understood that some of the occupations in demand entail several years' training. We would point out that digitisation could alter the list of critical occupations by changing the practice conditions of current occupations and generating new types of job, but also by causing other jobs to disappear in the medium term.

2.1.2 Labour supply shortage

Since 2008, the number of unemployed job-seekers has risen sharply on two occasions, namely at the time of the financial crisis and during the sovereign debt crisis. Since the economic recovery which began in 2014, there has been a steady and substantial decline, bringing the number of unemployed job-seekers down to a level similar to that prevailing before the great recession. In comparison with the same month in 2008, the number of unemployed job-seekers in October 2018 was slightly lower (–8 800). The picture varies from one Region to another. Wallonia was less affected by the economic downturns than Flanders, which is more sensitive to fluctuations in activity. Compared to the October 2008 figure, the number of unemployed job-seekers is lower in Brussels (–2 700), but especially in Wallonia (–28 900), while in Flanders it has yet to revert to its pre-crisis level (+22 800). In October 2018, there were 497 000 unemployed job-seekers: 192 000 in Flanders, 91 000 in Brussels and 214 000 in Wallonia.

The labour market pressures are also fuelled by the ageing of the population of working age, as the proportion of young people available to replace older persons leaving the labour market is steadily shrinking. This phenomenon, apparent since the early 2000s, is likely to persist for some years yet, before turning around by about 2023.

CHART 4 NUMBER OF JOB-SEEKERS PER VACANCY
(quarterly data)

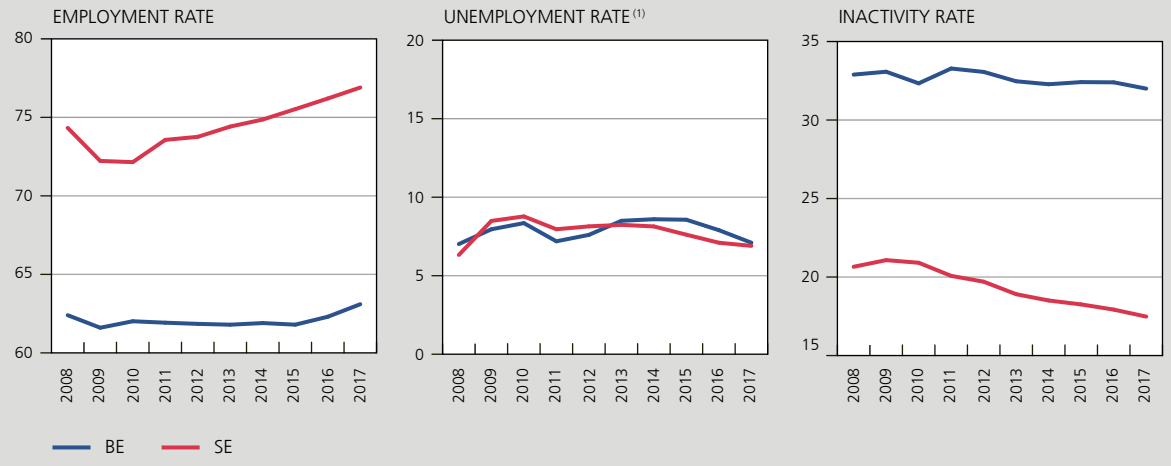


Sources: Eurostat, Statbel.

On the basis of the European job vacancy surveys and the labour force surveys, we can calculate a ratio for the number of job-seekers per vacancy. We should not read too much into such a purely quantitative, global indicator, because it has serious limitations, the main one being that it tells us nothing about the qualitative aspect of the matching process. Nonetheless, the trend in the indicator may reveal the potential development of labour market tensions. This ratio has fallen sharply since the economic recovery. At the end of 2014, there were approximately six job-seekers for each vacancy, but that figure is now down to two. In Flanders, the quantitative aspect of the matching problem is structurally more marked than in the other two Regions, because of both a smaller proportion of job-seekers and higher demand for labour. In the

second quarter of 2018, the number of job-seekers per vacancy was particularly low, almost one to one. Such a situation is associated with mounting recruitment problems for firms. However, it cannot be regarded as a full employment situation since, according to economic theory, the number of vacancies should in that case exceed the number of job-seekers.

CHART 5 EMPLOYMENT, UNEMPLOYMENT AND INACTIVITY RATES IN BELGIUM AND SWEDEN
(annual data, 15-64 age group)



Source: Eurostat.
(1) In % of the labour force.

It should be noted that, although Belgium has recorded a large number of net job creations since 2015, it still has a lower employment rate than the reference countries. As is evident from the comparison with Sweden, regarded as one of the best performing countries in labour market matters, the difference does not lie in higher unemployment but in much higher inactivity. In Belgium, one-third of the working age population is inactive (compared to 17.5 % in Sweden). This mediocre score is due to the high rate of inactivity at the extremities of the age distribution. Almost two-thirds of those under the age of 25 are inactive, and almost half of all people aged 55 and over, despite the strong rise in their activity rate since 2000. Flanders is no exception in that respect: while its activity rate is higher than that of the other two Regions, it is still below the European average. Given the large number of inactives of working age (over 2 million people), getting some of that population back into work could do much to ease the problem of the labour supply shortage.

2.2 Matching the labour supply to demand

Apart from the purely quantitative aspect, the matching of the labour supply to demand also depends on qualitative factors. This section examines the extent to which the characteristics of job-seekers and workers meet the employers' requirements in terms of education and skills.

As we have seen, the current number of job-seekers is fairly similar to the pre-crisis figure. However, the proportion of poorly-educated people is now smaller, and the percentage of highly-educated people is much greater, especially in Brussels and Flanders. The rise in the average educational level of job-seekers should make activation easier than in 2008. Nonetheless, at the same time firms' requirements have also changed. In the space of ten years, the share of medium-skilled jobs has dropped by 5 percentage points, in favour of highly-skilled jobs (+ 4 percentage points) and, to a significantly smaller degree, low-skilled jobs (+1 percentage point)(1). There has been no comparable trend in

(1) Low-skilled jobs represent 10 % of total jobs, compared to figures of 42 % for medium-skilled jobs and 48 % for highly-skilled jobs.

the educational level of persons in work. While the proportion of medium-educated people has fallen over ten years (–3 percentage points), the most marked decline concerns the poorly-educated (–6 percentage points), while the share of highly-educated workers increased by 9 percentage points over the same period. For any given job, the workers' educational level has steadily risen. Although digitisation may be a factor here, that trend could also be due to the recruitment policies of firms, which are increasingly focusing on specific profiles (increased requirements in terms of education and experience).

TABLE 3 DIFFICULTIES IN MATCHING THE LABOUR SUPPLY TO DEMAND [1], [2]

(in % of the corresponding population in the 15-64 age group, employment according to the job's skill level, unemployment according to the job-seekers' educational level, 2017)

	Brussels		Flanders		Wallonia	
	Employment	Unemployment	Employment	Unemployment	Employment	Unemployment
Low	12	41	10	30	10	39
Medium	30	31	44	44	46	44
High	57	28	46	26	44	17

Source : DGS.

(1) Skill level defined on the basis of the International Standard Classification of Occupations (ISCO) : Low-skilled jobs correspond to elementary occupations such as domestic helpers, labourers, etc. ; medium-skilled occupations correspond to clerical workers, skilled industrial trades, etc., and highly-skilled occupations correspond to managers, intellectual and scientific occupations, etc.

(2) Educational levels are defined according to the International Standard Classification for Education (ISCED). A low level of education corresponds to lower secondary education or less, a medium level corresponds upper secondary education or less, and a high level corresponds to tertiary education.

Comparison of the educational level of job-seekers with the skill level of the jobs reveals major problems in matching the labour supply to demand. In 2017, 10 % of jobs corresponded to low-skilled functions, while the proportion of poorly-educated job-seekers was 36 %. Conversely, highly-skilled jobs represented 47 % of employment, while the proportion of graduate job-seekers was 23 %. The problem of matching the labour supply to demand is particularly acute in Brussels and Wallonia, where around 10 % of jobs are in low-skilled occupations while some 40 % of job-seekers have a low educational level (30 % in Flanders). In Brussels, the share of jobs requiring high skill levels is greater than in the other Regions (57 %, compared to around 45 %). Wallonia is different in having a smaller percentage of highly-educated job-seekers (17 %, as opposed to 26 % in Flanders and 28 % in Brussels).

In regard to interpretation, caution is still required since the unemployed represent only a fraction of the people who may respond to firms' demand. According to an HCE analysis [1], among those newly recruited in 2017, only 16 % were job-seekers while 57 % were already in a job previously, but with a different employer, while 19 % were leaving education and the balance comprised persons who had previously been inactive. The labour reserve is therefore not confined solely to job-seekers registered with the public employment services.

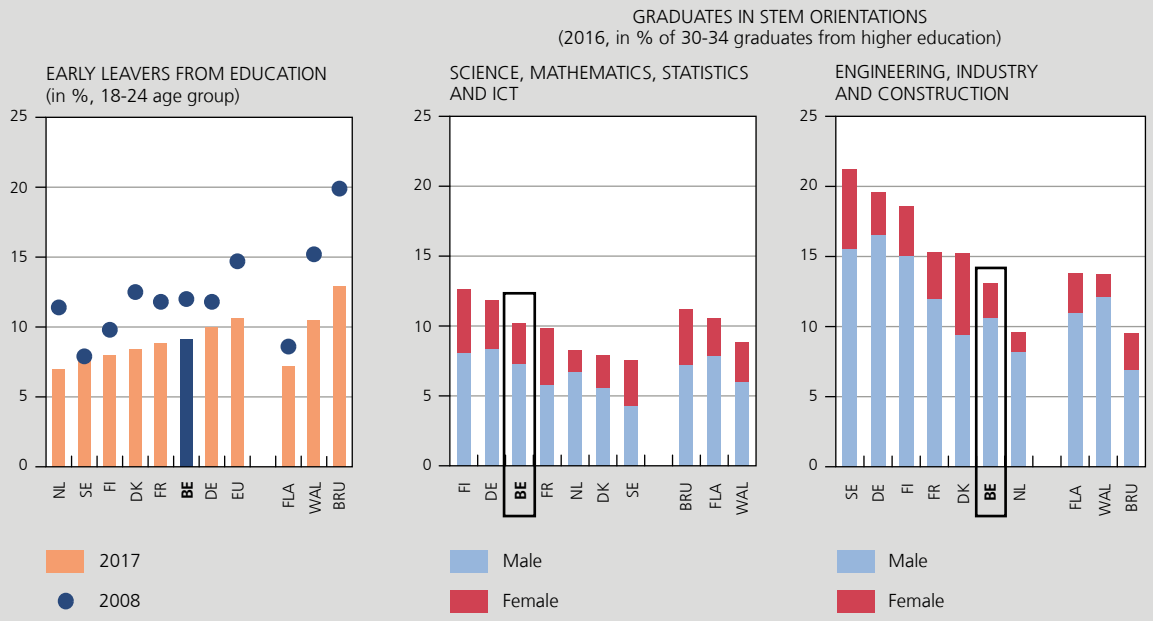
3. Factors influencing matching

3.1 Initial education and lifelong training

One source of the matching problems lies in the fact that the characteristics of the population in general – and job-seekers in particular – as regards education and skills do not meet the needs of firms. One of the key factors for improving the matching process therefore lies in the initial education and lifelong training of the population (in work, looking for work and inactive).

(1) See HCE (2018).

CHART 6 INITIAL EDUCATION



Source: Eurostat.

In this respect, Belgium presents a mixed picture. The drop-out rate, i.e. the proportion of young people in the 18-24 age group leaving the education system without obtaining any qualifications, has fallen sharply over the past ten years, but it nevertheless remains substantial, with almost 10 % of young people dropping out of education. Although the proportion of graduates (30-34 age group) is relatively high in Belgium (45.9 %), too few students choose higher education courses most closely linked to the needs of the labour market (sciences, ICT, engineering, etc.). Apart from these highly-skilled occupations, other types of training, such as vocational and technical courses, offer very attractive career opportunities. In the German-speaking Community, over 90 % of apprentices find a job within two months of completing their courses. In Flanders, only 10 % are still looking for a job after one year. In Wallonia, almost eight out of ten trainees have found a job within six months. However, students and their parents look down on these courses, which generally remain their second choice. Finally, apart from initial education, Belgium has one of the lowest levels of lifelong training in the EU (according to the labour force survey, the rate of participation in lifelong training over the past four weeks was 8.5 %, compared to 10.9 % in the EU). Moreover, training is rarely aimed at the workers who would benefit the most, such as the older age groups and the less-skilled. There is also a need to invest more heavily and more effectively in national language skills, in order to improve worker mobility, especially to enable job-seekers in Wallonia and Brussels to take jobs in Flanders. Finally, we would point out that digitalisation does not only affect the importance of the chosen courses. It also has an impact on the content of all occupations and makes it necessary to revise the school curriculum in order to include basic ICT and coding skills, but the priority is also teacher training, which is essential to pass on these new skills to their pupils.

The Communities have introduced various reforms to enhance the effectiveness and fairness of the education system. In the Flemish Community, the aim of the STEM action plan is to encourage young people to opt for the STEM subjects. In the French Community, the Excellence Pact stipulates that science and technology must be defined as one of the five areas of learning, in order to raise their visibility. In view of the cohort effects within the school population, it will be several years before the benefits of these reforms become apparent; moreover, they are only being gradually phased in. As regards worker training, the Law on "Feasible work, manageable work" has made it compulsory to provide an average five days' training a year per full-time equivalent in the private sector. At regional level, there are also many schemes available to support in-service training (training vouchers, paid study leave, integration/training plan, etc.). With the "jobs deal" unveiled this summer, the federal government aims to freeze the decrease in unemployment benefits

for unemployed people attending training in a shortage occupation. Wallonia has promised a financial incentive for the successful completion of such training. That Region has also undertaken to simplify the integration/training plan and to provide tailor-made training support for firms, subject to certain conditions.

3.2 Support for job-seekers

The speed and efficiency of matching also depend on the resources used to monitor and support job-seekers. That is particularly true in the case of the people farthest removed from the labour market, for whom the current strong growth of employment is an opportunity. Since the sixth State reform, the Regions have been responsible for this matter; they can therefore adapt their policies to their own specific situation. Despite some improvements, such as the establishment of closer monitoring of job-seekers, Belgium still devotes relatively more resources to passive policies[1] rather than to the active, personalised monitoring of job-seekers.

The success of the reforms adopted almost twenty years ago to encourage some of the inactive population to become active again[2] also depends on the ability of the public employment services to provide effective support for these job-seekers – who were previously exempted – in order to boost their rate of transition to employment, e.g. by offering jobs to the unemployed with adapted availability. This often concerns experienced, skilled workers who are unemployed and receiving a company supplement following restructuring. Encouraging them to return to employment would alleviate the shortage of skilled labour.

3.3 Mobility

Job mobility and switching from one socio-occupational status to another – i.e. the transition from one job to another or from unemployment or inactivity to employment – are less common in Belgium than in the neighbouring countries[3].

CHART 7 JOB SENIORITY AND DURATION OF UNEMPLOYMENT

(corresponding population in the 15-64 age group, 2017)

Source: Eurostat.

(1) Expenditure on (Belgian-style) "pre-pensions" is particularly heavy compared to other countries.

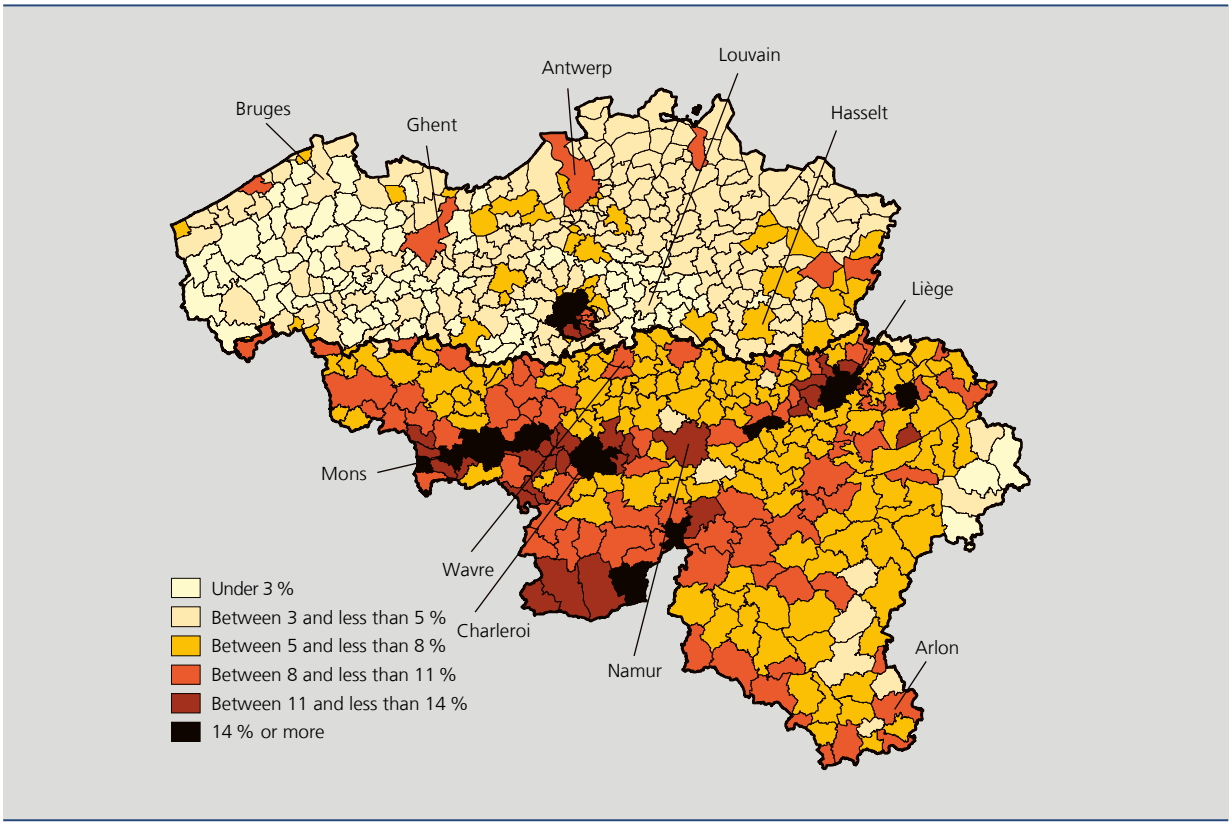
(2) This concerns in particular the termination of older unemployed person status and the introduction of tougher conditions governing end-of-career schemes. These measures resulted in large numbers of job-seekers exempt from seeking work being transferred to the non-exempt group (in some cases with adapted availability).

(3) See HCE (2018) and Saks (2016).

This low mobility is reflected in jobs generally being held for longer than in the comparison countries, but also in lengthier periods of unemployment. Job stability is obviously a positive aspect, but transitions (between jobs and into work) permitting a better allocation of resources should not be hampered by institutional or structural factors. The lack of mobility has various causes, such as a substantial replacement rate [1] in the event of unemployment for the low-skilled, a close correlation between wages and seniority, and a high level of employment protection (especially in the case of mass redundancies), a relatively high minimum wage for the lower-skilled, a heavy burden of taxes and parafiscal levies on wages, etc.

CHART 8 UNEMPLOYMENT RATES PER MUNICIPALITY

(in % of the labour force, 15-64 age group, 2016 [1])



Source : IWEPS.

(1) Latest available year at this level of detail.

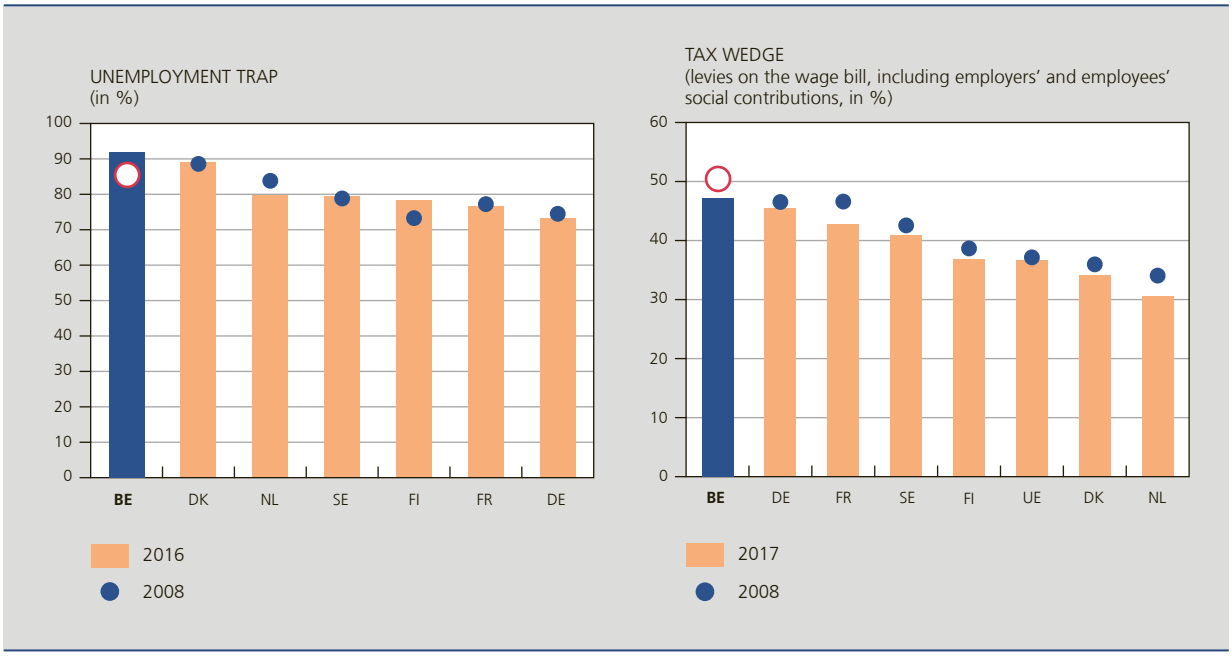
Geographical mobility between the Regions is also under-developed. While Flanders has a very low unemployment rate (4.4 % in 2017), the rates in the other two Regions are much higher (9.8 % in Wallonia and 15 % in Brussels) yet there is no mass inflow of workers from the latter two Regions into Flanders. The map showing unemployment rates per municipality clearly illustrates the geographical disparity of unemployment rates between the Regions, while those rates are fairly uniform within the Regions. The Wallonian municipalities along the border with Flanders perform better than those which are further away. The low geographical mobility of workers is due to a high commuting cost and the language barrier. The public employment services have set up exchange programmes to facilitate the flow of workers to areas where there are jobs, but so far the results have been meagre.

(1) Percentage of wages covered by unemployment benefits.

3.4 Financial incentives for working

CHART 9 FINANCIAL INCENTIVES FOR WORKING

(for a single person, with no children, paid 67 % of the average wage)



Source: EC.

Factors behind the lack of mobility include a lack of language skills, problems in combining work and family life (shortage of institutions caring for children and dependants, combined with the high price of these services), transport problems, but doubtless also a lack of financial incentives for working, especially in the case of people who can only aspire to a low wage. These unemployment traps are due to the tax system (both labour and property taxes), unemployment insurance, the wage policy, etc.

In Belgium, the unemployment traps are greater than in the comparison countries. Between 2008 and 2016, they increased in Belgium owing to the rise in unemployment benefits at the start of the benefit period, combined with more degressive benefit rates. This was once again the route taken by the federal government in its plan for jobs, in order to encourage unemployed persons to be quicker to accept a job and thus respond to the numerous vacancies which currently remain unfilled. This measure was intended to enhance the insurance aspect of unemployment at the start of the benefit period and increase the financial pressure for returning to work, though without guaranteeing an improved allocation of resources.

In regard to labour costs, in 2017, Belgium still had the second highest hourly labour cost in the EU, despite the recent wage moderation efforts. The tax wedge, which reflects the burden of taxation on labour costs, is greater than in the comparison countries, regardless of the income level considered, and despite the reforms already introduced to attenuate it (the tax shift), especially in the case of low pay.

Apart from the taxes and parafiscal levies on wages, the close correlation between wages and seniority may constrain the employment of older workers, whose productivity tends to level out at the end of their career. If the discrepancy between wage and productivity widens, the resulting increase in the relative cost of older workers therefore puts them in a vulnerable position on the labour market. Moreover, the rise in the reservation wage caused by this link may also exacerbate the difficulties encountered by people over 50 years of age in finding a job. In the agreement concluded this summer, the federal government called upon the social partners to link wages to skills and productivity rather than seniority.

As regards regional disparities, the wage-setting mechanism imposed at national level limits the scope for translating these differences into decentralised wage adjustments, which could encourage workers to increase their (geographical and job) mobility.

3.5 Labour force

In order to help to meet the unsatisfied demand for labour, it is necessary to boost the participation of the working age population (15-64 years) by mobilising not just job-seekers but also some of the inactive population, which comprises 2.3 million people, or one-third of the working age population. That is twice the figure in Sweden. On that basis, it seems that there is substantial scope to expand the potential labour force. Almost one in ten inactives actually state that they wish to work.

CHART 10 INACTIVITY: LEVEL AND REASONS

Source: Eurostat.

The reasons for not looking for a job vary greatly according to sex and age. For young people, the reason is almost always connected with education (92 %), which is a good thing if the chosen course meets the needs of the market. Older workers more frequently mention illness or invalidity (28 % of the 25-49 age group and 25 % of the 50-64 age group), some are retired (9 % aged 50-64), and others are discouraged (2 % aged 25-49 and 6 % aged 50-64). It is striking that the proportion of inactives not citing any of the suggested reasons (3 % aged 15-24, 10 % aged 25-49 and 35 % aged 50-64) is two to four times higher than in the other comparison countries. For women, from the age of 25 onwards, family responsibilities (care of children or dependants) are the main impediment to looking for a job (59 % of the 25-49 age group and 35 % of the 50-64 age group).

Conclusions

In Belgium, there are almost half a million unemployed job-seekers, and the unemployment rate is well above the frictional unemployment rate, which corresponds to a full employment situation. Nonetheless, the Belgian unemployment rate has fallen significantly for the third consecutive year, and has now reached a historically low level. Moreover, it has dropped below its structural level (NAIRU), implying the prospect of inflationary pressure. Up to now, however, wage inflation has been restrained by factors such as wage moderation and the constraints inherent in the wage-setting mechanism (implemented in order to restore firms' competitiveness). Although inflationary pressure has not yet materialised, there are nevertheless tensions on the labour market. Demand for labour shows no sign of slackening, and increasing numbers of employers report that they are encountering recruitment problems. This situation is more marked in Flanders, where activity is more dynamic and unemployment is considerably lower. In view of the number of job-seekers, the inability to fill vacancies may seem paradoxical. This contradiction is due to a combination of structural factors which need to be addressed in order to reduce the level of structural unemployment and, above all, to increase the employment rate.

Education is one of the main ways of achieving that, notably in order to match the labour supply more closely to demand for labour. We need to boost everyone's performance, to promote courses of study that lead to jobs without neglecting technical and vocational courses, to incorporate the ITC dimension in the content of all training courses, and to anticipate new types of job. Firms have a role to play here, in adjusting their staff training and management policies so as to optimise the skills of their workers and attract new talent. They could also rethink their recruitment policy, favouring potential rather than acquired skills. In many cases, the problems of matching the labour supply to demand stem from the working conditions offered, which the workers consider too unattractive (inconvenient hours, arduous work, etc. compared to the pay offered). Firms encountering recruitment difficulties do not adjust their employment conditions sufficiently to tempt candidates. That is one reason for the structural character of the shortage occupations. In addition, in some cases, there is too little financial incentive to find work, especially in the case of the low-paid. More generally, we need to introduce policies that encourage transition into employment (provision of sufficient, affordable personal support services, but also elimination of schemes that lead to inactivity, such as the one conferring older unemployed person status). Finally, mobility – which could at least partially resolve the regional disparities of the Belgian labour market – is hampered by the high cost of commuting between home and the workplace, and by the language barrier. Language learning and well-thought-out public transport infrastructures and policies could help to overcome these barriers. It should be remembered that the three Regions have very dissimilar labour markets, with different problems. The solutions must therefore be different while still being complementary at national level.

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Recent developments in the financial situation and the social data of non-financial corporations

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Ilse Rubbrecht

Introduction

Each year, in the December issue of the Economic Review, the Bank describes the developments reflected in the annual accounts of non-financial corporations. By the autumn, the Central Balance Sheet Office already has a representative sample of annual accounts for the previous year. The conclusions based on that sample can therefore be extrapolated to the population as a whole.

In financial 2016, Directive 2013/34/EU on financial statements as transposed into Belgian law came into force. These new provisions had a major bearing on the concepts of large and small undertakings within the meaning of the Company Code, while also introducing the concept of a micro-company. They have also changed the content of the annual financial accounts and the accounting treatment of certain items. In financial 2017, the new rules applied to all accounts filed, whereas in 2016 they had only applied to the financial year starting on or after 1 January 2016. In this article on the financial results of non-financial corporations, based on a sample of firms that filed annual accounts for 2016 and 2017, a distinction is made between large corporations and SMEs, using the following criteria: companies that have filed full-format accounts for both 2016 and 2017 are considered as large companies, while all others are included under SMEs. As a result, this latter category is more heterogeneous than the former, as it contains micro-companies, SMEs and a small number of companies classed as large under the size criteria in one of these two financial years.

The first section of this article briefly outlines the economic situation for non-financial corporations in 2017. As every year, the second section presents aggregate trends in the operating account. The third section assesses the financial situation of these firms on the basis of a range of relevant ratios. The fourth and last section highlights a few features of the workforce of non-financial corporations based on the social balance sheets that form part of the annual accounts.

The methodological aspects are dealt with in the annexes. Annex 1 describes the principles underpinning the selection of firms and the identification of populations for analysis, which are slightly different for financial results and social data. It also goes into the composition of the constant sample, needed to estimate the development of the key variables between 2016 and 2017. Annex 2 breaks down companies by branch of activity, while Annex 3 sets out the formulas for the financial ratios used in the third section of this article. Annex 4 has additional information about credit risk.

1. Economic situation in 2017

Economic activity picked up...

In 2017, GDP rose by 1.7 %, a minor acceleration in the pace of growth relative to 2016, which had come in at 1.5 %.

Higher expenditure was largely due to the 1.8 % uptick in investment in 2017, supported by continued historically low interest rates and a high rate of capacity utilisation in manufacturing. Impending local and provincial council elections also fed into local authority spending. Household investment in housing was stable, however, whereas private consumption growth slowed in 2017, to 1.1 % from 1.7 % in the previous year. Government consumption, by contrast, edged up by 0.6 % in 2017, compared with a decline of 0.2 % in 2016. Like the year before, international trade staged robust growth in 2017, with exports rising by 5 % and imports by 4.3 %.

Higher business volumes in the sectors were primarily underpinned by services, which saw growth accelerate to 2.2 % from the year-earlier 1.6 %. The expansion of activity was much less strong for industry in 2017; at 0.5 %, its pace was comparable to 2016. In construction, however, economic activity declined by 0.8 %.

... against a backdrop of rising production costs

Robust global demand and limitations on the supply of energy products conspired to push up energy commodity prices, which started their ascent in the second half of 2017 after over two years of stagnation. The price of Brent per barrel shot up by over 24 % on average compared with 2016. The industrial commodities index, which had been moving clearly upwards since the start of 2016, stabilised at a high level in the second half of 2017, working out at an average upturn of over 21 % between 2016 and 2017. As a result, the prices of consumables feeding into manufacturing processes also rose.

Unit labour costs in the private sector also went up (by 1.5 % in 2017). This compares with falls in the two previous years (of 1.5 % in 2015 and 0.1 % in 2016), themselves the result of the implementation of a series of wage moderation measures, such as the index jump of 2015 and several reductions in employers' social security contributions. The 2017 rise reflects a 1.4 % increase in hourly labour costs – itself largely the result of automatic index-linking (+1.6 %) – coupled with a 0.2 % drop in per-hour productivity.

Developments in the global commodities markets and the domestic labour market percolated through into production costs in Belgium, as shown by the change in industrial producer prices. These shot up by 8.5 % in 2017, with clearly steeper rises in sectors that most depend on imported oil products.

Bankruptcies up 8 % in 2017

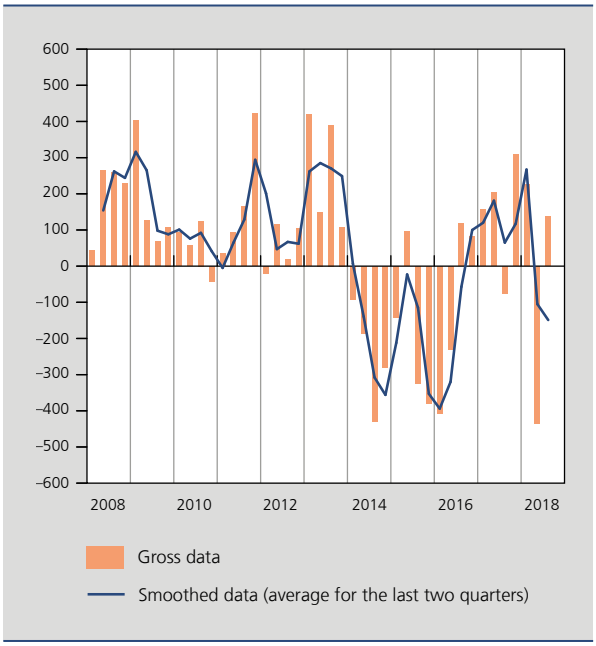
Despite quite favourable economic conditions, the number of bankruptcies – as reported to the Crossroads Bank for Enterprises by the commercial courts – (see chart 1), which had fallen for three years in a row since peaking in 2013, went back up in 2017 (+594 bankruptcies, 8 % more than in 2016). This has had a particularly hard impact on very small firms, i.e. those employing fewer than five people, which are typically the most vulnerable (+697 bankruptcies). By contrast, most other size categories recorded a decline.

Bankruptcies were up across all sectors, excluding agriculture and the production and distribution of energy, which recorded falls, and industry, where the number of bankruptcies was virtually unchanged. Hardest hit in 2017 were construction (+143 bankruptcies in twelve months, up 12 %), trade (+136 bankruptcies, up 7 %), real estate activities and business services (+125 bankruptcies, up 10 %), accommodation and food service activities (+117 bankruptcies, up 8 %) and transportation, storage and communications (+91 bankruptcies, up 15 %).

Remarkably, it is mostly companies in Wallonia and Brussels that account for the increase in business failures, with the impact particularly marked in the Brussels Region, which saw 687 businesses go under, an increase of 37 %. The March 2016 terrorist attacks and various urban development issues are often cited as being behind these business failures in Brussels. The rise in bankruptcies was a lot more subdued in Wallonia (+88, up +5 %). In Flanders, the number of bankruptcies, which had edged up by 40 in 2016, went down by 181 in 2017.

CHART 1 BUSINESS BANKRUPTCIES[1] IN BELGIUM

(numbers, changes compared with the corresponding quarter of the previous year)



Source: FPS Economy, SMEs, Self-employed and Energy.

(1) Bankruptcies of self-employed workers are typically ignored.

2. Aggregate trends in the operating account

The trends for the 2017 financial year as set out in this section reflect the change in data of non-financial corporations that – both for the 2016 and 2017 financial years – filed annual accounts that met the quality checks introduced by NBB's Central Balance Sheet Office in mid-September[1]. This data, then, refers to a constant population and does not include information about firms that filed annual accounts only for 2016 or for 2017. The first group includes companies that went bankrupt, for instance, or that ceased to exist due to takeovers or demergers. The second group comprises newly established companies, including those resulting from mergers or demergers of existing companies. This implies that 2017 developments as seen for the total population of companies – when these become available at the beginning of 2019 – may diverge from the provisional outcomes described below. That said, the representativeness of the constant population, whose 2016 value added accounted for 80 % of that for the total population, is more than adequate to assume that the differences will remain limited.

Value added at current prices rose by 3 % in 2017...

In the non-financial corporations of the constant population, value added at current prices – i.e. the difference between sales revenues and the cost of goods and services provided by third parties – increased by 3 % between 2016 and 2017, a rate of growth below that of the previous two years for the total population (see table 1).

At 3.2 %, SMEs recorded a slightly higher figure than large companies (3 %), with the latter group generating nearly three-fourths of total value added. Judging by the rather more detailed profit and loss accounts filed by large firms, sales revenues added 5.8 %. However, the costs of goods in trade, raw materials and consumables – which account for two-thirds of the sales amount – grew by 6.8 % in the same period, fuelled by rising commodity prices. This eroded value added, even if spending for the purchase of services and various goods rose less rapidly than sales revenues.

(1) For more information about the methodology used to select companies, see Annex 1.

TABLE 1 DEVELOPMENTS IN THE MAIN AGGREGATES OF THE OPERATING ACCOUNT

(in %, unless otherwise stated)

	Percentage changes compared with the previous year						€ million	Percentages of value added
	2012	2013	2014	2015	2016	2017 e	2017 e	2017 e
Value added (current prices)	**1.3**	**1.0**	**1.8**	**3.8**	**5.7**	**3.0**	**190 280**	**100.0**
Staff costs (–)	3.0	1.5	1.2	1.4	1.7	3.9	103 194	54.2
Depreciation and write-downs [1] (–)	3.9	1.7	2.2	1.5	16.7	2.4	38 371	20.2
Other operating expenses [2] (–)	3.7	0.0	–4.2	8.0	16.9	0.0	12 059	6.3
Net operating result	**–6.8**	**–1.2**	**5.4**	**12.3**	**3.5**	**2.4**	**36 656**	**19.3**

Source : NBB.

(1) On tangible and intangible fixed assets and on start-up costs (item 630).

(2) Mainly operating taxes and charges.

... but sectors differ widely

As table 2 shows, industry's value added, which generally accounts for nearly 30 % of total value added, only grew by 2 % in 2017, a figure that largely reflects negative value added trends in pharmaceuticals (–8.2 %). In turn, developments in this highly consolidated sector are determined by the dominant player. Sales revenues reported by this company, which primarily sells to other firms in the same group, rose by 45 % between 2016 and 2017, while the costs of goods in trade, raw materials and consumables and those for services and various goods doubled, pushing down value added by nearly 25 %. Other players in the pharmaceuticals sector, by contrast, reported an upturn of 8.7 %. Ignoring pharmaceuticals, industry notched up value added growth of 4 % in 2017 – roughly the same as services – and a sizeable improvement on the subdued (below 1 %) growth recorded in 2016. Available data for large industrial firms reveal a 9.8 % jump in sales revenues between 2016 and 2017. At the same time, the costs of goods in trade, raw materials and consumables and those for services and various goods shot up by a total 11.9 %. Even ignoring pharmaceuticals, higher costs (9.7 %) continued to outstrip the increase in sales revenues (8.6 %). Numerous companies were hit hard by rising prices of energy and industrial commodities.

Consolidation level is also extraordinarily high (at 61 %) in the energy, water supply and waste sector (simplified to "energy" for the purposes of this article). The sector's drop in value added of over 9 % chiefly relates to lower activity at the country's key company in the energy sector, which at the same time suffered from the reduced available capacity of Belgium's nuclear power plants – pushing down volumes sold – and from declining sales prices. In addition, one of its subsidiaries, which specialises in optimising assets, also reported lower value added.

Construction shows the lowest consolidation level of all sectors, with the ten largest building companies representing a mere 7 % of the sector's total value added, and SMEs generating over half. In fact, SMEs were the biggest contributors to the value added growth – of 1.6 % – in 2017 : large firms saw their value added inch up by as little as 0.9 %, while the figure worked out at 2.2 % for SMEs. Sales at the large firms were up by 6.3 %, but costs rose even more.

Services contributed most to the increase in the overall value added, coming in at 4.2 % – lower than the 6 % recorded in 2016 but still well ahead of the four previous years. At over 5 % growth, business services and wholesale trade further bolstered their leadership position in value added creation. That said, the determinants of growth looked to be different for these two groups of companies, as evidenced by the full-format data collected. In wholesale trade, sales barely moved but value added still improved on the back of lower costs, which account for 90 % of sales. By contrast, business services saw both sales and costs grow significantly and virtually simultaneously, but the lower cost weighting of 53 % helped value added grow by over 6 %.

TABLE 2 CHANGE IN VALUE ADDED

(in %)

	Change between 2016 and 2017				*p.m. Share of the corresponding value added, in 2016*		Consolidation level[1] in 2016
	Constant population companies	Of which: Large companies			*Total population companies*	*Of which: Large companies*	
	Value added	Value added	Sales	Costs[2]			
Industry	**2.0**	**1.9**	**9.8**	**11.9**	***29.6***	***36.3***	**25**
of which:							
Food industry	0.3	0.0	4.8	5.8	*4.5*	*5.4*	24
Chemicals	6.6	6.6	8.2	8.8	*4.3*	*5.7*	38
Pharmaceuticals	–8.2	–8.3	20.6	39.8	*4.8*	*6.5*	96
Metallurgy	8.9	10.2	15.5	16.9	*3.6*	*3.9*	40
Metal manufactures	5.2	5.2	2.2	1.3	*4.7*	*5.9*	34
Energy, water and waste	**–9.2**	**–11.4**	**1.9**	**4.0**	***2.2***	***2.6***	**61**
Construction	**1.6**	**0.9**	**6.3**	**7.9**	***7.7***	***4.8***	**7**
Services	**4.2**	**4.5**	**3.8**	**3.7**	***60.6***	***56.2***	**11**
of which:							
Trade in motor vehicles	6.9	8.6	11.3	11.5	*3.1*	*3.0*	29
Wholesale trade[3]	5.1	5.6	0.4	–0.2	*13.7*	*15.0*	20
Retail trade[3]	–0.3	0.2	2.0	2.3	*6.7*	*5.6*	26
Transportation and storage	1.6	1.2	12.1	16.5	*6.4*	*6.6*	25
Accommodation and food service activities	3.1	0.0	0.4	0.6	*2.2*	*0.9*	13
Information and communication	3.7	3.2	1.1	–0.3	*6.9*	*7.7*	42
Real estate activities	3.9	3.8	2.2	0.1	*2.9*	*1.4*	10
Business services[4]	5.6	6.2	6.5	6.7	*17.0*	*15.0*	17

Source: NBB.

(1) Ten largest companies' share of the value added recorded by the corresponding branch of activity.

(2) Costs for goods in trade, raw materials and consumables and those for the purchase of services and various goods.

(3) Excluding trade in motor vehicles.

(4) Excluding head office activities (NACE-BEL 70 100).

As operating expenses rose faster than value added, net operating result grew by only 2.4 %

The value added that a business generates enables it to cover its operating expenses and make an operating profit on the excess.

Staff costs – which represent the major part of operating expenses – 53.8 % of value added in 2016 – increased by 3.9 % in 2017 relative to 2016 (see table 1), i.e. more than value added. The relative share of these costs in the total was consequently a bit higher, at 54.2 %. Higher staff costs were due both to the expansion of employment, up by 1.8 % in full-time equivalents (as it had been in 2016), and to higher hourly labour costs in the private sector which had virtually stabilised in 2015 and in 2016 even slightly declined as a result of the wage moderation policy in place at the time. These measures' moderating effect gradually wore off and hourly labour costs grew by 1.4 % in 2017.

After staff costs, the main operating expenses are depreciation and write-downs on tangible and intangible fixed assets and on start-up costs. Both in 2016 and in 2017, these costs accounted for a little over 20 % of the value added. Having peaked at 16.7 % in 2016, the pace of growth returned to levels typical of the preceding years as 2017 progressed. The 2016 development was barely relevant, as it primarily reflected the way research costs were recognised. Since 2016, these costs are no longer capitalised and must be taken in full to the financial year in which they are occurred, whereas companies used to be able to write them down over a period of three years. The change's one-off impact was only limited in 2017 and the "depreciation and write-down" item fell to a more subdued level in 2017, at 2.4 %.

Remaining operating expenses (mainly operating taxes and charges), the outstanding amount for which represents around 6 % of value added, were unchanged from 2016 to 2017.

Total operating expenses were up by 3.2 % and grew more rapidly than value added, impacting the net operating result, where the increase was limited to 2.4 %. The growth in services was more pronounced at an average 5.2 %. Key contributors here were wholesale trade – which saw the net operating result rise by 14 % – and business services, which notched up an increase of nearly 11 %.

Net operating result reflects recurring results deriving from a company's normal business operations and does not include non-recurring (or exceptional) results, as these items and the amounts they involve are difficult to extrapolate due to unpredictability. Since 2016, companies have to break down their exceptional revenues and costs between operational and financial activities. Based on the data derived from the constant population, the balance of exceptional revenues and costs generated by operational activities in 2017 turned out to be so small as to be negligible, as was the case in 2016. The exceptional component of operational activities had only a limited effect on the change in aggregate net operating result.

3. Trends in the financial situation of companies

The financial analysis which follows is based on a theoretical interpretation of the annual accounts that uses a number of ratios derived from these. The latter are defined in detail in Annex 3. The ratios are presented mainly in the form of globalisations and medians. The aim of using these two distinct concepts is to arrive at a complementary analysis. With globalised ratios influenced by outliers, median values are important to counter them. However, globalised averages tend to paint a picture from macroeconomic and mesoeconomic perspectives, whereas medians reflect microeconomic conditions.

3.1 Profitability

In this sub-section, profitability is studied in relation to sales, to equity and total assets, and to operating assets.

3.1.1 Sales and investment margins

The return on sales is traditionally measured by the net margin on sales. This provides an indication of a firm's ability to make a profit on its sales proceeds after deducting all operating costs, excluding financial and exceptional items and taxes.

With the change in the accounting rules[(1)] for the amortisation of research expenditure, any growth in the net operating result may be distorted for 2016 and to a lesser degree for 2017, and so it may be useful to also plot the gross indicator as well, which shows the operating profit before non-cash expenses.

Margins on sales down in 2017...

Small and medium-sized enterprises' gross and net sales margins were wider across the review period than they were for large companies. That said, chart 2 only features SMEs whose data allow for sales margins to be calculated, and that is only possible if they report their turnover in their annual accounts. The micro and abbreviated formats do not actually

(1) New research costs – i.e. those incurred after 31 December 2015 – can no longer be capitalised but must be amortised in full. This impacts the operational costs of an entity in the financial year of first application of the new rules, depending on when financial 2016 started. Development costs can still be capitalised and written off over the life of the intangible fixed asset created, up to a maximum of ten years.

have turnover as a compulsory field to complete and ever fewer SMEs report their revenues from sales, which might well distort the sales margin levels for SMEs. Whereas 30 % of SMEs voluntarily reported their sales turnover in their annual accounts for 2003-2004, this proportion has dipped to 8 % in recent financial years.

Irrespective of company size, gross and net sales margins are showing identical trends, with the exception of the 2016 financial year, as the change in the accounting treatment of research expenditure after 31 December 2015 turned out to have had a significant impact on 2016 annual accounts in particular.

CHART 2 NET AND GROSS SALES MARGINS BY COMPANY SIZE
(in %)

Source : NBB.

... as a result of rising raw materials and consumables prices and steeper hourly labour costs

Estimates for 2017 are suggesting declines in both gross and net sales margins, irrespective of company size. An important explanation already put forward is that the purchase costs of commodities, raw materials and consumables have been growing more rapidly than revenues, and particularly oil and gas products. The second explanation is the 1.4 % rise in hourly labour costs in the private sector in 2017 (compared with a 0.2 % drop in 2016).

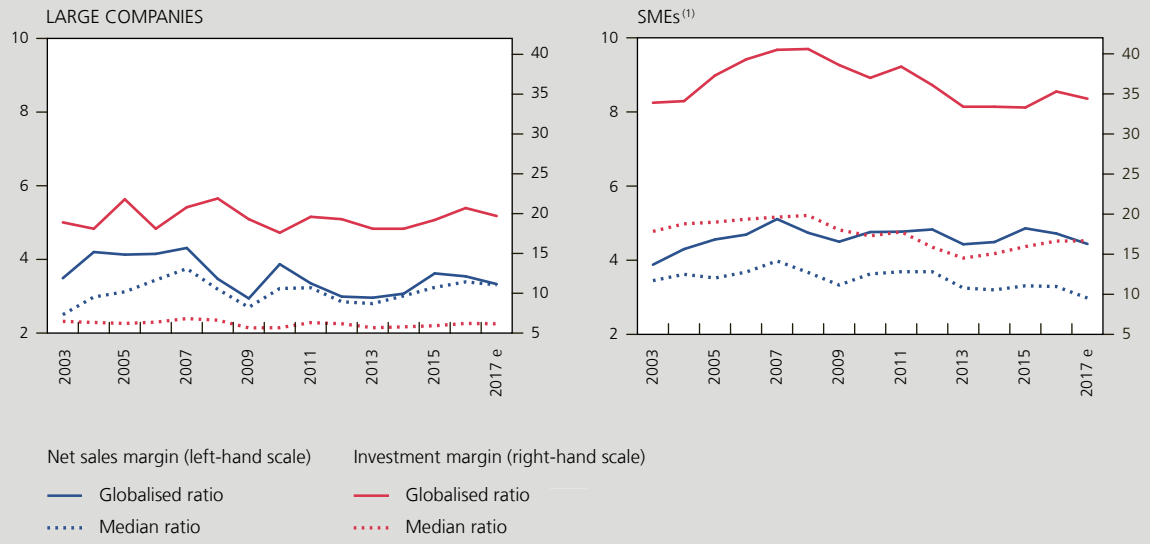
Sales margin fluctuations also affect the way investment margins move – albeit after some delay

Higher profitability makes it easier for companies to build their own resources or to gain easier access to external funding towards their new investment plans from banks among other players. Chart 3 shows how the trend in globalised investment margins is influenced by movements in the globalised net sales margin, after a one-year delay. The investment margin[(1)] is defined as the relationship between tangible fixed asset purchases and gross value added.

(1) The investment margin can be calculated for all SMEs but net sales margins cannot, as only 8 % of the SMEs have reported their turnover figures in their annual accounts in the past few financial years.

CHART 3 NET SALES AND INVESTMENT MARGINS BY COMPANY SIZE

(in %)



Source: NBB.

(1) Some caution should be observed when interpreting the figures for SMEs: the calculations of investment margins relate to every SME, but the calculations of net sales margins relate only to those reporting their turnover figures in their annual accounts. That said, a graphic representation remains relevant as these are ratios and not absolute values.

Since 2013, both median values and globalised values have shown a slow recovery in the investment rate, at levels still below those recorded before the financial crisis, particularly for SMEs. Estimated globalised investment margins point to a decline in 2017, irrespective of company size and despite still low interest rates charged by Belgian banks on new business loans. This may be due to less confidence in the economy, as shown up in 2017 economic indicators.

In 2017, median value levels remained stable at both large companies and SMEs. This suggests that, in every company size category, firms with a larger value added invest relatively less in tangible fixed assets than do firms with a smaller value added.

3.1.2 Economic and financial profitability

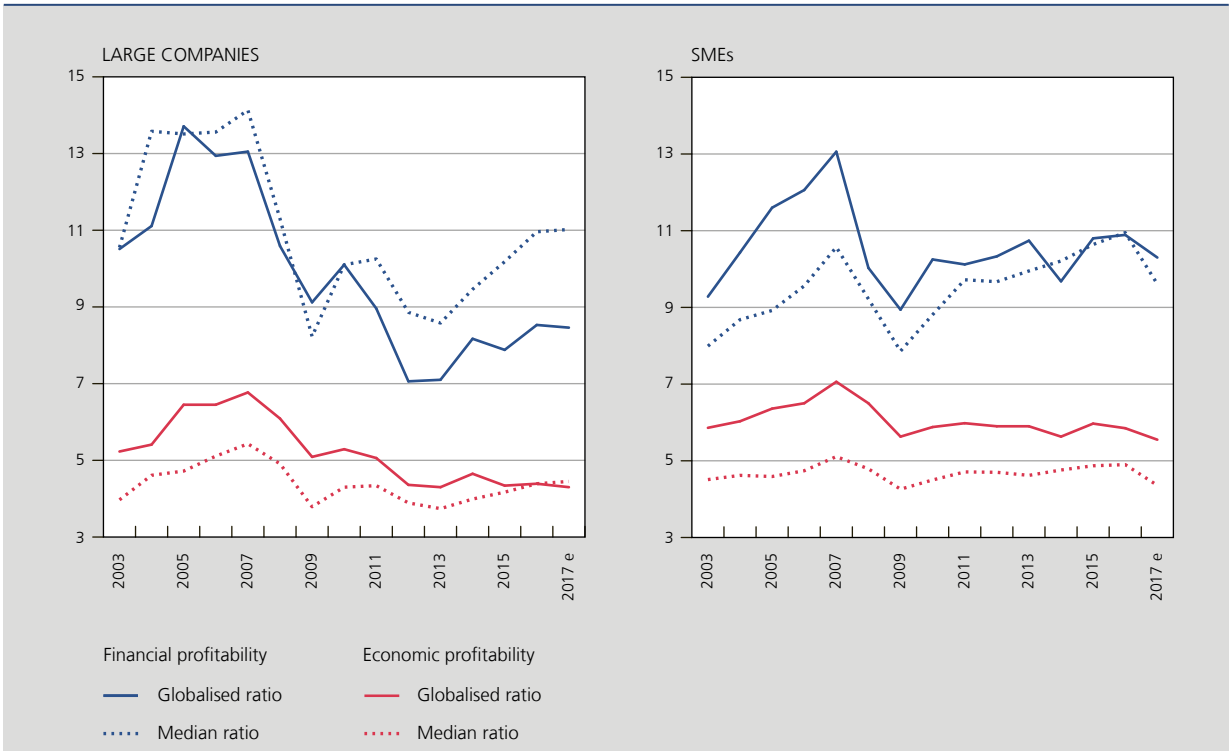
The economic profitability, which measures the net result before tax and financing costs in relation to total assets, serves as an indicator of the economic health of a company, regardless of the way its operations are financed. The financial profitability, by contrast, does factor in the funding method and reflects net profit before tax relative to total equity. In other words, this ratio captures the return that shareholders stand to earn from a company's ongoing activities. Both ratios are calculated before tax and exclude exceptional results to allow for comparison (1).

The globalised and median values of the economic profitability show significant falls at the time of the 2008-2009 financial crisis at both SMEs and large firms. In the post-crisis years, SMEs saw their economic returns hold fairly steady and recorded an estimated globalised ratio of 5.5 % in 2017. SMEs in Belgium are strongly represented in business services, i.e. in activities that are less sensitive to economic downturns. The globalised economic profitability of large companies, by contrast, tends to move more up and down with movements in domestic and global economies and with commodity price swings. Estimated globalised ratios for this group fell to the same level as in 2013 (4.3 %). That said, the median scores for large companies have been recording a steady recovery in the economic profitability since 2013.

(1) Exceptional results are purposely left out, as these are one-off items and this analysis focuses on net results for ordinary business activities.

CHART 4 ECONOMIC AND FINANCIAL PROFITABILITY BY COMPANY SIZE

(in %)



Source : NBB.

In 2017, financial profitability for SMEs shrank, while remaining stable for large companies

Chart 4 shows financial profitability exceeding economic profitability in the period under review, indicating that companies, regardless of their size, are able to contract debt at interest rates [1] below their economic profitability.

SMEs' globalised financial profitability slowly recovered after 2009 on the back of their relatively constant economic profitability coupled with the lower cost for fresh bank loans they were able to take out after 2009 (right-hand panel of chart 9). Projections for both the globalised and the median values in 2017 see financial returns weakening to 10.3 % and 9.6 % respectively. This downward movement was visible in virtually all SME activity.

In contrast, globalised financial profitability recorded by large companies kept falling year on year post-financial crisis until touching a nadir in 2013. By then their globalised ratio was well below that of the median entity, implying that large companies with a sizeable equity position were recording relatively lower financial returns than large companies with less weight in equity. After that, globalised ratios gradually improved before stabilising in 2017.

Although large companies have seen their globalised financial profitability dip below that for SMEs in the past few years, their stocks still lock in higher returns than Belgian government bonds

Investors typically want to know whether equities will generate higher returns than risk-free investment such as government bonds. Chart 5 compares large companies' globalised return on equity after tax [2] (a version of financial

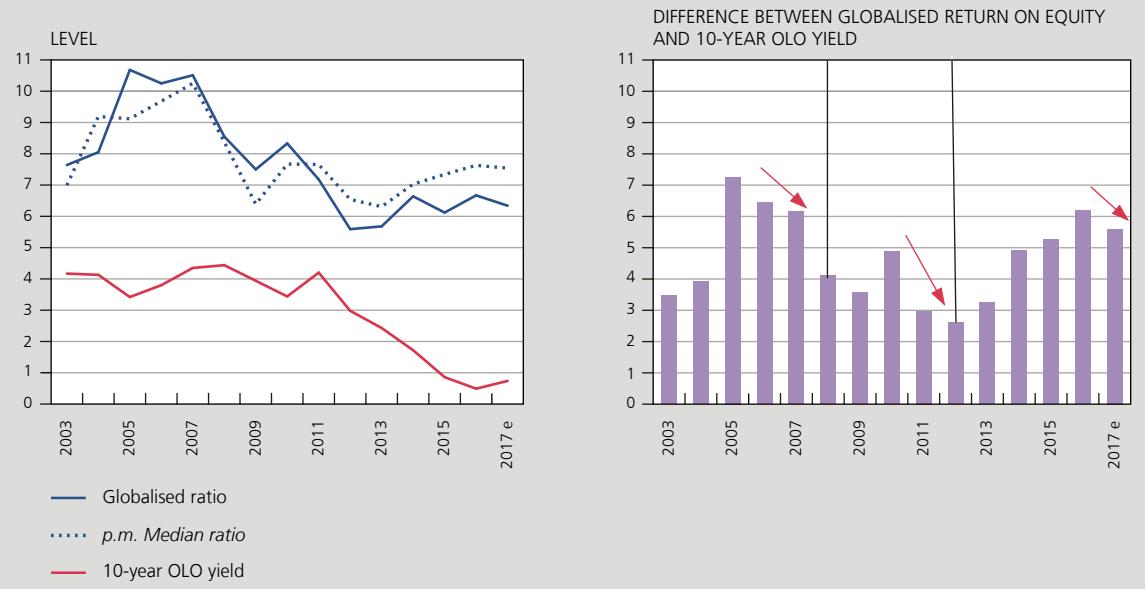
(1) This does not just involve the interest charges on bank loans and bonds, but also the cost of any intra-group debt and discount rates paid by the company when trading receivables as in factoring.

(2) In other words, earnings after interest and tax on equity, excluding exceptional items.

profitability) with ten-year yields on Belgian government bonds. The difference between these two ratios gives a first indication of the size of the risk premiums large firms' shareholders can expect to receive. Investors need to tread carefully when interpreting the outcomes, as quite a few large companies have no listings. That said, Belgian bond yields have been declining more steeply than the net return on equity of large companies over the past few years, making investing in stocks more attractive. However, in 2017, ten-year linear bonds (OLOs) recorded their first yield rise in six years and, coupled with a fall in the 2017 estimated globalised net return on equity after tax, this saw risk premiums narrow. Financial analysts are keeping a beady eye on these latest developments, as similar movements occurred in both 2008 and 2012.

CHART 5 NET RETURN ON EQUITY AFTER TAX COMPARED TO THE YIELD ON BELGIAN GOVERNMENT BONDS

(in %, large companies)



Source : NBB.

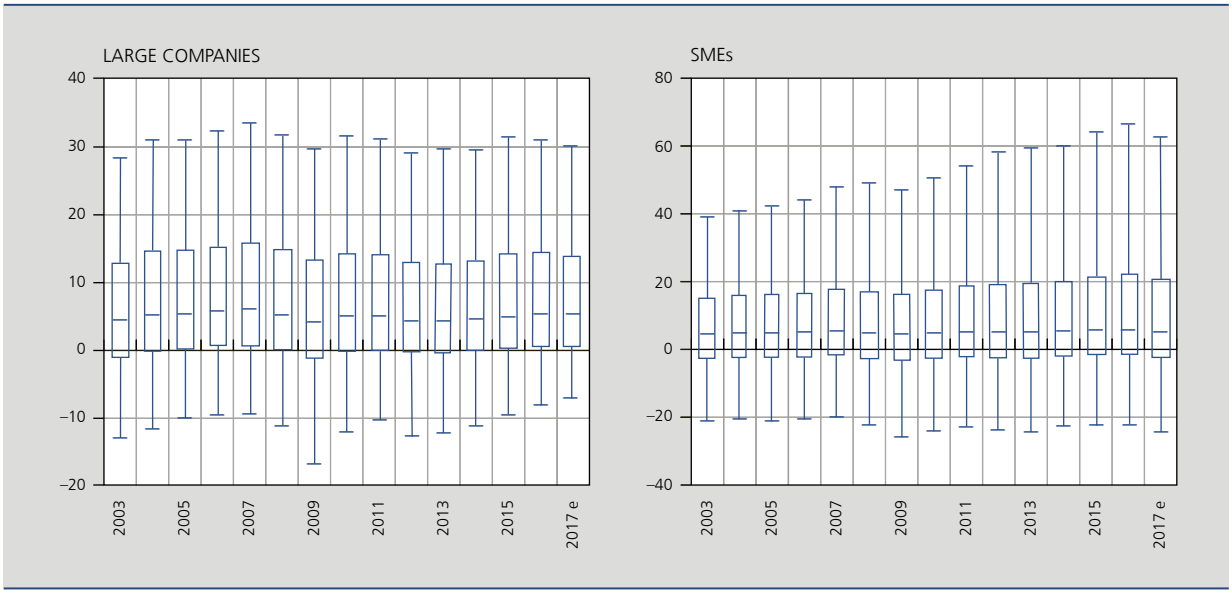
3.1.3 Net return on operating assets

In addition to the return on total assets (defined as economic profitability above) another interesting measure is the return on operating assets, which reflects the relationship between net operating result and operating assets[(1)]. This ratio expresses a company's commercial performance in relation to the balance sheet items directly allocated to operating activities and is an indicator of the efficiency of the production processes of firms active in various sectors, whose sizes and asset structures may differ significantly.

Chart 6 shows the breakdown of net returns on operating assets. Over the past 15 years, both the most profitable (9th decile) and the least profitable (1st decile) of large companies were largely influenced by the economic cycle. The favourable economic environment between 2003 and 2007 coincided with an upward movement across the entire distribution, particularly at large companies. The financial crisis of 2008-2009 saw a reversal in fortunes, followed by a tentative recovery across the full spectrum after 2013, particularly at the least profitable of large firms, narrowing the spread between them.

(1) Operating assets are the sum of the non-financial fixed assets, inventories, receivables within one year and deferrals and accruals. Unlisted items on the assets side of the balance sheet (financial fixed assets, receivables after one year, term deposits and cash & cash equivalents) do not feature in the ratio's denominator, as these are considered as types of financial asset.

CHART 6 NET RETURN ON OPERATING ASSETS: DISTRIBUTION OF OBSERVATIONS, BY COMPANY SIZE[1]
(in %)



Source: NBB.

(1) The box plot should be read as follows: the lower and upper edges of the box correspond respectively to the 1st and 3rd quartiles. The line inside the box represents the median. The ends of the lower and upper whiskers correspond respectively to the 1st and 9th deciles.

The widening distribution for SMEs implies that movements in the median and the first quartile have limited visibility. That said, the most profitable SMEs are tracking a clear course, with the net return on their operating assets moving mostly upward in the past 15 years, with a slight downward turn in the projections for 2017. The most profitable SMEs mainly operate in business services, as these involve fewer operating assets. The least profitable SMEs, particularly in the real estate sector, fluctuate more with times of economic down cycles (2008-2009 and 2012-2013), as reflected in the net return ratio.

3.2 Solvency

The key purpose of solvency ratios is to measure the ability of firms to meet their financial commitments, i.e. to pay their interest charges and debt.

3.2.1 Degree of financial independence

The best-known measurement of solvency is the degree of financial independence, i.e. the ratio between equity and total liabilities. The greater the financial independence, the smaller the company's debt position and the bigger its equity-based buffer to repay its creditors. In other words, the degree of financial independence measures the robustness of a company's capital structure.

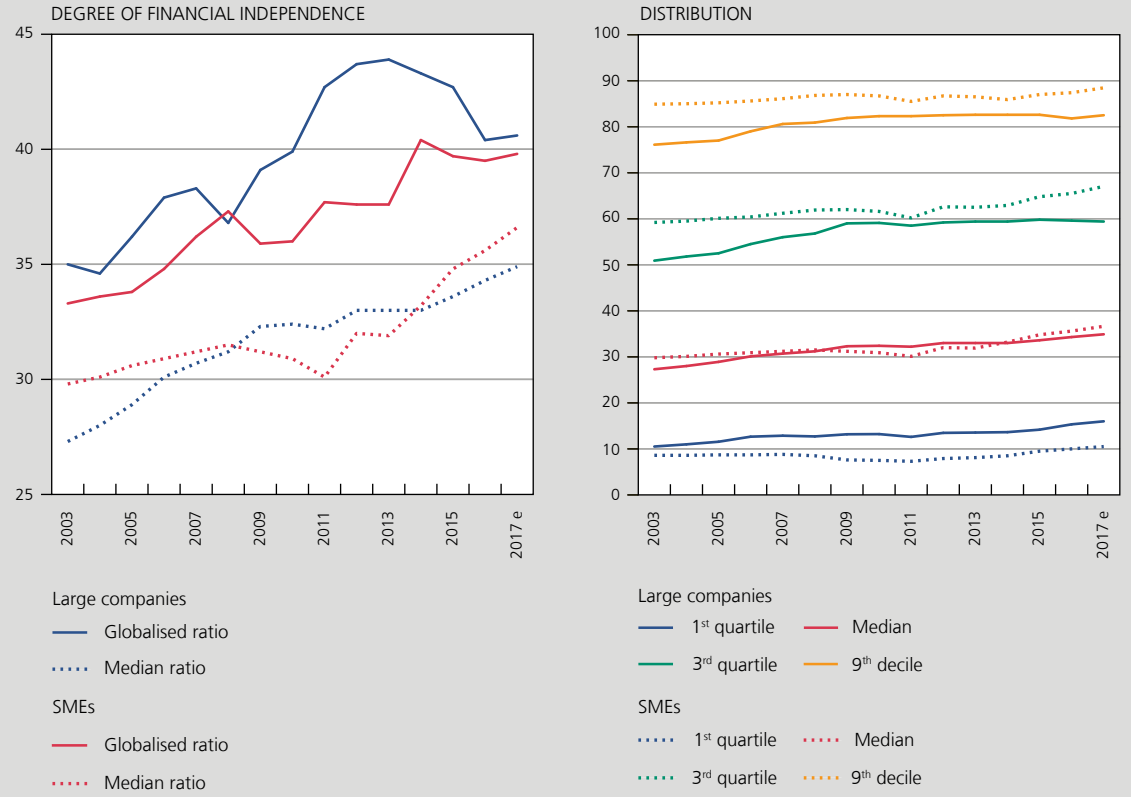
An alternative way of measuring solvency is via the degree of self-financing. This ratio differs from the degree of financial independence as its numerator comprises the reserves and results carried forward. It reveals more about cumulative profitability for the past and current financial year, while it is also an indicator of a company's dividend and reserves policies.

The median values for SMEs solvency ratios point to a significant improvement in recent years...

Chart 7 reveals a steep improvement in the degree of financial independence in the past 15 years, for both SMEs and large companies. A key factor was the introduction of the tax allowance for risk capital in 2006 ("notional interest")

CHART 7 DEGREE OF FINANCIAL INDEPENDENCE BY COMPANY SIZE

(in %)



Source : NBB.

that saw particularly larger corporations attract a major inflow of foreign capital to Belgium. In recent years, however, this impact was dulled by an annually declining rate of notional interest (see table 3), in the wake of lower ten-year OLO yields and additional restrictions imposed to make the interest deduction less attractive[1]. Large companies' globalised degree of financial independence has been coming down since 2014, triggered by significant reductions in capital. Recent years have seen SMEs' globalised ratio match the level for large companies, with their median ratio even exceeding that for large companies. The right-hand part of chart 7 shows how the top half of the distribution is higher for SMEs than for large companies even if the median values of the degree of financial independence are virtually similar. This implies that very many SMEs finance a significant proportion of their total balance sheet from their own resources. In 2017, the estimated globalised average of the degree of financial independence was virtually stable for both small and large firms, at 40.6 % and 39.8 % respectively.

(1) It has been impossible since 2013 to carry forward tax deductions from one assessment year to the next. In addition, the basis for national interest calculation changed with effect from the 2019 assessment year (Article 537 of the Income Tax Code). The deduction no longer applies to the total amount of adjusted equity but to the accrual of adjusted equity.

TABLE 3 NOTIONAL INTEREST DEDUCTION: RATES

(in %)

Tax year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Basic rate	4.473	3.800	3.425	3.000	2.742	2.630	1.630	1.131	0.237
Increased rate for SMEs	4.973	4.300	3.925	3.500	3.242	3.130	2.130	1.631	0.737

Source: FPS Economy, SMEs, Self-employed and Energy.

... partly reflecting the change in tax treatment of liquidation surpluses and the new system of liquidation reserves

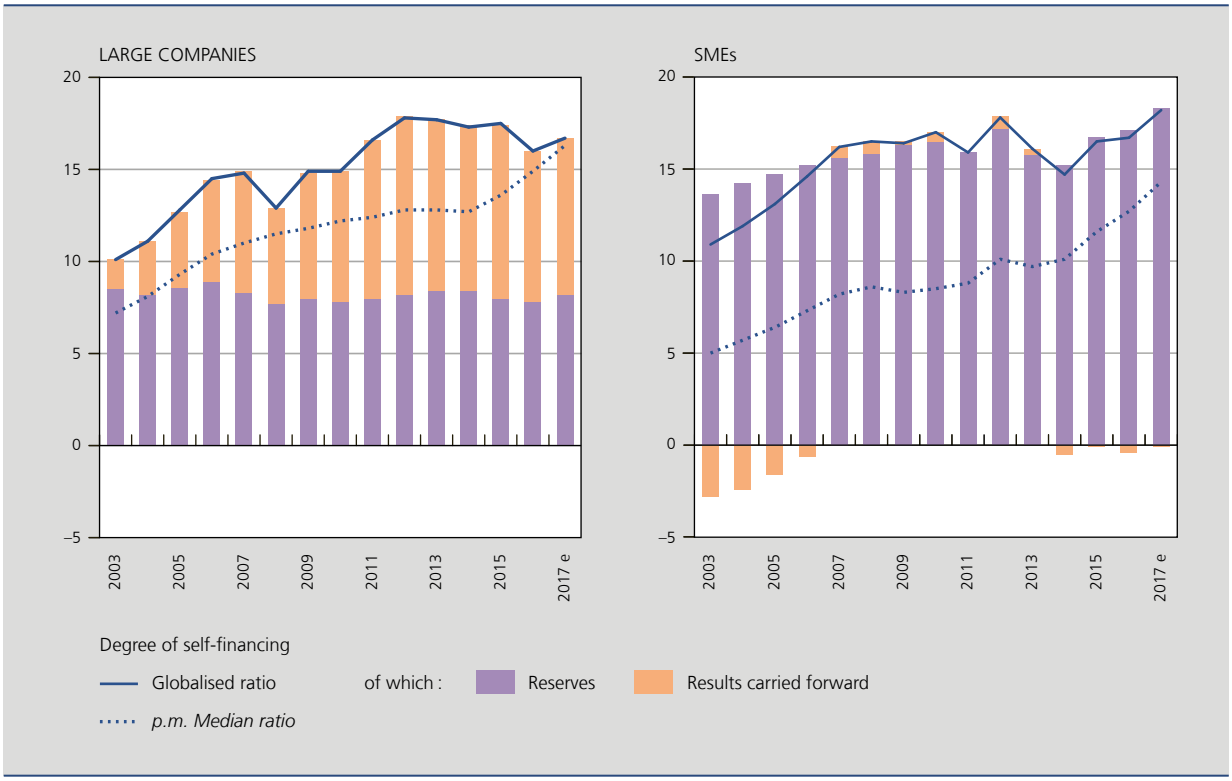
The impact of the changes in the tax treatment of liquidation surpluses is primarily visible for SMEs (chart 8). These surpluses[1] are regarded as dividends and are therefore subject to withholding tax. The tax rate applicable here used to be 10 %, but was raised to 25 % in October 2014, then to 27 % in January 2016 and 30 % in January 2017.

To head off a wave of liquidations of active companies, in November 2013, the then Finance Minister Koen Geens implemented a transitional arrangement in Article 537 of the 1992 Income Tax Code, allowing a company to pay out a

(1) It should be recalled that the liquidation surplus corresponds to the capital a disbanded company allocates to its shareholders on top of the repaid tax-free paid-up capital.

CHART 8 DEGREE OF SELF-FINANCING, BY COMPANY SIZE: LEVEL AND COMPOSITION OF THE GLOBALISED RATIO

(in % of the balance sheet total)



Source: NBB.

proportion of its taxed reserves, as approved by its annual general meeting by 31 March 2013, at the still reduced rate of 10 %, on condition that the amount so paid was immediately incorporated into the company's capital and was kept there for a specific period of time (1). The dividend payment and the simultaneous capital increase under this measure had to be recognised in the last taxable year that ended before 1 October 2014. Quite a few SMEs opted for this treatment and the 2013-2014 period saw an accounting shift at SMEs from reserves to capital. As a result, their globalised degree of self-financing declined in the same period (chart 8).

The proportion of reserves in the degree of self-financing at SMEs has been back on the up since 2015, as numerous SMEs apply the new system of liquidation reserve (2).

From the end of 2017 – i.e. four years after allocating the reserves to their capital – SMEs will be able to reduce their capital by the amount of any dividend paid under the transitional arrangement in Article 537 of the 1992 Income Tax Code. The effect this will have on the globalised degree of SMEs' financial independence are not reflected in the projected figures for 2017 in chart 7. The box below describes the capital reductions in greater detail.

(1) The minimum period the incorporated capital should be held to be paid out free of tax is four years for SMEs and eight for large companies, counting from the date it was contributed.

(2) It should also be recalled that SMEs, instead of paying out earnings to shareholders, can opt to transfer to a special reserve any accounting profits generated in financial 2014 or beyond. This liquidation reserve is subject to an immediate tax levy of 10 %, but no withholding tax will be due at a later liquidation, provided that these reserved earnings are retained in the company until the time of such liquidation. If the reserve is paid out before liquidation, as dividends for instance, a withholding tax of 5 % will be due if the liquidation reserve is retained in the business for five years, or of 17 % otherwise.

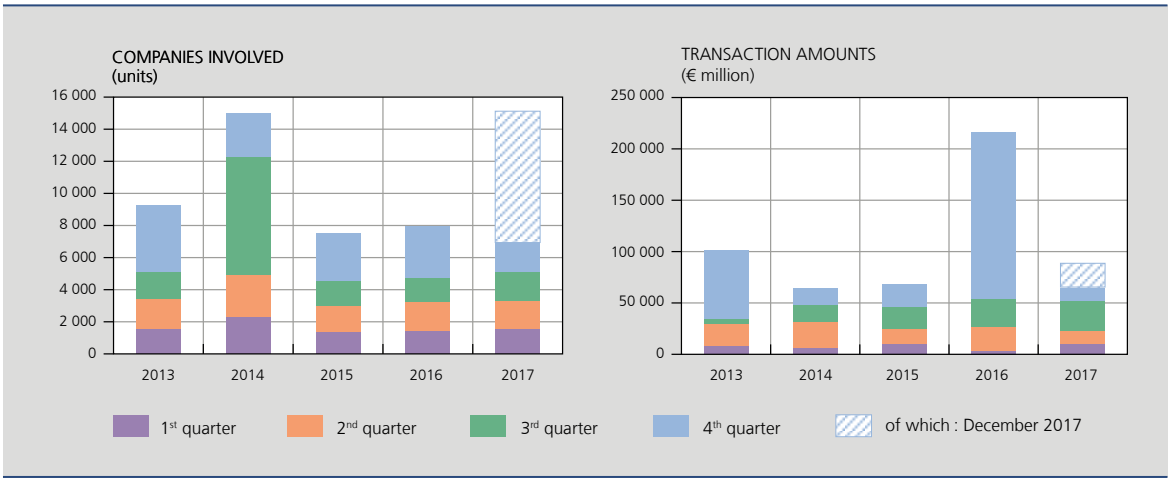
Box – Reductions in capital by SMEs due to tax treatment changes

At the end of 2017, several tax considerations prompted companies to reduce their capital. Firstly, at the end of 2017, SMEs that had taken advantage in 2013 of the transitional measure governing the taxation of liquidation surpluses (Article 537 of the 1992 Income Tax Code, see above) to transfer amounts from reserves to authorised capital benefited from the end of the compulsory four-year holding period. Meanwhile, reductions in capital, which had been completely free of tax until the end of 2017, have been treated on a par with dividend payments since 1 January 2018 and so taxed at 30 %. This change, which was announced in the summer of 2017, has encouraged some companies to stay ahead of future reductions in capital in order to avoid this new tax. Lastly, some SMEs' business leaders coming to the end of their careers simply decided to liquidate their business early and so side-step later taxation on reductions in capital.

Capital change statistics recorded by the Bank on the basis of information published in the Belgian Official Gazette (*Moniteur belge / Belgisch Staatsblad*) confirm that quite a few entities reduced their capital in 2017. A total of over 15 000 reductions were recorded, i.e. twice as much as in the previous two years. Two-thirds of these reductions were concentrated in the fourth quarter of 2017 and over half in the month of December alone. Still, the amounts involved do not contrast with those previously recorded. Granted, the latter were sometimes influenced by a limited number of large transactions – often reflecting liquidations of corporations following mergers, demergers or the winding-up of activities – compared with which the many smaller transactions that may have been recorded in the same period pale in comparison. Total reductions in capital for full 2017 worked out at € 89 billion, of which € 36 billion was taken in the last quarter. However, in 2017 repayments to shareholders turned out to account for 57 % of the reductions in capital, a percentage clearly up on previous years.

The above-mentioned statistics reflect all equity reductions and not just those by non-financial corporations, which are the subject of this article. The latter group has recorded fewer reductions in capital, totalling € 34 billion in 2017, € 18.5 billion of which was in repayments to shareholders and € 10.6 billion the outcome of liquidation operations.

REDUCTIONS IN CAPITAL



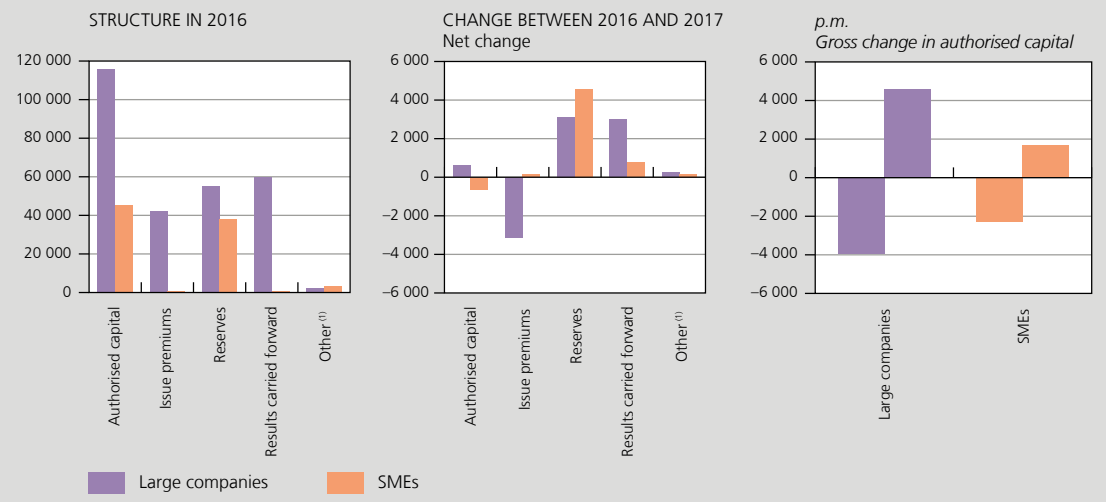
Source : NBB.

In the month of December 2017, around 5 900 non-financial corporations carried out one or more reductions in capital by way of payments to their shareholders, for a total amount of € 5.5 billion. Three-quarters of these cases involved private limited liability companies. The average amount per transaction, i.e. € 928 000, is largely determined by capital reductions at Delhaize. If this company is stripped out of the calculations, the average works out at less than € 670 000. A study of the distribution of the operations revealed that half of these reductions involved small amounts of € 200 000 or less, and even lower than € 91 000 in a quarter of cases.

That same December month saw around 1 750 non-financial corporations reduce their capital because of liquidation, involving a total amount of € 1.2 billion. Here, too, private limited liability companies represented nearly two-thirds of reductions. Amounts involved in liquidation transactions are typically lower than repayments to shareholders : 25 % of transactions involved capital reductions of over € 128 000 and nearly 40 % was used to settle authorised capital of around € 18 600, roughly equalling the minimum capital requirement for private limited liability companies.

The information from the Belgian Official Gazette (*Moniteur belge / Belgisch Staatsblad*) is supplemented with data from the annual accounts filed by non-financial corporations in our constant population. The latter help demonstrate that equity breaks down very differently at SMEs than it does at large companies. Equity at SMEs is typically made up of authorised capital (51 % of the total) and reserves (43 %). Admittedly, authorised capital and reserves account for the bulk of equity at large companies as well (42 % and 20 % of the total respectively) but results carried forward and issue premiums also make up a sizeable proportion of equity (22 % and 15 % of the total respectively). Although the total outstanding amount in authorised capital was unchanged across all companies between 2016 and 2017, SMEs and large companies are reporting diverging trends, with the former experiencing a fall of 1.4 % while the latter edged up by 0.5 %. In gross terms, these developments were even more pronounced : 5 486 corporations reduced their capital by a total € 6.3 billion, while 6 254 firms increased their authorised capital by the same amount. Among the companies that cut their authorised capital, over 5 000 were SMEs. The capital erosion related to over 60 % of the initial amount. For large companies, the decline was limited to a little over one-third of authorised capital in 2016.

STRUCTURE AND DEVELOPMENTS IN EQUITY OF COMPANIES AVAILABLE IN THE CONSTANT POPULATION
(€ million)



Source: NBB.
(1) Revaluation surplus and capital subsidies, less advances to associates upon division of net assets.

These observations are based on a constant population and are incomplete by definition: not all annual accounts were available at the time of analysis and capital movements at companies that started or ended their operations (and particularly companies liquidated in 2017) were stripped out. Although the information derived from the constant population is only partial, it is nonetheless valuable, as it confirms that amounts in individual capital reductions were relatively low – less than € 175 000 in half of them. It also shows that quite a few companies have reduced their authorised capital to the legal minimum requirement in Belgium (€ 18 550 – € 6 200 of which paid up – for a private limited liability company and € 61 500 for a public limited liability company). Of the companies that ran down their authorised capital, 3 129 were registered as private limited liability companies in 2017, with 59 % of these having authorised capital of less than € 20 000; in 8 % of these cases, the authorised capital had even dipped below € 6 200. It should also be noted that, in the 2017 financial year, nearly 280 public limited liability companies switched to the legal status of a private limited liability company and now enjoy lower minimum requirements on authorised capital. In fact, nearly two-thirds of them have lowered their authorised capital to below the € 20 000 threshold. Of the public limited liability companies that have retained their original legal status, 33 % have lowered their authorised capital to the threshold of € 62 000 or below. This behaviour is not without consequences: all other things being equal, corporations that reduce their authorised capital to a level close to the legal minimum are jeopardising their financial resilience and are exposing themselves to trouble in financing their activities further down the line.

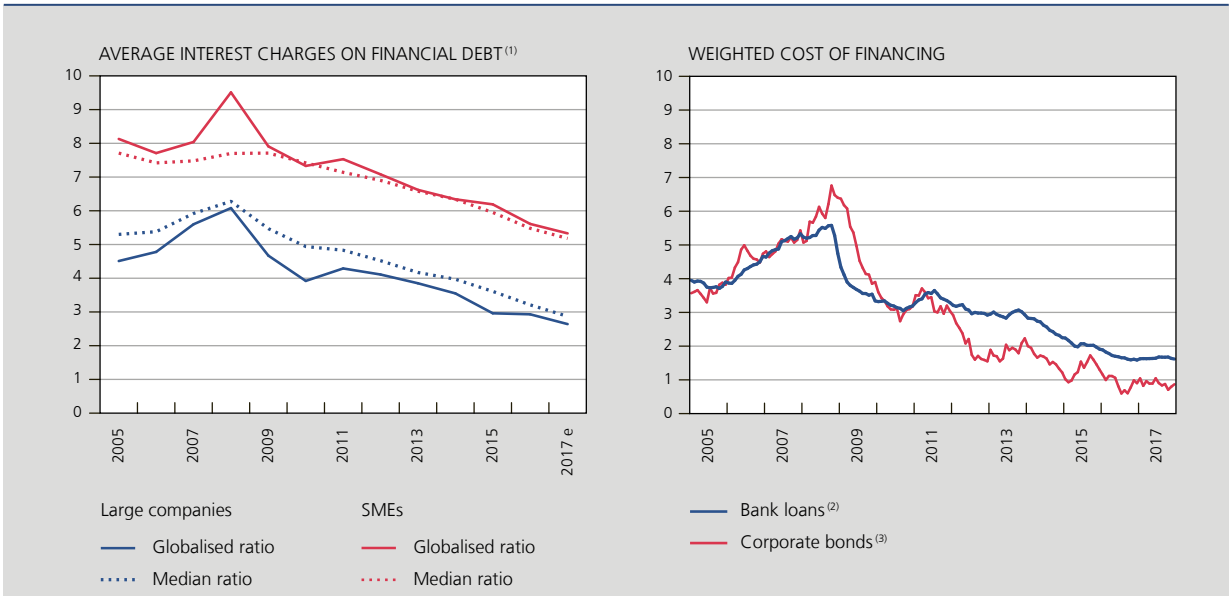
3.2.2 Interest charges and net short-term debt ratio

The degree of financial independence constitutes only a partial take on solvency, as it provides no insight into the extent of the charges related to financial debt nor of the ability of firms to repay debt in the short term.

The interest charge measures the interest costs a company pays on its financial debt as a proportion of the sum of short-term and long-term financial debt.

CHART 9 FINANCING COSTS

(in %)



Sources: Thomson Reuters Datastream, NBB.

(1) As SMEs do not report interest charges on financial debt separately, their numerator is wider and includes all financial costs. This figure may also include exchange rate costs and any discounts they grant to customers for cash payments.

(2) Weighted average interest rates imposed by Belgian banks on new business loans. Interest rates are weighted by outstanding amounts of the different types of loans.

(3) Return on the index of bonds issued by Belgian non-financial corporations, denominated in euros, with maturities in excess of one year and a rating upwards of Baa. The index is weighted by outstanding amounts.

Average financing costs have narrowed virtually continuously since 2008

In 2008, average financing costs touched their highest levels for both large companies and SMEs, only to fall to their lowest point in 2017 – at a projected 2.6 % and 5.3 % respectively for their globalised averages. The virtually continuous decline in interest charges shows the same trend as the weighted average costs Belgian banks charge on new business loans and as the return on corporate bonds (right-hand panel in chart 9). In 2017, the cost of bank loans remained low due to the ongoing accommodating monetary policy pursued by the ECB, while competitive pressures prompted banks to cut their margins on loans ever more. Both in globalised and in median terms, average interest charges are higher for SMEs than for large companies. Much of this phenomenon is explained by the way the interest charge is calculated: the numerator of the ratio for SMEs measures a broader concept than for large companies. In addition, SMEs are likely to have less access to group funding at lower interest costs, a frequent phenomenon at large companies. Note, however, that this is hard (or even impossible) to prove statistically.

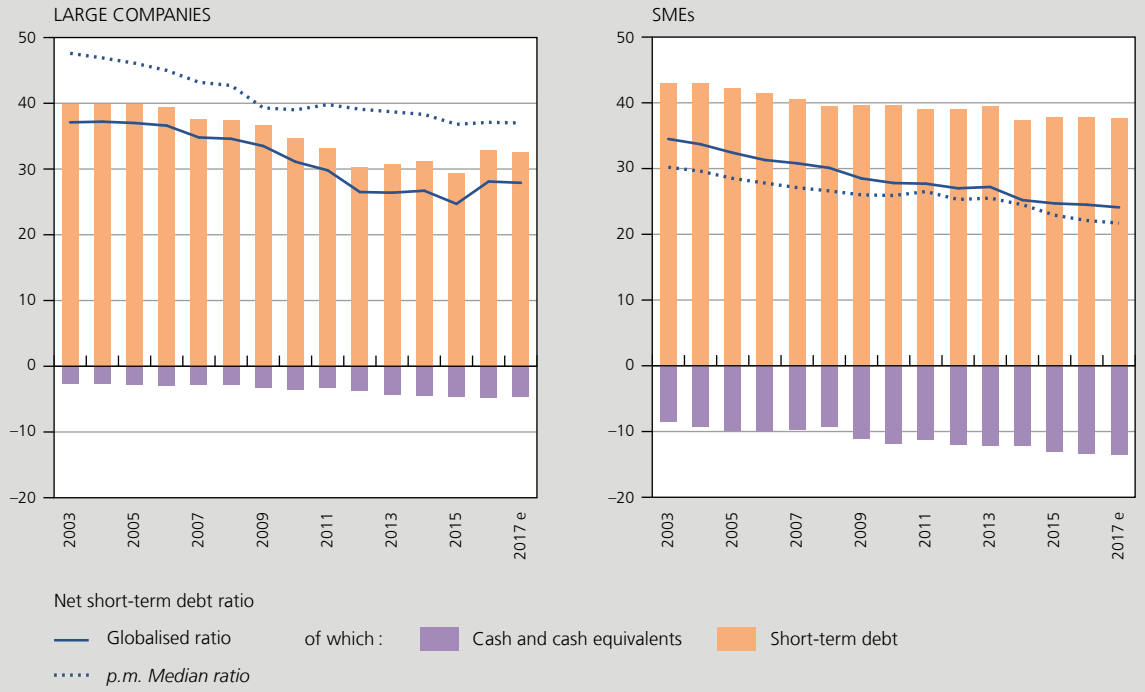
The composition of the net short-term debt ratio differs depending on company size

The net short-term debt ratio calculates the proportion of the balance sheet total that needs to be repaid with debt contracted for less than one year, and for which no cash or cash equivalents are available. Short-term debt does not just comprise financial debt, but also includes trade payables, advances received on orders, debt related to taxation, remuneration and social security, other debt and accruals. This final item includes "costs as yet unpaid" that are recognised in the current financial year (such as telephone costs) and "deferred income" which has been collected in the course of a financial year but that relates to a later financial year (such as rent received in advance). Other debt includes such items as dividends and bonuses, guarantees received in cash, debt to affiliated corporations and current account liabilities, i.e. private money taken from the company by managers or managing partners.

The higher the net short-term debt ratio, the bigger the risk that short-term debt will not be repaid in time, in which case it will need to be refinanced and rolled over into a long-term liability.

CHART 10 NET SHORT-TERM DEBT RATIO, BY COMPANY SIZE: LEVEL AND COMPOSITION OF THE GLOBALISED RATIO

(in % of the balance sheet total)



Source: NBB.

SMEs have relatively more cash and cash equivalents, as well as other short-term debt...

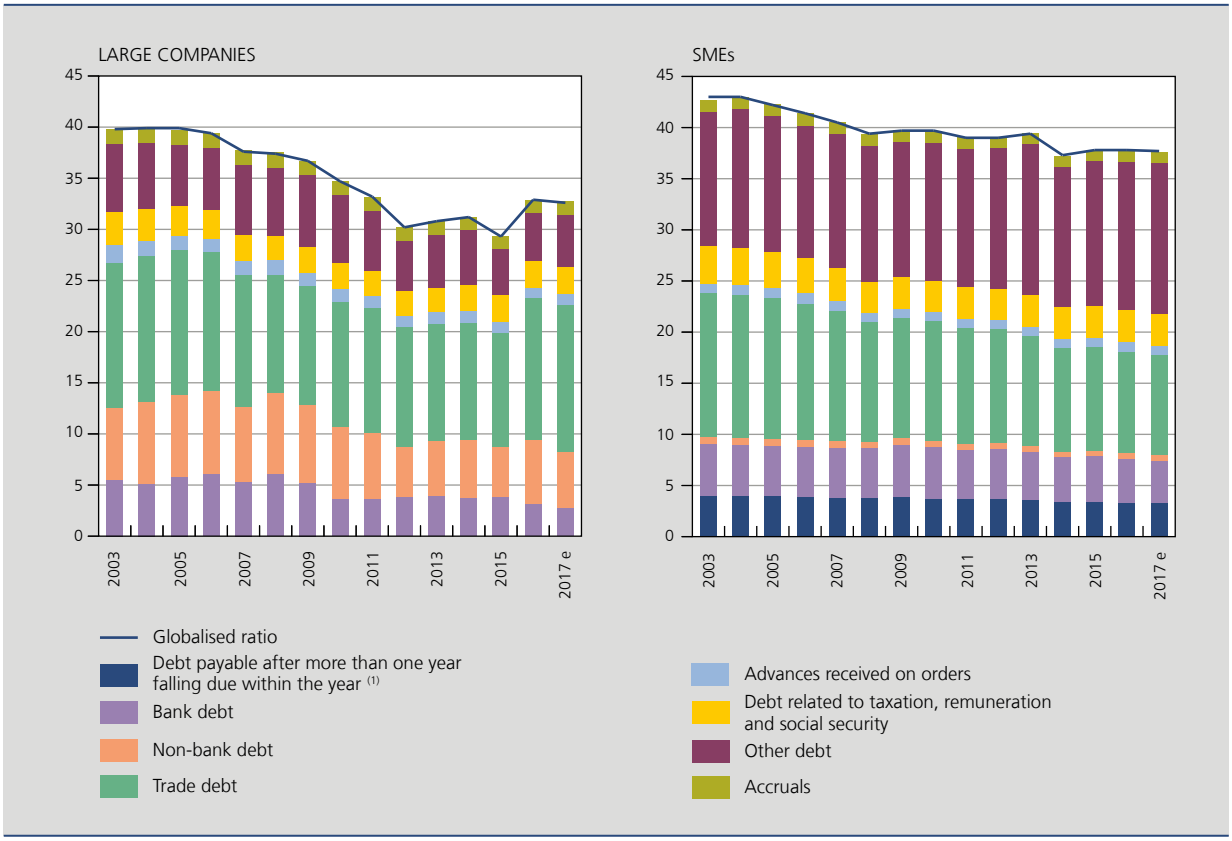
In the period under review (2003-2017), the net short-term debt ratio recorded a declining trend and stable levels for 2017. Large companies' higher median value relative to the globalised ratio demonstrates that firms with a higher balance sheet total tend to attract relatively less net short-term debt. Although the globalised ratio is similar for large companies (averaging 31 % in 2003-2017) and for SMEs (averaging 29 % in 2003-2017), there is a clear difference in the way the ratio breaks down. Relatively speaking, SMEs typically have more cash and cash equivalents. This build-up of cash resources may be a sign that SMEs have less swift access to new loans to meet unexpectedly growing corporate capital requirements, cover current expenditure or finance future capital spending. What is more, SMEs take on relatively more short-term debt than do large companies, with the relative proportion of "other debt" particularly notable. Quite possibly, the owner/manager of an SME will put more private money into their business.

... whereas large companies use proportionally more bond loans, leasing debt or loans through group companies

Chart 11 also captures the different weights for "non-bank financial debt". Whereas large companies can tap credit institutions for short-term funding, they also find it easier to attract "other financial loans", i.e. bond loans, leasing debt or loans via group companies. This is often less easy for SMEs.

CHART 11 SHORT-TERM DEBT RATIO, BY COMPANY SIZE: LEVEL AND COMPOSITION OF THE GLOBALISED RATIO

(in % of balance sheet total)



Source: NBB.

(1) "Debt payable after more than one year falling due within the year" appears only on the right-hand panel of the chart. SMEs do not have to break down this (aggregate) item. By contrast, large companies do report precisely what type of short-term debt is involved.

Net short-term debt ratio for large companies unchanged in 2017, with diverging developments by branch of activity

Table 4 shows that the globalised net short-term debt ratio is lowest in the real estate activities sector. The forecast for 2017 works out at 15.7 %, while the weighted average large company comes in at 27.9 %. This is unsurprising, as the real estate sector chiefly uses long-term debt.

The globalised ratio remains continuously high in trade in motor vehicles, as companies in this branch of activity have relatively high trade debt (averaging 28 % in 2017) compared with 13 % for an average weighted large company. Possibly, this reflects the specific relationship between manufacturers and distributors.

Chemicals and food are the industry sectors that account for the largest proportion of the balance sheet total. The globalised net short-term debt ratio for chemicals fluctuates as a result of swings in the aggregate level of "other financial loans falling due within the year". In 2016, one of Belgium's biggest production centres received a € 1 billion intra-group loan, which it repaid in 2017. As a result, the short-term debt ratio fell back to 2015 levels. In the food sector, the projected rise for 2017 is attributable to an increase in the amount of outstanding trade debt.

In 2017, the energy sector recorded a rise in its net short-term debt ratio as one of the big energy stakeholders borrowed additional short-term funds from companies in the same group.

TABLE 4 NET SHORT-TERM DEBT RATIO BY BRANCH OF ACTIVITY

(in % of balance sheet total, unless otherwise stated; globalised data; large companies)

	Net short-term debt ratio				Share of balance sheet total
	2014	2015	2016	2017 e	2017 e
Industry	**23.0**	**19.6**	**22.9**	**21.5**	**38.0**
of which:					
Food industry	19.2	21.0	21.8	22.4	5.2
Chemicals	27.5	19.1	29.3	19.2	6.9
Pharmaceuticals	17.5	22.7	26.9	30.9	4.8
Metallurgy	34.8	31.8	34.5	35.8	3.4
Metal manufactures	23.5	20.9	25.2	23.5	4.0
Energy, water and waste	**19.8**	**15.8**	**18.6**	**20.1**	**9.2**
Construction	**37.4**	**37.1**	**36.2**	**36.1**	**4.1**
Services	**30.9**	**30.4**	**33.5**	**33.1**	**48.0**
of which:					
Trade in motor vehicles	40.5	43.1	43.0	44.8	4.2
Wholesale trade (1)	38.0	35.4	42.7	40.4	16.7
Retail trade (1)	31.1	29.4	30.6	41.1	3.6
Transportation and storage	27.4	23.5	22.2	26.0	4.2
Accommodation and food service activities	18.7	18.1	14.7	19.2	0.7
Information and communication	30.0	41.1	26.3	22.5	5.9
Real estate activities	21.0	16.4	13.3	15.7	3.6
Business services (2)	23.2	22.2	32.8	29.4	9.0
Total	**26.7**	**24.7**	**28.1**	**27.9**	**100.0**

Source: NBB.
(1) Excluding trade in motor vehicles.
(2) Excluding head-office activities (NACE-BEL 70 100).

The key sectors in terms of balance sheet total in the services sector recorded a decline in in 2017, causing the projected globalised ratio for services activities as a whole to shrink to 33.1 %. Wholesale trade saw its 2017 globalised net short-term debt ratio narrow to more normal levels after this had grown significantly in 2016 as a result of a key wholesale player adding the inventory management for its entire group. For business services, the projected net short-term debt ratio fell after a major rise in 2016. Some big multinationals received large short-term intra-group loans from their parent companies or affiliated corporations, which they were able to partly repay in 2017 by selling off major participating interests. In the information and communication branch, the ratio was also down, as one of Belgium's largest telecoms firms rolled over its large short-term bank debt into a long-term liability.

3.3 Credit risk

In 2015, the ECB approved the Bank's In-house Credit Assessment System (ICAS)[1], which has since been used to assess the credit quality of Belgian non-financial corporations under the Eurosystem's monetary policy. The credit quality is a measure of the risk of default within the next 12 months. A company can default not only if it goes bankrupt or is subject to legal restructuring, but also if it is unable to repay its debts or if payment incidents are recorded for a material loan liability and it is past due on such commitments for over 90 days.

The probability of default within the next 12 months is measured using statistical modelling techniques drawing on financial ratios and inputting data from individual annual accounts and from Belgium's Central Corporate Credit Register. These model ratios provide information on a range of company aspects, including profitability, solvency and cash flows. Seven different models – each one of which focuses on a set of related company activities – hone in on the specific features of associated activities in order to arrive at a credit risk score by company. The left-hand panel of chart 12 shows the breakdown of these scores for all corporations together, segregated by company size. Annex 4.1 captures an identical exercise aggregated on the level of branches of activity, likewise broken down by company size.

The credit risk score can be translated into a credit risk class, which our study numbers from 1 through 14[2], with the first category featuring corporations at the lowest risk of default and category 14 comprising those at the highest risk. It is useful to break down companies into credit risk classes, as the intervals defining the various credit risk risk classes are not all the same size.

The "companies with a low credit risk" group is largely made up of SMEs...

The left-hand panel of chart 12 shows the breakdown of the credit risk scores to be rather different for the two company size categories. Although average scores of both large companies and SMEs are close together, actual scores recorded for SMEs are significantly more widely distributed, even though the median value is lower for SMEs than for large companies. This finding is the same across the 2012-17 period. One explanatory factor for this observation that a significant number of SMEs have lower credit risk scores than do large companies is that one-third of them operate in business services, a sector in which SMEs run a relatively small risk of defaulting (see Annex 4.1). At the same time, SMEs' scores in the 9th decile are much higher than those for large companies. SMEs at a higher risk of default typically operate in sectors such as food, chemicals, wholesale and retail, transportation, accommodation and food service activities, real estate and construction.

In 2017, SMEs' scores in the 9th decile and 3rd quartile came down, suggesting some reduction in SME credit risks relative to the previous year, whereas those for large companies remained fairly stable. Clear exceptions to this general rule are large companies that are active in information and communication and SMEs operating in food. In addition, both SMEs and large companies operating in the "trade in motor vehicles" sector displayed relatively high default risks, which in fact even went up a little in 2017.

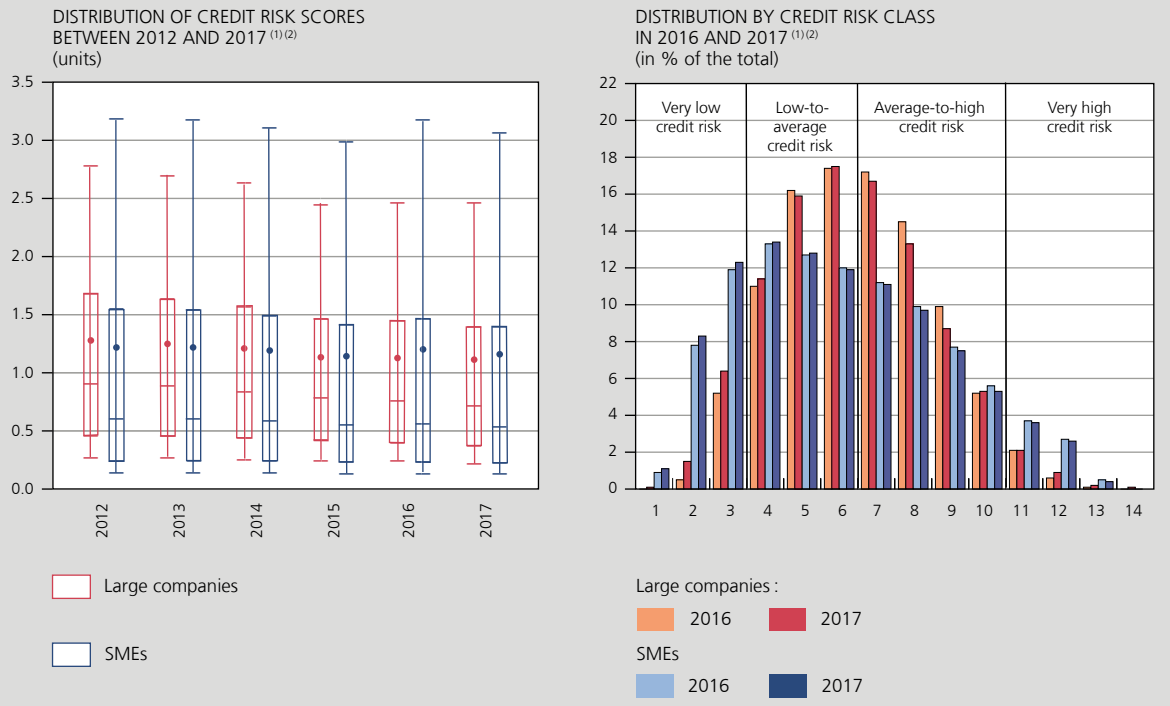
... as well as the group of "companies at very high credit risk"

The right-hand panel of chart 12 confirms that SMEs are more highly represented in both the group of companies at very low and in the group at very high credit risk. In other words, the distribution of the credit risk categories is wider for SMEs, with large companies more frequently showing up in the middle categories.

The above observations on credit risk broadly confirm the outcomes of the ratio analysis of the preceding sections. Previously, the quartile distribution demonstrated that SMEs' financial independence is often higher than that of large companies, i.e. for SMEs whose degree of financial independence exceeds the median value (chart 7). This suggests that quite a few SMEs run less credit risk, which is confirmed in chart 12. A particularly interesting finding is the significantly wider distribution of credit risk for SMEs. In addition, the fact that companies in trade in motor vehicles branch have relatively high trade debt and so have higher short-term debt ratios also suggests that these players are running higher credit risks – which is indeed confirmed.

(1) See https://www.ecb.europa.eu/paym/coll/risk/ecaf/html/index.en.html
(2) For more information about the 14 credit risk classes, see Annex 4.2.

CHART 12 CREDIT RISK BY COMPANY SIZE



Source : NBB.

(1) The box plots on the left-hand panel should be read as follows : the lower and upper edges of the box plots correspond respectively to the 1st and 3rd quartiles. The line inside the box represents the median. The ends of the lower and upper whiskers correspond respectively to the 1st and 9th deciles.

(2) Annex 4.2 presents a conversion table showing which credit risk scores (based on the ICAS system) correspond to a specific credit risk class.

4. Characteristics of the workforce

The social balance sheets as an instrument to measure the consequences of the 2008 crisis on the composition of the workforce

As mentioned in section 2, employment volumes in FTEs, as reported in annual accounts (1), have grown strongly in the past two years, rising by 3.6 % between 2015 and 2017. This growth, supported by the wage moderation measures of 2015 and 2016, followed a long stretch of virtually stagnating labour volumes. Employment volumes as expressed in FTEs had shrunk in the aftermath of the 2008 crisis ; the figure returned to pre-crisis levels in 2011 but the following four years saw it barely move above that level, recording a negligible increase of 0.2 %. It was not until 2016 that 2008 levels were well and truly exceeded.

This ongoing employment crisis could have led to changes in the shape of the workforce. Although annual accounts give little information about companies' workforces, their social balance sheets – as included in keeping with the provisions of the Belgian Company Code – provide some insight into the characteristics and turnover of workers, provided these are completed accurately. Social balance sheets come in full and abbreviated versions (2), the latter applying to all small firms including micro-companies (3). The information so collected is plentiful and varied, even in the abbreviated version, with this part of the analysis based on a set of data that are common to all filers.

(1) Item 9087.

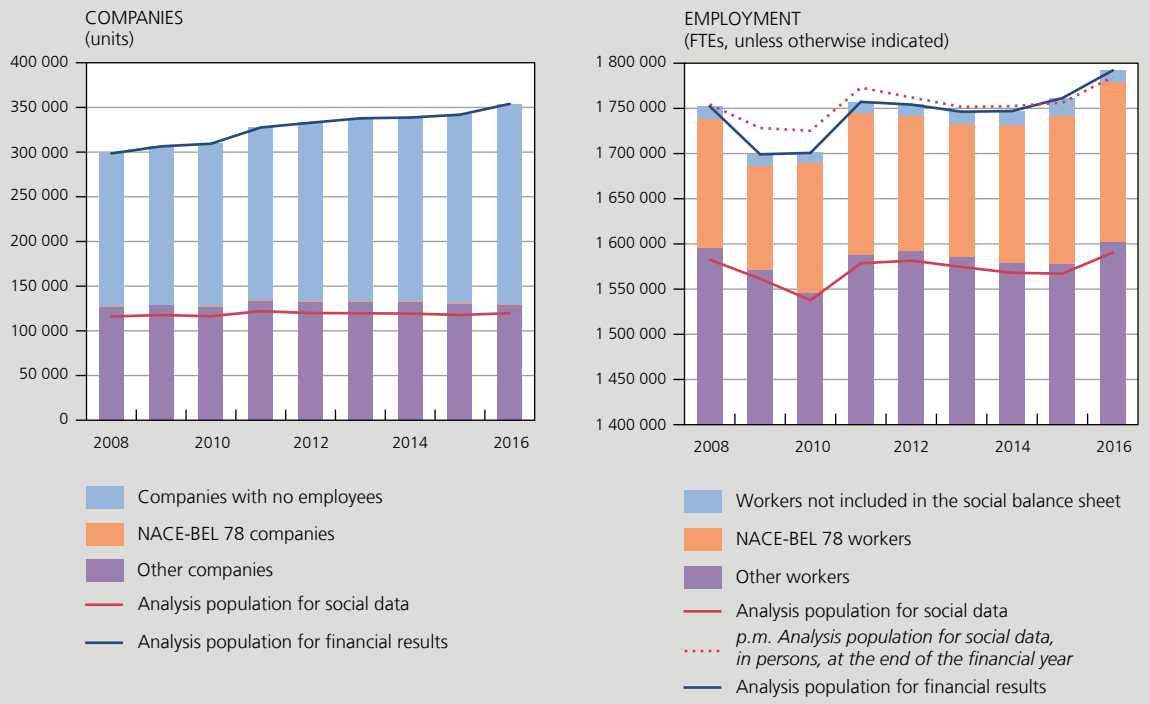
(2) For more details about what is in the social balance sheets, see https://www.nbb.be/en/central-balance-sheet-office/models-annual-accounts/models-social-balance-sheet.

(3) With the transposition into Belgian law of Directive 2013/34/EU on annual financial statements, the content of these forms did not change, but size criteria modifications have brought changes to the scope of the full models : some information that used to be disclosed by companies considered large according to the previous criteria has not been available since 2016, as these companies now rank in the small companies category and are able to complete the abbreviated, less detailed model.

The population for the analysis of social data is made up of around 120 000 companies...

The analysis of social data related to a smaller company population than the analysis of financial results, as a little under 120 000 corporations qualified for the former for the financial year 2016 (see chart 13) – a mere 34 % of the 354 000 firms selected for analysis of financial results. First to be stripped out of the social data analysis scope are all companies with no employees. In the population of companies for the analysis of financial results, just over 223 000 had no employees in 2016 and thus did not complete a social balance sheet. Also excluded are firms that specialise in employment-related activities[1] (NACE-BEL 78, primarily temporary employment agencies), as well as those that have filed incomplete or inconsistent data. This ensures that the analysis is only carried out on social balance sheets data guaranteeing internal consistency.

CHART 13 ANALYSIS POPULATION



Source : NBB.

... which together account for 89 % of the employment volume in the analysis population of the financial results

Employment (in FTEs) of the analysis population for the social data accounts for 89 % of that of the analysis population for the financial results, the main reason being that temporary employment agencies are left out. Though not many in number, these agencies account for nearly 10 % of full-time equivalents in the analysis population for the financial results. The second difference between annual accounts and social balance sheets is that the latter only relate to employees working on Belgian soil. Employees seconded abroad are not included in the social balance sheets, even if their employers have their official head offices in Belgium[2]. The remainder concerns employment in firms not eligible because of incomplete or inconsistent data.

(1) High levels of employee turnover in these companies make it difficult to calculate full-time equivalents and annual averages, as well as to interpret the development of these variables.

(2) This explains why, for some companies, there may be a difference – which can be major at individual level – between workforce and staff costs as recognised in the annual accounts and in the social balance sheet.

The characteristics of the workforce may be derived from the table for workers listed in the staff register at the end of the financial year under review or for whom a Dimona declaration was made[1]. This table breaks down workers on a range of characteristics: employment scheme, gender, education level, type of employment agreement and occupational category. Some of these characteristics undergo little change from one year to the next, but others may vary starkly, even at short notice, especially if there has been a specific event that upsets the applecart (particularly a crisis) or as the result of political measures aimed at promoting employment of certain population groups or guaranteeing the development of certain activities.

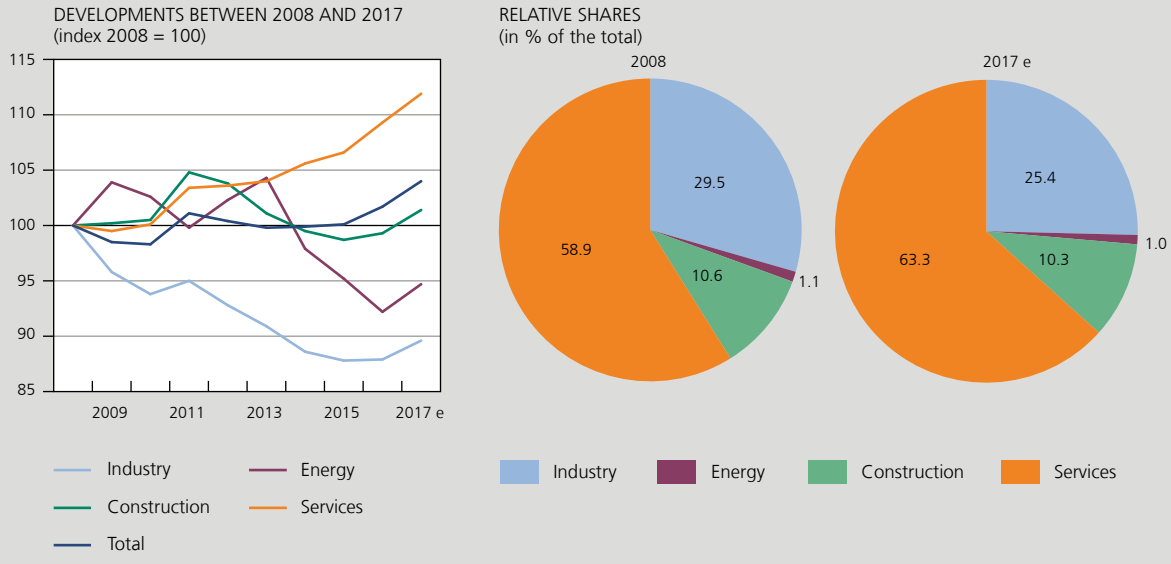
Change in economic structure...

The 2008 financial crisis sparked a major change in the country's economic structure, which has continued into the last decade and which has caused a lasting reduction in the number of people working in industry (see chart 14). Particularly affected were textiles, pulp and paper, metallurgy, and metal manufacturing. The downtrend reversed in 2015 and constant population data even point to an increase in industrial employment in 2017. In services, by contrast, the economic downturn had only a subdued effect: after the number of employees edged down in 2009, the figure was back to where it started in 2010 and has been continuously on the rise ever since – propelled mainly by business services, retail trade, and accommodation and food service activities.

As a result, the services sector's share of employment has risen by 4.4 percentage points since 2008 and worked out at 63.3 % by 2017. This increase came at the expense of industry, whose relative weight fell back to 25.4 % in 2017 from 29.5 % in 2008. Construction also declined, albeit by a marginal 0.3 percentage points, and ended up at 10.3 %. The energy sector accounted for barely 1 % of the workforce in the analysis population in 2017, the same as in 2008[2].

(1) This concerns employees with employment or internship agreements, including those on a student contract. Not included are temp agency workers and the self-employed (particularly directors) who perform duties for a company. Data is available in people and in FTEs. The remainder of this section discusses the change in people numbers.
(2) Note that Belgium's utility companies, although amply involved in these kinds of activities, are not included in the population, either for the analysis of financial results or for that of the social data, owing to the specific way they work. The employment developments discussed do not therefore apply to all companies in the energy sector.

CHART 14 NUMBER OF WORKERS, BY BRANCH OF ACTIVITY



Source: NBB.

... coupled with greater flexibility of labour via an increase in the number of part-time workers...

Although by the end of 2015 employment levels had inched barely higher than those in 2008, the solid increases of 2016 and 2017 took them 4 % above their base levels. The recent recovery is also visible in the full-time workforce, where numbers in 2017 came close to those in 2008, while they had still been 5 % lower only two years previously (see chart 15). The number of part-time workers, by contrast, continued to grow throughout the period and added a total 21 % between 2008 and 2017, taking the proportion of part-timers in the workforce from 22.9 % in 2008 to 27 % in 2014. The increase in part-time work then stalled until 2016, after which it even started to come down : constant population data suggest this proportion shrank by 0.3 of a percentage point in 2017.

In services, the number of full-time workers has regained its 2008 levels since 2011, but it was not until 2014 that annual growth took a real upward turn and was sufficient to offset the advance of part-time work. The proportion of part-time workers, which since 2008 had grown by four percentage points to 35.5 % by 2014, gradually narrowed to 34.5 % in 2017.

In industry, part-time workers constitute a smaller percentage of the overall workforce : only 15 % in 2017, three percentage points up on 2008. In the aftermath of the crisis, full-time and part-time workforce numbers went completely opposite ways : the cyclical downturn saw a proportion of companies choose to cut working hours instead of the workforce, with a number of workers switching from full to reduced working hours. Afterwards, the number of part-time workers remained fairly stable – if with relatively major annual fluctuations – while the number of full-time employees continued to fall until 2014. This figure did not start to pick up again until 2017.

... and a rise in temporary employment agreements

Working hours were only one way to adjust work volumes to the sudden drop in activity after the 2008 crisis. In 2009, companies also cushioned the effects of the economic downturn for their permanent workers[(1)] by not extending the employment agreements of a proportion of their temporary workforce[(2)] : that year saw the number of temporary workers cut by over 7 % (see chart 15).

The demand for temporary workers underwent the most sweeping change in industry in the aftermath of the crisis : the number of temporary workers plummeted by nearly one-third in 2009 and did not return to its former level until 2017. That said, the percentage of temporary workers did show a slight upward movement between 2008 and 2017, as the number of permanent workers continued to fall.

In the services sector, by contrast, temporary employment remained fairly stable after the crisis. However, the jump in the number of temporary workers from 2011 was quite distinct from the way permanent worker numbers were moving, i.e. barely. In fact, in 2017, services employed 60 % more temporary workers than it had in 2008, taking their relative share to 10.6 % of the total, compared with 7.4 % in 2008. These employment agreements, which enable employers to swiftly align the volume of employment with economic activity, are primarily used in specific branches, such as retail trade or accommodation and food service activities, two sectors accounting for nearly half of temporary workers. A proportion of this temporary workforce may be made up of students and/or seasonal workers, but unfortunately this cannot be formally established from social balance sheets. Successive legal changes since 2012 extending the number of hours students are allowed to work, have actually encouraged student labour.

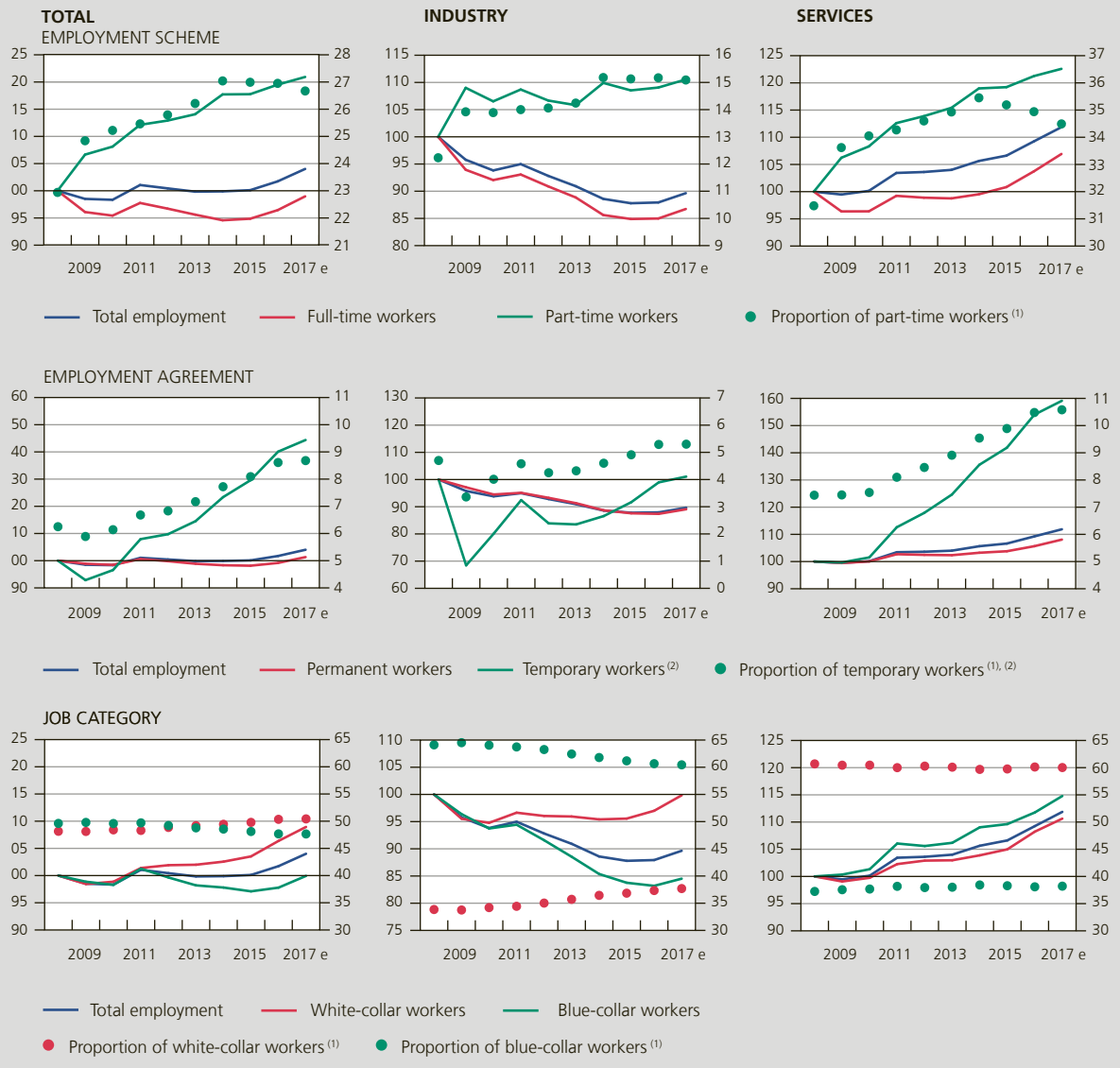
By 2017, temporary workers accounted for 8.7 % of the workforce across all sectors, which was over 2.4 percentage points up on 2008.

(1) Permanent workers are employees tied to their employers through open-ended contracts.

(2) Temporary workers have time-limited contracts, replacement contracts or agreements to perform certain clearly delineated tasks which are time-limited by definition. Temp agency workers are not included in this group of temporary workers.

CHART 15 NUMBER OF WORKERS, BY EMPLOYMENT SCHEME, EMPLOYMENT AGREEMENT AND JOB CATEGORY

(index 2008 = 100, left-hand scale unless otherwise stated)



Source : NBB.

(1) In % of the total (right-hand scale).

(2) Temporary employment agreements are fixed-term contracts, replacement contracts or agreements to perform certain clearly delineated tasks which are fixed-term by definition.

Steeply higher in- and outflows of employees and turnover rates

The developments discussed above reflect the net movements in the workforce, that is to say, employment fluctuations between two given moments in time. Social balance sheets also provide a glimpse of gross movements in the scale of the inflows and outflows of employees in any given financial year. These figures capture any type of job gains and losses : they reflect changes in the economic fabric, as well as the inflows and outflows of employees related to job mobility between employers or renewals of temporary employment agreements.

Study of this data reveals that employee turnover – i.e. inflows of employees or, conversely, outflows of employees, as expressed in percentages of employment – has shot up since 2008. Whereas in 2008 the number of newcomers

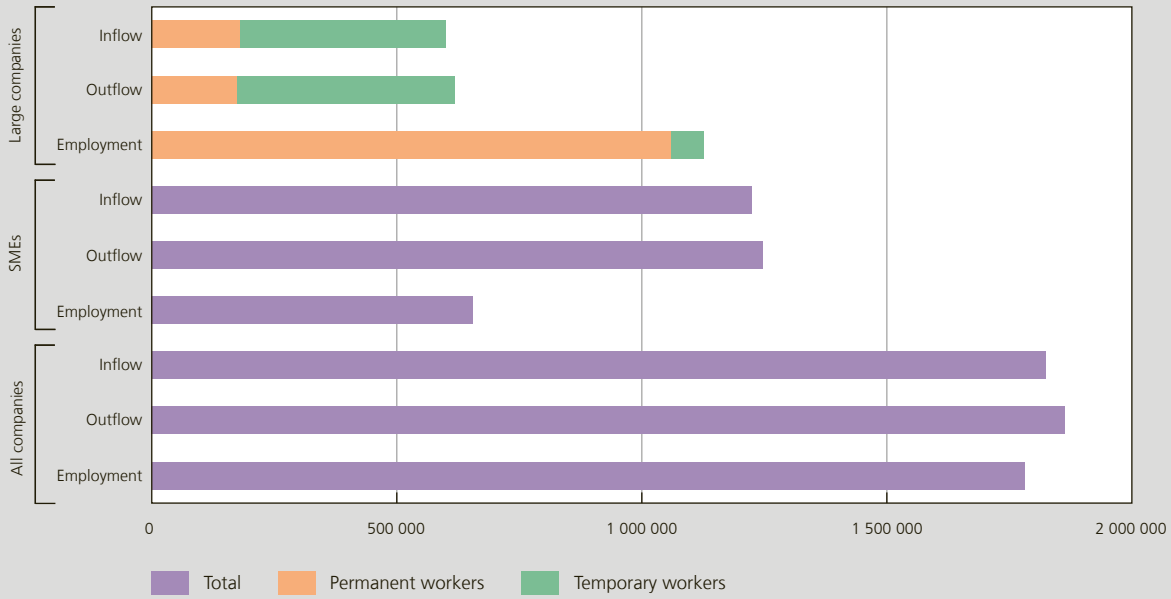
represented a little under three-quarters of the workforce, in 2017, there were more newcomers than those already in work.

Higher inflow rates come with equally higher outflow rates, suggesting that some employees change jobs often. That is particularly the case for employees in services, where the turnover rate in 2017 was around 150 %. Accommodation and food service activities, retail trade and business services (which includes cleaning of buildings) especially, record extremely high turnover rates. These three sectors account for nearly two-thirds of the annual in- and outflows of employees, whereas they employ only a little over a third of the total number of workers. Turnover is evidently less high in industry, energy and construction : a little over 20 % in the former two sectors – with turnover rates even dropping to around 10 % in chemicals and pharmaceuticals – and 30 % in the latter.

Chart 16 shows that in 2017 employee turnover is significantly higher at SMEs (nearly 200 %) than it is at large companies (55 %). The social balance sheets of corporations that filed full-format accounts reveal that 70 % of the in- and outflows of employees in large firms in 2017 related to temporary workers, whereas their share in the total workforce was only 5.9 %. A dichotomy appears to have occurred in large firms between staff on permanent contracts, whose turnover is low and falling (inflow rates of around 20 % in 2008 and around 16 % in 2017), and the temporary workforce, which is renewed nearly seven times over in the course of the financial year (inflow rates of 668 % in 2017).

CHART 16 GROSS MOVEMENTS IN THE NUMBER OF WORKERS IN 2017 (1)

(units)



Source : NBB.

(1) Projected data on the basis of the outcome for the constant population, for companies whose financial year was a 12-month period.

(2) Temporary employment agreements are fixed-term contracts, replacement contracts or agreements to perform certain clearly delineated tasks which are fixed-term by definition.

Fall in the number of blue-collar workers in industry

The first steps towards a harmonisation of the occupational status of blue- and white-collar workers date back to 2014 (initially with a standardisation of provisions for notice periods and unpaid first days of sick leave, followed later by those for supplementary pension entitlements), but a lot of areas still show plenty of differences, more specifically in terms of remuneration, access to temporary unemployment or joint committee representation. To this day, distinctions between employees based on their occupational category are still being made in Belgium.

These two categories of workers accounted for 98 % of the employee population 2017, with directors and staff with undetermined occupational status each making up less than 1 %. There have been no notable changes in the proportion of blue-collar workers and white-collar workers in the total employee population since 2008 (see chart 15), although there has been a slight shift in their share of the workforce : in 2008, blue-collar workers were the largest group with 49.6 % of the total, while this majority position had shifted to white-collar workers by 2017 (50.4 % of the total).

This shift harks back to the gradual expansion of the tertiary sector, a process that started long before the 2008 crisis and accelerated as a result of that same crisis. Between 2008 and 2015, industry lost 16 % of its original blue-collar workforce, while white-collar workers managed to contain the damage to 4 % compared with their position in 2008. As a result, the proportion of blue-collar workers in the total workforce contracted from 64 % to 61 %. The general recovery in employment, which started for white-collar workers in 2016 and for blue-collar workers in 2017, would appear to have slowed the decline in the share of blue-collar workers in the total workforce.

The share of blue-collar workers is even more important in construction than it is in industry : three-quarters of employees have blue-collar workers status. Here, too, blue-collar work has declined (–4 % of the original workforce), but the decrease was smaller than in industry. The number of white-collar workers, by contrast, has gone up by 30 %, admittedly from a very low base.

The fact that the total number of blue-collar workers stayed at its 2008 levels is due to increases in services, where blue-collar worker numbers (+15 % between 2008 and 2017) rose faster than those for white-collar workers (+11 %). It is worth noting that this expansion of blue-collar work occurred almost exclusively in two branches : accommodation and food service activities – a sector in which the increase amounted to 20 % across the period and where over three out of four workers were blue-collar by 2017 – and especially business services, which has seen an upsurge of 75 % in employment of blue-collar workers thanks to the rise in firms offering activities paid in service vouchers. Despite this robust growth, the overall share of blue-collar workers in services inched up by a single percentage point between 2008 and 2017, to 38.2 %.

Increased proportion of working women...

The development in business services as described above is mainly attributable to larger numbers of women having joined the workforce : their relative share has risen to 58 % from 50 %, while there has also been an increase in the number of men in work. Over 61 000 additional female employees and 20 000 additional male employees joined the workforce in business services since 2008 (see chart 17). The overall services sector created new jobs for a total of 122 000 new employees in the period, two-thirds of whom are women.

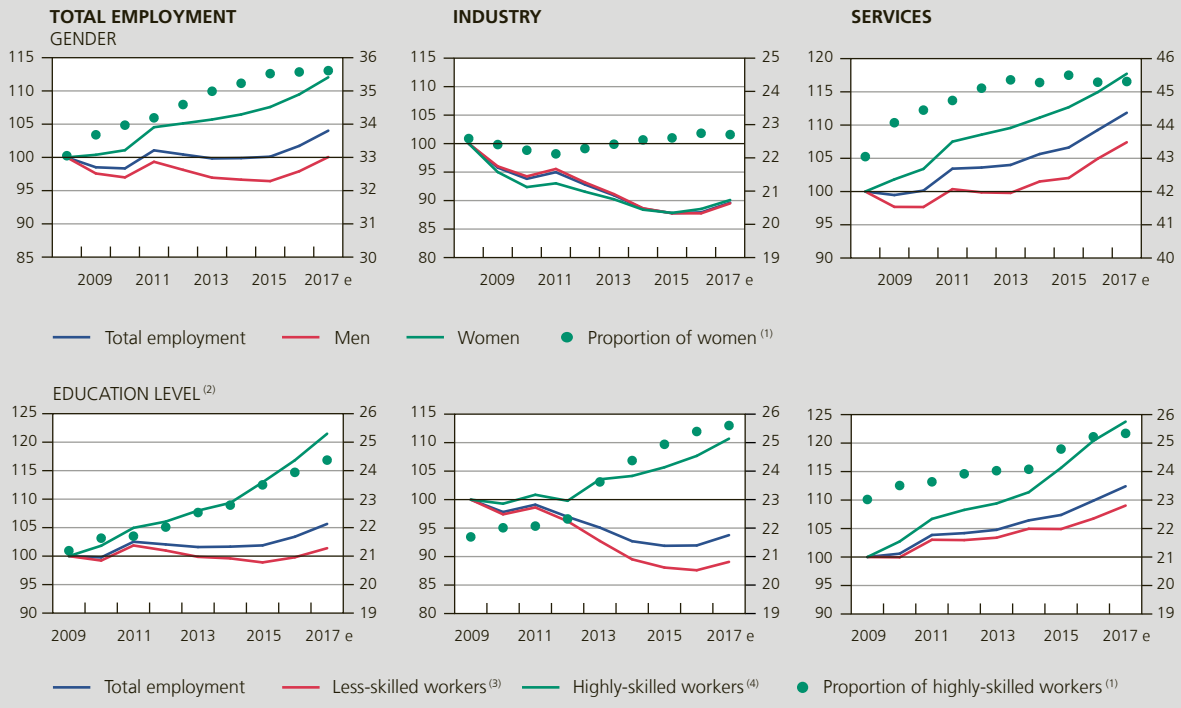
Meanwhile, more women now also work in construction, whereas the male workforce has remained virtually stable. The sector retains its reputation for being traditionally male, though, as nine out of ten employees were men in 2017.

In industry, the fall in employment hit women and men equally hard, and their relative share has not changed : just as in 2008, men accounted for over 77 % of the total workforce in the sector in 2017.

Overall, women saw their share of the workforce rise by three percentage points in the period, from 33 % to 36 %. Male employment, which suffered as a result of falling economic activity in 2008-2009 and in 2011, was back at pre-crisis levels in 2017 on the back of renewed growth in employment in industry and accelerated recruitment in services.

CHART 17 NUMBER OF WORKERS, BY GENDER AND EDUCATION LEVEL

(index 2008 = 100 (left-hand scale), unless otherwise stated)



Source: NBB.

(1) In % of the total (right-hand scale).

(2) Index 2009 = 100.

(3) The category of "less-skilled workers" comprises all employees with no more than secondary education.

(4) The category of "highly-skilled workers" includes all employees with higher education qualifications.

... and higher average education levels of employees

Levels of education for employees are among the least well completed variables of the social balance sheet. This breakdown, which was introduced in 2008, only applied to companies whose financial years ended on 31 December of that year, and 2008 cannot therefore be taken as the base year as in the other breakdowns. What is more, regular checks suggest that companies are not very consistent when completing this part of the table: some put their entire workforce in one and the same educational level, which may vary from one year to the next; others make corrections, leading to category changes between two successive financial years. This kind of behaviour can significantly distort identified trends as far as a large firm is implied. To lessen the impact of such changes, the number of education levels was cut to two: "less-skilled" – referring to employees who at most attained a secondary education qualification (and which includes those with a certificate of primary school attendance as their highest qualification) – and "highly-skilled", comprising employees who have attained higher education qualifications (postgraduate degrees, obtained in high school or at university).

In 2009, less-skilled workers still accounted for 78.8 % of the total workforce (see chart 17). Their numbers remained virtually stable in subsequent years, whereas the number of highly-skilled rose by over 20 %. As a result, the relative proportion of the first group fell to 75.6 % in 2017.

The stability of the less-skilled workers is an illusion, though, as shown by the steep drop (of 11 %) in the number of less-skilled working in industry between 2009 and 2017. At the same time, the highly-skilled in industry saw their

numbers grow by over 11 %, causing their relative share to rise to a little over a quarter of the workforce in 2017 from over one-fifth in 2009.

In services, highly-skilled staff also represented 25 % of the total workforce in 2017. Less-skilled work grew by 9 % in the period under review, but the number of highly-skilled workers went up a lot faster, by 24 %. As a result, the relative share of the less-skilled came down.

The construction sector has a large number of employees who have built their skills after secondary or lower-education studies or on the job : in 2017, nine out of ten employees were less-skilled. The increase in highly-skilled employees is the most notable feature in this sector, as it surged by over 40 % between 2009 and 2017. This helped to keep employment close to its base level, by the way, as the number of less-skilled employees fell.

These generally unfavourable developments for the less-skilled in this eight-year period under review should not cloud the past two years' reversals in fortune : a more favourable economic situation and the country's wage moderation policy have boosted trends in employment in 2016 and 2017, even for the less-skilled. A detailed breakdown shows that in the constant population the number of less-skilled rose across the board in 2017 in every branch, even in those that had recorded each year a contraction in the previous five years, such as textiles, pulp and paper, metal manufacturing and construction. Only retail trade reported a fall in the number of less-skilled, which can be fully explained by a major player that reclassified its employees between the various education categories.

Conclusions

Against a background marked by a slight acceleration in GDP and higher production costs, non-financial corporations saw value added growth slow down, from 5.7 % in 2016 to 3 % in 2017. However, information collected from large companies shows that sales in 2017 have steadily grown. The recovery in commodity prices caused an even bigger rise in supply costs, which in their turn caused the value added to shrink. Services made the biggest contribution to the actual rise in the value added, particularly business services and wholesale trade. Operating costs were up a total 3.2 % in 2017, slowing the increase in net operating result from 3.5 % to 2.4 %. Higher staff costs (+3.9 %) greatly impacted costs : steeply increased employment (as in 2016) was accompanied by higher hourly labour costs in 2017, as the effects of the wage moderation measures introduced in 2015 and 2016 gradually faded away.

Most profitability ratios edged down in 2017 at both large companies and SMEs. Although the financial profitability of the former has undershot that of the latter in the past few years, large companies' shares still generate higher returns than do Belgian government bonds.

The last few years have seen a significant improvement in the median values of SME solvency ratios. In part, this relates to the changes in the fiscal treatment of liquidation surpluses, which initially (i.e. in 2013-2014) encouraged SMEs to shift their taxed earnings from reserves to authorised capital and then in a second step (from 2015) to report these under liquidation reserves. A reversal may have got under way since the end of 2017 but is not yet visible in globalised or median ratios : however, statistics on capital changes reveal that nearly 6 000 non-financial corporations cut their capital by returning it to their shareholders in the month of December 2017 alone, while nearly 2 000 other reductions were the result of liquidations. These trends reflect successive changes in the tax treatment of income and the distribution of capital in the past couple of years, which caused a drop in outstanding authorised capital at SMEs between 2016 and 2017. Various actions at individual firm level have typically scaled back authorised capital to minimum required levels, which might well impinge on the financial resilience of the companies involved.

Ever since 2008, average financial debt-related costs have been falling for both large companies and SMEs. This change corresponds with the development in weighted average costs charged by Belgian banks on new business loans as well as with the trend in the average yields on corporate bonds.

The net short-term debt ratio remained virtually stable in 2017. Although the level of the globalised ratios is similar for both large companies (averaging 31 % in 2003-2017) and SMEs (averaging 29 % in 2003-2017), their composition differs : SMEs tend to have relatively more cash and cash equivalents, possibly because it is less easy for them to attract

new loans. In addition, SMEs take on relatively more short-term debt than do large companies, and the weight of "other debt" in particular is more significant at SMEs.

The outcomes of the ratio analysis are largely corroborated by credit risk scores derived from the Bank's In-House Credit Assessment System (ICAS). The ICAS models show that SMEs are more highly represented in both the group of companies with very low credit risks and in the group in which credit risks are very high.

The analysis of data in the social balance sheets showcases a change in the economic structure at the expense of industry – which was hit hard by the 2008 crisis – and to the benefit of services. By accelerating the process of tertiary sector expansion that had been going on for years, the crisis led to a significant fall in the employment of blue-collar workers in industry, which could not be fully offset by the upturn in the services branches, particularly business services whose development was amply supported by the service voucher system. Services have grown largely on the back of more women in employment, whereas downward employment trends in industry affected men and women equally. However, the feminisation of the workforce in the analysis population has slowed in the past few years, thanks to a recent recovery in male employment both in industry and in services.

The changes in the economic structure have been accompanied by greater flexibility in the workforce, with the proportion of part-time workers having risen until 2014 and stabilised thereafter. The recent recovery in full-time employment may have pushed down part-time work share, to be confirmed in the years ahead. After the number of employees in temporary employment agreements declined in the aftermath of the crisis – excluding temp agency workers for the purpose of this analysis – the figure bounced back in recent years, with a key contributor being services branch dynamics, which saw temporary employment shoot up by 60 % in the period under review.

Although the number of less-skilled employees remained generally stable – with these types of job losses in industry offset by job gains in services – the overall education level of workers increased, as the number of highly-skilled employees rose significantly.

Annexes

Annex 1 – Definition of analysis populations

1. Analysis population for financial results

1.1 Selection criteria for the analysis population

Most Belgian corporations where shareholders' or managing directors' liability is limited to their contributions are obliged to publish their annual accounts by filing these with the Bank's Central Balance Sheet Office. The same applies to foreign companies and foundations that are active in Belgium.

The population studied in this article corresponds to companies in the non-financial sector (S11) as defined by the National Accounts Institute, i.e. institutional units which are independent legal entities and market producers and whose main activity is the production of non-financial goods and services. Filers of annual accounts from other institutional sectors – financial sector (S12), general government sector (S13) or non-profit institutions (S15) – are not considered.

Certain categories of firms are excluded from the analysis population :

- corporations whose annual accounts do not meet the quality requirements imposed by the Central Balance Sheet Office ;
- non-financial corporations that are monitored by the government and that feature on the list of public entities drawn up by the National Accounts Institute [(1)], excluding those that are active in sufficiently competitive markets (mainly the Proximus group companies) ;
- companies that take the form of a holding company or a treasury centre and that are identified on the basis of the share of their balance sheet represented by financial fixed assets and intra-group claims ;
- some companies with a specific legal form ;
- corporations in the process of judicial winding-up.

The population thus defined comprised just under 354 000 firms for the 2016 financial year, the last complete financial year. For a breakdown of these companies by sector, see Annex 2.

The number of filers keeps increasing : in 2016, the analysis population had grown by around 101 000 companies compared with 2003.

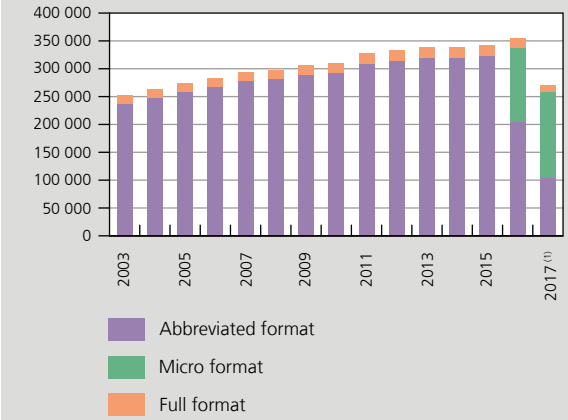
The structure of formats used by companies changed radically from the 2016 financial year, which was the first year to apply new size criteria aiming to distinguish large companies from small ones, with the smallest among them permitted to apply an even more simplified format called the micro format, under the transposition into Belgian law of Directive 2013/34/EU on financial statements.

The new legislation applied to any financial years that started on or after 1 January 2016. As the analysis population for a financial year includes all annual accounts closed in that financial year, regardless of when the financial year actually started, the 2016 financial year comprised both annual accounts filed in keeping with the old models and size criteria, and annual accounts that met the new requirements. By 2016, 37 % of all firms had already switched to the new micro format, while the relative share of companies filing the full format had declined, from 5.7 % of the total in 2015 to 4.8 % in 2016. The figures evolved even further in 2017, as 2017 was the first year that every firm applied the new models and size criteria. Once again, there was a shift in the number of abbreviated formats towards micro formats.

(1) These companies stand out for a series of particular features related to regulation, price-setting, funding (subsidies) or their social purpose. Such corporations include public transport companies, electricity, gas and water companies, public network and infrastructure operators (airports, ports, etc.), social housing companies, care and rest homes, economic development companies, environmental management companies, etc. The principles for financial analysis typically applied to private companies cannot be immediately transposed to them.

CHART 1 FORMAT USED BY COMPANIES IN THE ANALYSIS POPULATION

(units)



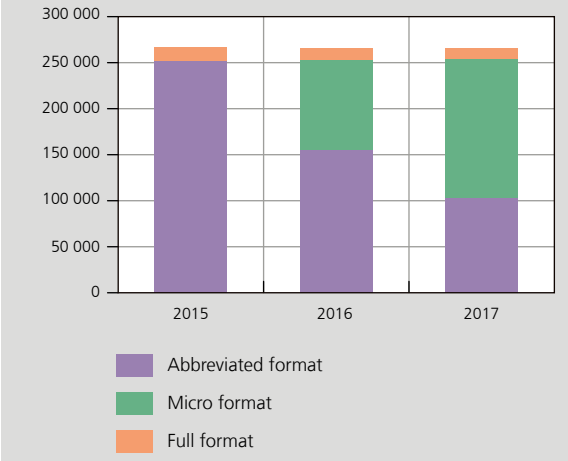
Source : NBB.

(1) Companies in the constant population.

With the 2017 population incomplete when this article went to press, it is not yet possible to gauge the extent to which the changeover influenced the relative shares of the various groups. Still, we note a gradual shift in the formats for corporations that have filed annual accounts in three successive years, a total of over 266 000 companies. In 2015, the full formats accounted for 5.4 % of total filings, with this share having come down to 4.3 % in 2017. This means that one in five companies that filed full-format accounts in 2015, i.e. a total of 3 000 firms, used the abbreviated or micro format in 2017. This shift is even more pronounced for the abbreviated formats, where the relative share fell from 95 % in 2015 to 58 % a year later and less than 40 % in 2017. The entire shift went to the micro format, which accounted for 57 % of the involved population in 2017.

CHART 2 FORMAT SHIFT IN COMPANIES FILING ANNUAL ACCOUNTS IN 2015, 2016 AND 2017

(in %)



Source : NBB.

1.2 Constant sample

As every year, the annual accounts relating to the last financial year studied – in this case 2017 – were not all available at the time of the analysis. That is because a considerable number of annual accounts are filed late or fail the arithmetical and logical checks conducted by the Central Balance Sheet Office. The data relating to 2017 are therefore estimated on the basis of a constant sample. The sample comprises firms which filed 12-month annual accounts that meet the quality checks of the Central Balance Sheet Office for both 2016 and 2017.

The method involves extrapolating the 2017 results according to the changes seen within the constant sample, which are presumed to be representative of the changes affecting the population as a whole. Firms from the constant sample are broken down into homogenous sub-groups by company size (corresponding to the filling format used), sector and region. We subsequently measure developments in key variables for each of these sub-groups, weight the recorded growth percentages based on the sub-group shares in the total and then arrive at an aggregate result for the total population. Our basic assumptions are largely borne out: in the majority of cases, these extrapolations give a good indication of the direction and scale of the real movements.

This year's constant sample was drawn on 20 September 2017. It comprises nearly 270 000 annual accounts, or 76.2 % of the total number of accounts filed for the 2017 financial year. Measured in terms of value added, the rate of representativeness comes to 80.2 %. This rate was a little higher in industry (83.3 %) than in services (79.2 %), energy (77.5 %) and construction (76.5 %). Note that this rate was pushed down by the absence of a very large retail trade company, whose annual accounts were not available when the constant sample was drawn.

2. Analysis population for the social data

2.1 Selection criteria for the analysis population

The non-financial corporations selected in keeping with the methodology as set out above do not all complete a social balance sheet; only those employing people on Belgian soil are obliged to do so.

Aside from having to meet the applicable selection criteria for the analysis of the financial results, companies eligible for the analysis of their social data should meet the following conditions:

- the number of FTEs should be positive, both in terms of their annual average and at the end of the year;
- the internal consistency of the data in social balance sheet tables should be assured[(1)];
- companies may not be active in the NACE-BEL 78 category for "employment activities", including employment placement and temporary employment agencies, due to their specific nature, making it hard to count their workforce, given the many that join and leave.

The number of eligible social balance sheets was around 120 000 for 2016, the last full financial year observed (see Annex 2), corresponding to 34 % of the companies in the selected population for the analysis of the financial results. However, their representativeness as measured in employment volumes (number of FTEs) is clearly higher and amounts to nearly 89 %.

2.2 Constant sample

Just as in the analysis of the financial results, developments relating to the 2017 financial year are extrapolated on the basis of those that are identified in the constant population of companies that have filed a 12-month social balance sheet that meet the quality checks of the Central Balance Sheet Office for each of the 2016 and 2017 financial years. The methodology is the same as the one described under 1.2.

(1) Social balance sheets lacking certain data – even if the law permits not including certain information for reasons of privacy protection of the employees – are also left out, as the internal consistency is not then assured.

This year's constant sample was drawn on 20 September 2017. It comprises nearly 83 000 corporations, or 69.2 % of the total number of companies selected for the analysis of the social data of the 2017 financial year. Measured in terms of employment in FTEs, the rate of representativeness comes to 78 %. This rate was a little higher in industry (79.7 %) and in energy (80.9 %), and lower in construction (73.1 %), as the annual accounts of small firms, which are strongly represented in the latter sector, are not given priority by the Central Balance Sheet Office, in view of their lower relative weight. For services, the rate of representativeness is close to the average (78.2 %) but was pushed down by the absence of a very large retail trade company, whose annual accounts were not available when the constant sample was drawn.

Annex 2 – Breakdown of analysis population by branch of activity

	NACE-BEL 2008 divisions	Analysis population of financial results in 2016		Analysis population of social data in 2016	
		Companies	Value added	Companies	Employment
		(units)	(in % of total)	(units)	(in % of total)
Industry	**05-33**	**22 137**	**29.6**	**12 350**	**25.5**
of which:					
Food industry	10-12	4 083	4.5	2 673	4.6
Chemicals	20	609	4.3	409	2.3
Pharmaceuticals	21	139	4.8	78	1.4
Metallurgy	24-25	4 334	3.6	2 556	4.0
Metal manufacturing	26-30	2 401	4.7	1 338	4.8
Energy, water and waste	**35-39**	**1 471**	**2.2**	**620**	**1.0**
Construction	**41-43**	**51 948**	**7.7**	**19 832**	**10.3**
Services	**45-82; 90-96**	**278 404**	**55.6**	**86 946**	**63.2**
of which:					
Trade in motor vehicles	45	11 452	3.1	5 334	3.1
Wholesale trade[1]	46	32 787	13.7	13 392	9.8
Retail trade[1]	47	38 107	6.7	18 322	13.9
Transportation and storage	49-53	11 577	6.4	5 589	8.0
Accommodation and food service activities	55-56	22 612	2.2	11 136	5.8
Information and communication	58-63	20 536	6.9	4 368	5.0
Real estate activities	68	32 849	2.9	3 520	0.7
Business services[2]	69-82	90 537	17.0	19 205	14.6
Total		**353 960**	**184 675**[3]	**119 748**	**1 784 806**[4]

Source: NBB.
(1) Excluding trade in motor vehicles.
(2) Excluding head office activities (NACE-BEL 70 100).
(3) In € million.
(4) Number of workers at the end of the financial year.

Annex 3 – Definition of the financial ratios

The globalised average is calculated as the sum of the numerators of all companies divided by the sum of their denominators. Hence, the globalised ratio is the weighted average of all ratios at individual company level, while the weight is the proportion of each company in the total value of the ratios denominator. As a result, the globalised average reflects the situation of companies with the largest denominator value.

The median equals the central value of an ordered distribution, with 50 % of companies having a ratio below the median.

Formulas for the ratios analysed are as follows:

	Item numbers allocated	
	Full format	Abbreviated format[1]
1. Gross margin on sales		
Numerator[2] (N)	9901 + 630 + 631/4 + 635/7	9901 + 630 + 631/4 + 635/7
Numerator[3] (N)	9901 – 76A + 66A + 630 + 631/4 + 635/8	9901 – 76A + 66A + 630 + 631/4 + 635/8
Denominator (D)	70 + 74 – 740	70
Condition for calculation of the ratio:		
Abbreviated format: D > 0		
2. Net margin on sales		
Numerator[2] (N)	9901 + 9125	9901 + 9125
Numerator[3] (N)	9901 – 76A + 66A + 9125	9901 – 76A + 66A
Denominator (D)	70 + 74 – 740	70
Condition for calculation of the ratio:		
Abbreviated format: D > 0		
3. Investment margin		
Numerator (N)	8169 + 8229 – 8299	8169 + 8229 – 8299
Denominator[2] (D)	70/74 – 740 – 60 – 61	9900
Denominator[3] (D)	70/76A – 76A – 740 – 60 – 61	9900 – 76A
Condition for calculation of the ratio:		
D > 0[4]		
4. Net return on total assets before tax and financial charges, excluding exceptional results (= economic profitability)		
Numerator[2] (N)	9904 + 650 + 653 – 9126 + 9134 – 76 + 66	9904 + 65 – 9126 + 67/77 – 76 + 66
Numerator[3] (N)	9904 + 650 + 653 – 9126 + 9134 – 76A – 76B + 66A + 66B	9904 + 65 + 67/77 – 76A – 76B + 66A + 66B
Denominator (D)	20/58	20/58
Condition for calculation of the ratio:		
12-month financial year		

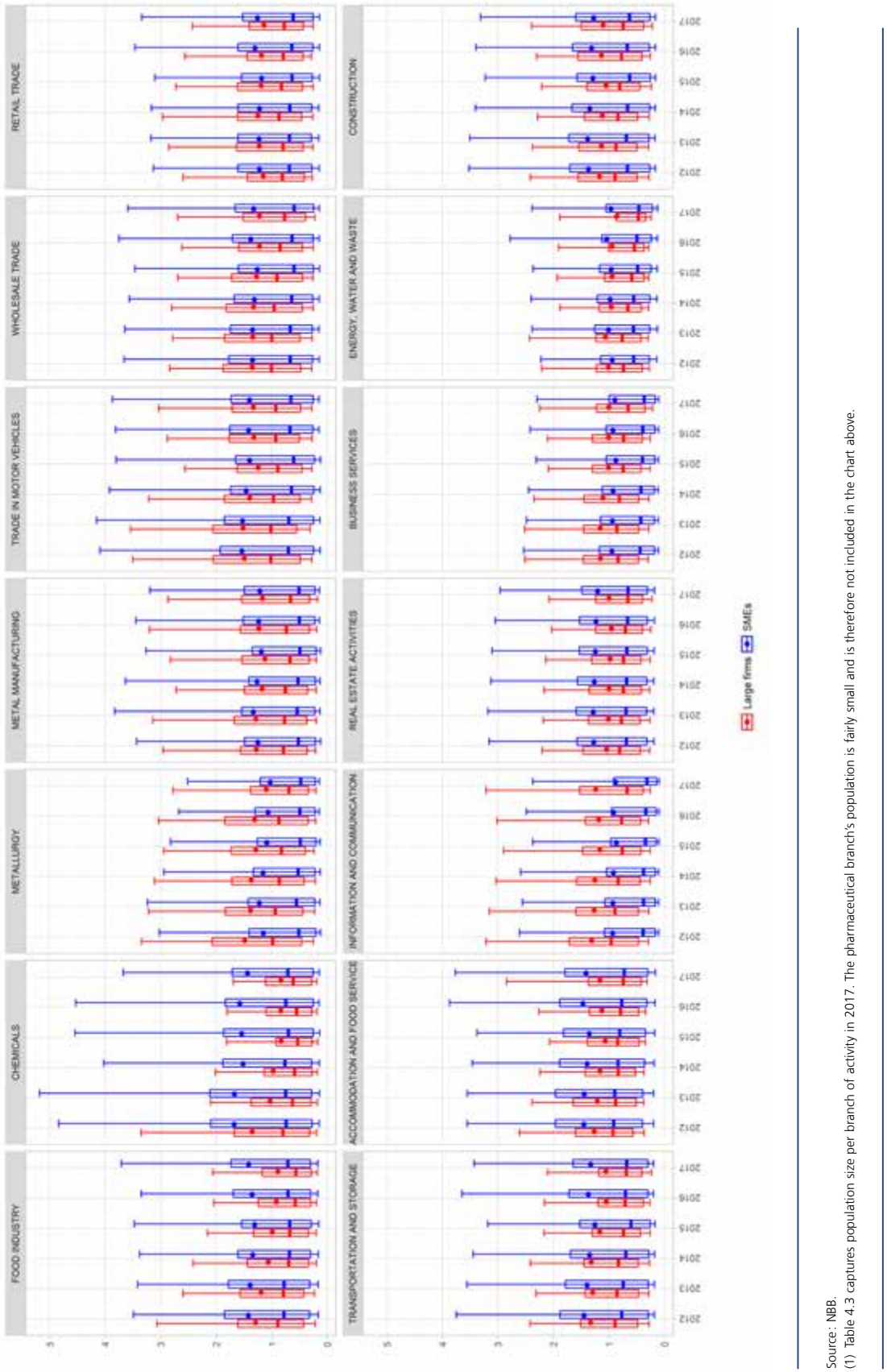
(1) Formulas for financial years commencing after 31 December 2015 are also valid for the micro format.
(2) Financial years commencing before 1 January 2016.
(3) Financial years commencing after 31 December 2015.
(4) Condition valid for calculating the median ratio but not the globalised ratio.

	Item numbers allocated	
	Full format	Abbreviated format[1]
5. Net return on total assets before tax (after financial charges), excluding exceptional results (= financial profitability)		
Numerator[2] (N)	9904 + 9134 – 76 + 66	9904 + 67/77 – 76 + 66
Numerator[3] (N)	9904 + 9134 – 76A – 76B + 66A + 66B	9904 + 67/77 – 76A – 76B + 66A + 66B
Denominator (D)	10/15	10/15
Conditions for calculation of the ratio:		
12-month financial year		
D > 0[4]		
6. Net return on equity, excluding exceptional results		
Numerator[2] (N)	9904 – 76 + 66	9904 – 76 + 66
Numerator[3] (N)	9904 – 76A – 76B + 66A + 66B	9904 – 76A – 76B + 66A + 66B
Denominator (D)	10/15	10/15
Conditions for calculation of the ratio:		
12-month financial year		
D > 0[4]		
7. Net return on operating assets		
Numerator[2] (N)	9901	9901
Numerator[3] (N)	9901 – 76A + 66A	9901 – 76A + 66A
Denominator (D)	20 + 21 + 22/27 + 3 + 40/41 + 490/1	20 + 21 + 22/27 + 3 + 40/41 + 490/1
Conditions for calculation of the ratio:		
12-month financial year		
D > 0[4]		
8. Degree of financial independence		
Numerator (N)	10/15	10/15
Denominator (D)	10/49	10/49
9. Degree of self-financing		
Numerator (N)	13 + 14	13 + 14
Denominator (D)	10/49	10/49
10. Average interest charges on financial debt		
Numerator[2] (N)	650	65 – 9125 – 9126
Numerator[3] (N)	650	65
Denominator (D)	170/4 + 8801 + 43	170/4 + 42 + 43
Condition for calculation of the ratio:		
12-month financial year		
11. Net short-term debt ratio		
Numerator (N)	42/48 + 492/3 – 54/58	42/48 + 492/3 – 54/58
Denominator (D)	20/58	20/58

(1) Formulas for financial years commencing after 31 December 2015 are also valid for the micro format.
(2) Financial years commencing before 1 January 2016.
(3) Financial years commencing after 31 December 2015.
(4) Condition valid for calculating the median ratio but not the globalised ratio.

Annex 4 – Additional information about credit risk analysis

4.1 Breaking down of ICAS credit risk scores by branch of activity[1] and company size



Source : NBB.
(1) Table 4.3 captures population size per branch of activity in 2017. The pharmaceutical branch's population is fairly small and is therefore not included in the chart above.

4.2 Conversion table

Credit risk classes	Corresponding ICAS credit risk scores	ECAI rating categories
1	[0 – 0.079]	AAA to A
2	[0.079 – 0.126]	A–
3	[0.126 – 0.199]	BBB+
4	[0.199 – 0.314]	BBB
5	[0.314 – 0.492]	BBB–
6	[0.492 – 0.765]	BB+
7	[0.765 – 1.179]	BB
8	[1.179 – 1.795]	BB–
9	[1.795 – 2.695]	BB– / B+
10	[2.695 – 3.985]	B+
11	[3.985 – 5.787]	B+ / B
12	[5.787 – 8.238]	B
13	[8.238 – 11.473]	B–
14	[11.473 – 100]	CCC/C

Source: NBB.

4.3 Number of companies used in estimating ICAS credit risk scores

	Large companies	SMEs
Food industry	416	3 198
Chemicals	152	331
Pharmaceuticals	30	84
Metallurgy	281	3 675
Metal manufacturing	270	1 827
Trade in motor vehicles	607	9 678
Wholesale trade	2 071	26 497
Retail trade	593	33 572
Transportation and storage	788	9 216
Accommodation and food service activities	163	19 501
Information and communication	439	18 132
Real estate activities	700	29 294
Business services	1 230	81 486
Energy, water and waste	193	1 080
Construction	951	46 191

Source: NBB.

Abstracts from the Working Papers series

344. Trade and Domestic Production Networks, by F. Tintelnot, A. Kikkawa, M. Mogstad, E. Dhyne, September 2018

The authors use Belgian data with information on domestic firm-to-firm sales and foreign trade transactions to study how international trade affects firm efficiency and real wages. The data allow them to accurately construct the domestic production network of the Belgian economy, revealing several new empirical facts about firms' indirect exposure to foreign trade through their domestic suppliers and buyers. The authors use those data to develop and estimate models of domestic production networks and international trade.

They first consider a model of trade with an exogenous network structure, which provides analytical solutions for the effects of a change in the price of foreign goods on firms' production costs and real wages. To examine how gains-from-trade calculations change if buyer-supplier links are allowed to form or break in response to changes in the price of foreign goods, they next develop a model of trade with endogenous network formation. They take both models to the data and compare the empirical results to those they obtain using existing approaches. This comparison highlights the relevance of data on and modelling of domestic production networks in studies of international trade.

345. Central banking through the centuries, by I. Maes, October 2018

Anniversaries are occasions for remembrance and reflections on one's history. Many central banks take the occasion of an anniversary to publish books on their history. In this essay the author discusses five recent books on the history of central banking and monetary policy. In these volumes, the Great Financial Crisis and the way in which it obliged central banks to reinvent themselves occupies an important place. Although this was certainly not the first time in the history of central banking, the magnitude of the modern episode is remarkable. As comes clearly to the fore in these volumes, there is now, also in the historiography of central banking, much more attention being paid to the (shifting) balance between price stability and financial stability. The history of central banking is more perceived as one of an institution whose predominant concern varied between 'normal' times and 'extraordinary' times. So, central banks will have to remain vigilant, as one should expect financial crises to return. Moreover, the new world of central banking, with a greater responsibility of central banks for financial stability, will make life more complicated for central banks. It may also have consequences for central bank independence, as the modalities of the two mandates, price and financial stability, are not the same. Another aspect which comes to the fore in these volumes is the relationship between central banking and state formation. Historically, central banks have been embedded in processes of nation-building. By extending their network of branches across the country, or by being at a centre of a system of liquidity provision, ultimately tied to the national currency, they played a key role in the shaping of 'national economies'.

346. IT and productivity: A firm level analysis, by E. Dhyne, J. Konings, H. Van den Bosch, S. Vanormelingen, October 2018

Using a novel comprehensive data set of IT investment at the firm level, the authors find that a firm investing an additional euro in IT increases value added by 1 euro and 38 cents on average. This marginal product of IT investment increases with firm size and varies across sectors. IT explains about 10 % of productivity dispersion across firms. While they find substantial returns of IT at the firm level, such returns are much lower at the aggregate level. This is due to underinvestment in IT (IT capital deepening is low) and misallocation of IT investments.

347. Identifying credit supply shocks with bank-firm data: methods and applications, by H. Degryse, O. De Jonghe, S. Jakovljevic, K. Mullier, G. Schepens, October 2018

Current empirical methods to identify and assess the impact of bank credit supply shocks rely strictly on multi-bank firms and ignore firms borrowing from only one bank. Yet, these single-bank firms are often the majority of firms in an economy and most prone to credit supply shocks. The authors propose and underpin an alternative demand control (using industry-location-size-time fixed effects) that allows identifying time-varying cross-sectional bank credit supply shocks using both single- and multi-bank firms. Using matched bank-firm credit data from Belgium, they show that firms borrowing from banks with negative credit supply shocks exhibit lower financial debt growth, asset growth, investments, and operating margin growth. Positive credit supply shocks are associated with bank risk-taking behaviour at the extensive margin. Importantly, to capture these effects it is crucial to include the single-bank firms when identifying the bank credit supply shocks.

348. Can inflation expectations in business or consumer surveys improve inflation forecasts?, by R. Basselier, D. de Antonio Liedo, J. Jonckheere, G. Langenus, October 2018

In the paper the authors develop a new model that incorporates inflation expectations and can be used for the structural analysis of inflation, as well as for forecasting. In this latter connection, they specifically look into the usefulness of real-time survey data for inflation projections. They contribute to the literature in two ways. First, their model extracts the inflation trend and its cycle, which is linked to real economic activity, by exploiting a much larger information set than typically seen in this class of models and without the need to resort to Bayesian techniques. The reason is that they use variables reflecting inflation expectations from consumers and firms under the assumption that they are consistent with the expectations derived from the model. Thus, their approach represents an alternative way to shrink the model parameters and to restrict the future evolution of the factors. Second, the inflation expectations that they use are derived from the qualitative questions on expected price developments in both the consumer and the business surveys. This latter source, in particular, is mostly neglected in the empirical literature. Their empirical results suggest that, overall, inflation expectations in surveys provide useful information for inflation forecasts. In particular for the most recent period, models that include survey expectations on prices tend to outperform similar models that do not, both for Belgium and the euro area. Furthermore, it is found that the business survey, i.e. the survey replies by the price-setters themselves, makes the largest contribution to these forecast improvements.

349. Quantile-based Inflation Risk Models, by E. Ghysels, L. Iania, J. Striaukas, October 2018

The paper proposes a new approach to extract quantile-based inflation risk measures using Quantile Autoregressive Distributed Lag Mixed Frequency Data Sampling (QADL-MIDAS) regression models. The authors compare their models to a standard Quantile Autoregression (QAR) model and show that it provides better quantile forecasts at several forecasting horizons. They use the QADL-MIDAS model to construct inflation risk measures proxying for uncertainty, third-moment dynamics and the risk of extreme inflation realisations. They find that these risk measures are linked to the future evolution of inflation and changes in the effective federal funds rate.

350. International food commodity prices and missing (dis)inflation in the euro area, by G. Peersman, October 2018

The paper examines the causal effects of shifts in international food commodity prices on euro area inflation dynamics using a structural VAR model that is identified with an external instrument (i.e. a series of global harvest shocks). The results reveal that exogenous food commodity price shocks have a strong impact on consumer prices, explaining on average 25 %-30 % of inflation volatility. In addition, large autonomous swings in international food prices contributed significantly to the twin puzzle of missing disinflation and missing inflation in the in the aftermath of the Great Recession. Specifically, without disruptions in global food markets, inflation in the euro area would have been 0.2 %-0.8 % lower in the period 2009-2012 and 0.5 %-1.0 % higher in 2014-2015. An analysis of the transmission mechanism shows that international food price shocks have an impact on food retail prices through the food production chain, but also trigger indirect effects via rising inflation expectations and a depreciation of the euro.

351. Pipeline Pressures and Sectoral Inflation Dynamics, by F. Smets, J. Tielens, J. Van Hove, October 2018

In a production network shocks originating in individual sectors do not remain confined to individual sectors but permeate through the pricing chain. The notion of 'pipeline pressures' alludes to this cascade effect. In the paper the authors provide a structural definition of pipeline pressures to inflation and use Bayesian techniques to infer their presence from quarterly U.S. data. They document two insights. (i) Due to price stickiness along the supply chain, they show that pipeline pressures take time to materialise which renders them an important source of inflation persistence. (ii) As they trace their origins to 35 disaggregate sectors, pipeline pressures are documented to be a key source of headline/disaggregated inflation volatility. Finally, they contrast the results to the dynamic factor literature which has traditionally interpreted the co-movement of price indices arising from pipeline pressures as aggregate shocks. The results highlight the role of sectoral shocks – joint with the production architecture – to understand the micro origins of disaggregate/headline inflation persistence/volatility.

352. Price Updating in Production Networks, by C. Duprez, G. Magerman, October 2018

The paper evaluates how firms change their prices in response to cost shocks and other price changes in their environment. The authors first document three new facts on the heterogeneity of firm-level producer prices and their relationship to buyers and suppliers in a production network. They then develop a non-parametric framework of how producers update their prices, taking into account this production network. The framework is very general, and accounts for the heterogeneity in price changes and the production network from the stylised facts. Moreover, the framework is consistent with various price-setting mechanisms, and does not impose a particular market structure or demand functional form. Exploiting rich data on producer prices and the network structure of production in Belgium, the model to evaluate the importance of both channels in the data is estimated. It is found that, on average, input price pass-through is incomplete and very much below one, while firms also strongly react to other prices in their environment. This implies that firms can adjust their markups in response to both cost shocks and prices of other firms. Furthermore, firms react differently to common shocks than to idiosyncratic shocks, on average completely passing through common shocks, but much less idiosyncratic shocks.

353. Dominant currencies How firms choose currency invoicing and why it matters, by M. Amiti, O. Itskhoki, J. Konings, October 2018

Large movements in exchange rates have small effects on the prices of internationally traded goods. Using a new dataset on currency invoicing of Belgian firms, the authors study how the currency of invoicing interacts with firm characteristics in shaping the extent of exchange rate pass-through at various time horizons. The US dollar and the Euro are the dominant currencies in both Belgium's exports and imports, with substantial variation in currency choice across firms and products even within narrowly defined manufacturing industries. They find that smaller, non-import-intensive firms tend to denominate their exports in euro (producer currency pricing) and exhibit nearly complete exchange-rate pass-through into destination currency prices at all horizons. In contrast, the largest most import-intensive firms, and in particular with

imports denominated in US dollars, tend to denominate their exports also in US dollars (dominant currency pricing) and exhibit very low pass-through in the short run, which gradually increases to 40–50 % pass-through at the annual horizon.

The authors show that these empirical patterns are in line with the predictions of a theoretical framework featuring heterogeneous firms with variable markups, endogenous international input sourcing and staggered price setting with endogenous currency choice. It is proposed to use a variant of a such model, disciplined with the Belgian firm-level data, for counterfactual analysis of the gradual increase in the use of the euro in international trade flows.

354. Endogenous forward guidance, by B. Chafwehé, R. Oikonomou, R. Priftis, L. Vogel, October 2018

The authors propose a novel framework where forward guidance (FG) is endogenously determined. Their model assumes that a monetary authority solves an optimal policy problem under commitment at the zero lower bound. FG derives from two sources: 1. from commiting to keep interest rates low at the exit of the liquidity trap, to stabilise inflation today. 2. From debt sustainability concerns, when the planner takes into account the consolidated budget constraint in optimisation. Their model is tractable and admits an analytical solution for interest rates in which 1 and 2 show up as separate arguments that enter additively to the standard Taylor rule.

In the case where optimal policy reflects debt sustainability concerns (satisfies the consolidated budget), monetary policy becomes subservient to fiscal policy, giving rise to more volatile inflation, output and interest rates. Liquidity trap (LT) episodes are longer, however, the impact of interest rate policy commitments on inflation and output are moderate (?). 'Keeping interest rates low' for a long period, does not result in positive inflation rates during the LT. In contrast, the model consistently predicts negative inflation at the onset of a LT episode.

On the other hand, in the absence of debt concerns, LT episodes are shorter, but the impact of commitments to keep interest rates low at the exit from the LT, on inflation and output is substantial. In this case, monetary policy accomplishes to turn inflation positive at the onset of the episode, through promising higher inflation rates in future periods.

The authors embed their theory into a DSGE model and estimate it with US data. Their findings suggest that FG during the Great Recession may have partly reflected debt sustainability concerns, but more likely policy reflected a strong commitment to stabilize inflation and the output gap.

Thus, their quantitative findings are broadly consistent with the view that the development of debt aggregates may have had an impact on monetary policy in the Great Recession, but this impact is likely to be minor.

355. Is euro area lowflation here to stay? Insights from a time-varying parameter model with survey data, by A. Stevens, J. Wauters, October 2018

Inflation has been persistently weak in the euro area, despite the economic recovery since 2013. The authors investigate the sources behind this protracted low inflation by building a time-varying parameter model that jointly explains the dynamics of inflation and inflation expectations from the ECB Survey of Professional Forecasters. They find that the inclusion of survey data strengthens the view that low inflation was mainly due to cyclical drivers. In particular, the model with survey expectations finds a more muted decline of trend inflation in recent years and a larger degree of economic slack. The impact of economic slack and import prices on inflation is found to have increased in recent years. They also find that survey expectations have become less persistent over the financial crisis period, and that including survey data improves the model's out-of-sample forecasting performance.

356. A price index with variable markups and changing variety, by T. Demuynck, M. Parenti, October 2018

The paper proposes an estimation of an augmented Tornqvist price-index – featuring demand shifters – which is exact for homothetic translog preferences. Contrary to previous work based on a constant elasticity of substitution across varieties, this demand system allows for changes in markups even when the number of products is large. The authors

then propose a structural decomposition of this index in terms of changes in markups, productivity, variety and demand shocks. They illustrate their approach using sample data from ACNielsens Homescan Panel. For instance, the results are consistent with competition effects where a decrease in per-product demand translates into lower markups.

357. Markup and price dynamics: linking micro to macro, by J. De Loecker, C. Fuss, J. Van Biesebroeck, October 2018

The authors analyse the aggregate markup of a small open economy, Belgium, using a firm-level dataset that includes all non-financial, private firms. The dataset covers the period 1980-2016 and merges the annual firm accounts over three periods when firms faced different reporting thresholds for the key variables they use. After harmonising the data, they find that for the median firm the revenue share of service intermediates doubles, to some extent at the expense of in-house employment.

As this general patterns holds true for the vast majority of firms and all sectors of the economy, they must control for it in the calculation of their firm-level markup estimates.

The authors document increasing markups in the overall economy throughout the first fifteen years of their sample, 1980-1995, and a continued rise in manufacturing until the early 2000s. In the remaining years, the aggregate markup, although cyclical, remained relatively stable. These patterns are driven by the dynamics in the sales-to-expenditure ratio, with only a small role for changes in the technology parameters. Two decompositions illustrate that the aggregate pattern masks systematic dynamics at the sector and firm level. The authors find that in periods where the aggregate markup rises – for the full economy or for one of the major sectors – it is almost entirely due to the within component, i.e. firm-level markup growth. In periods where the aggregate markup is stable, the average hides a strong process of re-allocation. Firms or sectors with high markups increase their market share, which raises the aggregate markup, but this is dominated by a negative correlation between changes in market share and markups, which depresses the aggregate.

358. Productivity, wages and profits: Does firms' position in the value chain matter?, by B. Mahy, F. Rycx, G. Vermeylen, M. Volral, October 2018

The paper is the first to estimate the impact of a direct measure of firm-level upstreamness on productivity, wage costs and profits (i.e. productivity-wage gaps). To that end, the authors merged detailed Belgian linked panel data, covering all years from 2002 to 2010, to a unique dataset developed by Dhyne *et al.* (2015), which contains accurate information on the position of (almost) each commercial firm in the value chain at each year. They rely on the methodological framework that has been pioneered by Hellerstein *et al.* (1999) to estimate dynamic panel data models at the firm level. Their estimates show that if upstreamness increases by one step (that is, by approximately, one standard deviation), productivity rises on average by 5 %. They also indicate that productivity gains associated to upstreamness are shared almost equally between wages and profits. However, upstreamness is found to be more beneficial for workers' wages in less competitive environments, where the price elasticity of demand for firms' products is typically smaller. Overall, these findings are compatible with the assertion that firms should move up the value chain to be more productive and profitable, but also that being higher in the value chain is likely to facilitate firms' control over strategic downstream activities. The results can also be understood through the application of the Melitz (2003) model to the value chain framework.

359. Upstreamness, social upgrading and gender: Equal benefits for all?, by N. Gagliardi, B. Mahy, F. Rycx, December 2018

The paper examines social upgrading related to firms' participation in Global Value Chains (GVCs) from a developed countries' perspective. Merging detailed matched employer-employee data relative to the Belgian manufacturing industry with unique information on firm-level upstreamness, the authors examine whether workers on the upstream stage of GVCs benefit from higher wages. They also enrich their analysis with a gender dimension. Unconditional quantile regressions and decomposition methods reveal that firms' upstreamness fosters workers' social upgrading. Nevertheless, gains are found to be unequally shared among workers. Male top earners are the main beneficiaries; whereas women, irrespective of their earnings, appear to be unfairly rewarded.

Conventional signs

%	per cent
e	estimate
e.g.	*exempli gratia* (for example)
etc.	*et cetera*
i.e.	*id est* (that is)
p.m.	*pro memoria*
EUR	euro
GBP	pound sterling
USD	US dollar

List of abbreviations

Countries or regions

BE	Belgium
DE	Germany
EE	Estonia
IE	Ireland
EL	Greece
ES	Spain
FR	France
IT	Italy
LT	Lithuania
LU	Luxembourg
NL	Netherlands
AT	Austria
PT	Portugal
SK	Slovakia
FI	Finland
EA	Euro area
CZ	Czech Republic
DK	Denmark
PL	Poland
SE	Sweden
UK	United Kingdom
EU	European Union
AU	Australia
CA	Canada
CH	Switzerland
JP	Japan
NO	Norway
US	United States

Other abbreviations

ABEX	Belgian Association of Surveyors
Actiris	Brussels regional employment office
AUC	Area under the curve
DGS	Directorate General Statistics
DIMONA	Déclaration IMmédiate/ONmiddelijke Aangifte (electronic declaration for notifying hirings and departures to social security authorities)
DSTI	Debt-service-to-income ratio
EC	European Commission
ECB	European Central Bank
ECM	Error correction model
ESA	European System of Accounts
ESRB	European Systemic Risk Board
Fed	Federal Reserve
FOMC	Federal Open Market Committee
Forem	Walloon public service for vocational training and employment
FPB	Federal Planning Bureau
FPS	Federal Public Service
FTE	Full-time equivalent
GARCH	Generalised auto-regressive conditional heteroskedasticity
GDP	Gross domestic product
HCE	High Council for Employment
HFCS	Household Finance and Consumption Survey
HICP	Harmonised index of consumer prices
ICAS	In-House Credit Assessment System
ICT	Information and communication technology
IMF	International Monetary Fund
ING	Internationale Nederlanden Groep
IRB	Internal ratings-based approach
ISCED	International Standard Classification for Education
ISCO	International Standard Classification of Occupations
IT	Information technology
IWEPS	Institut wallon de l'évaluation, de la prospective et de la statistique (Walloon Institute for Evaluation, Forecasting and Statistics)
LATDS	Liquid-assets-to-debt-service ratio
LTCM	Long-term capital management
MAE	Mean absolute error
NACE	Nomenclature of economic activities in the European Community
NACE-BEL	Nomenclature of economic activities of the European Community Belgian version
NAI	National Accounts Institute
NAIRU	Non-accelerating inflation rate of unemployment
NAWRU	Non-accelerating wage rate of unemployment
NBB	National Bank of Belgium

NBER	National Bureau of Economic Research
NCPI	National consumer price index
NEO	National Employment Office
NPI	Non-profit institution
OECD	Organisation for Economic Cooperation and Development
OFR	Office of Financial Research
OLO	Linear bond (obligation linéaire/lineaire obligatie)
ONS	Office for National Statistics (United Kingdom)
PMR	Product Market Regulation
R&D	Research and development
RMSE	Root-mean-square error
S&P	Standard and Poor's
SME	Small and medium-sized enterprise
Statbel	Belgian statistical office
STEM	Science, Technology, Engineering and Mathematics
TFP	Total factor productivity
VaR	Value at risk
VAT	Value added tax
VDAB	Vlaamse Dienst voor Arbeidsbemiddeling en Beroepsopleiding (Flemish public employment service)
VIX	S&P 500 Volatility Index
VSTOXX	Euro Stoxx 50 Voliatility Indicator

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