International Macroeconomic Implications of Gradual Portfolio Adjustment

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Motivation

- Modern international macro/finance models: Expected excess returns are small as portfolio positions are assumed to adjust immediately to shocks
  - May imply large portfolio changes
- Often directly assume Uncovered Interest rate Parity (UIP). Or linearization methods produce trivial portfolio decisions
- In these models financial shocks, e.g. exogenous portfolio shifts, have little impact
- Inconsistent with the data

Conflicting Evidence

1. Expected excess returns can be large and vary over time
   - Both for short-term debt and equity
   - Even predictable, but sign of predictability changes with the horizon
   - Short-term returns on long-term bonds not predictable

2. Capital flows do not react strongly to expected excess returns
   - Passive portfolio investors
   - Autocorrelated portfolio flows
   - Link between flows and lagged return

3. Financial shocks affect capital flows and asset prices
   - Gabaix-Koijen (2020) (Inelastic market hypothesis)
   - Large-scale FX intervention

Recent Developments: Risk and Market Segmentation

- Gabaix-Maggiori (QJE 2015) propose a model where all transactions go through financial intermediaries
  - This increases the overall degree of risk aversion as intermediaries are risk averse and have large positions
  - This in turn can generate significant expected return differentials
- This can also be attained by increasing the level of risk, e.g. introducing disaster risk (e.g. Dou-Verdelhan, 2015)
- Various forms of segmentation
  - E.g., Greenwood, Hanson, Stein, Sunderam (2020), Gourinchas, Ray, Vayanos (2020)
- Role of financial shocks
  - UIP shocks (Kollman, 2002)
  - Itskhoki-Mukhin (2019)

Our Approach: Gradual or Infrequent Portfolio Adjustment

- Widespread evidence of limited or infrequent portfolio adjustment at the investor level
  - E.g. Giglio, Maggiori, Stroebel, and Utkus (2019) on US retail investors

- Huge volume in financial markets, but outstanding positions of frequent traders are not large

$\Rightarrow$ Frequent trading may not offset the impact of slow portfolio adjustments

- Gradual portfolio adjustment implies smaller response of portfolios and thus larger movements in expected excess returns
  - No need to assume large risk aversion
  - Is a form of endogenizing market segmentation
  - Has a different dynamic impact, implying a lagged response of portfolios to shocks

Our Recent Work

- We find that open economy models with infrequent portfolio adjustment can explain many stylized facts
- In Bacchetta and van Wincoop (AER 2010) we used this approach to explain the forward premium puzzle
  - Inspired by Froot and Thaler (1990) who suggested that the forward discount puzzle can be explained by delayed portfolio adjustment
- In several recent papers we analyze further implications of gradual international portfolio adjustment
- In this presentation I will
  1. Explain the general approach
  2. Mention some applications
  3. Describe our empirical evidence

Modeling Gradual Portfolio Adjustment

1. Investors adjust their portfolio every T period in a staggered way
   - $1/T$ investors adjust their portfolio in each period and there are T overlapping portfolios
   - Most papers in finance assume a fixed frequency of adjustment

2. Constant probability p of adjusting portfolio
   - As in Calvo pricing
   - Portfolios depend on present value of returns with declining weight $\beta(1-p)$

3. Cost of adjusting portfolios
   - Either portfolio shares or portfolio values

Optimal Portfolios with Frequent Investors

- Optimal portfolio share in Foreign equity by Home investors: z_t
- Excess return:

$$er_{t+1} = R_{F,t+1} - R_{H,t+1}$$

- Frequent portfolio adjustment :

$$z_t = \frac{E_t er_{t+1}}{\gamma \sigma^2} + \bar{z}_t$$

where $\bar{z}_t$ is made of various elements (e.g., hedging terms) including portfolio shifts. Can represent **financial shocks**

- Assume only frequent investors, both Home and Foreign and consider market equilibrium

- Shocks to excess returns or financial shocks have very little impact on asset prices or exchange rate as $\gamma \sigma^2$ is small

Optimal Portfolio with Costly Adjustment

- Assume a quadratic cost of adjusting the portfolio:

$$0.5\psi \left(z_t - z_{t-1}\right)^2$$

- Assume myopic (two-period OLG) investors. Optimal portfolio:

$$z_t = \frac{\psi}{\psi + \gamma\sigma^2} z_{t-1} + \frac{\gamma\sigma^2}{\psi + \gamma\sigma^2} z_t^f$$

- Weighted average of past portfolio and *frequent* portfolio

- Portfolio can be rewritten as:

$$z_t = \underbrace{\frac{\psi}{\psi + \gamma\sigma^2} z_{t-1}}_{\text{Portfolio persistence}} + \underbrace{\frac{1}{\psi + \gamma\sigma^2} E_t er_{t+1}}_{\text{Return sensitivity}} + \tilde{z}_t$$

Remarks on Optimal Portfolio with Costly Adjustment

- With infinite horizon, discounted future expected excess returns also matter.
  - Discounting depends on ψ
- If we assume a probability p of changing the portfolio instead of an adjustment cost, we get a related portfolio demand with weight on past portfolio of $1 - p$
  - Link between ψ and p: increasing ψ is similar to decreasing p
- If the adjustment is about portfolio values rather than portfolio shares, there is also a valuation effect
  - This can also be represented as a deviation from buy-and-hold portfolio

Implications of Portfolios with Costly Adjustment

- Assume all investors have costly adjustment and consider market equilibrium
- Shocks to expected excess returns or financial shocks generate a small portfolio response $\Rightarrow$ larger excess return change is required
  - Similar to very large risk aversion, implies market segmentation
  - Explains excess return and large impact of flows (Gabaix-Koijen)
- If shock is persistent portfolio adjustment will continue in future periods $\Rightarrow$ predictability
- If shock is not permanent, portfolio changes will be reversed and there will be a change in the sign of predictability
- Also explains delayed overshooting of asset price

Applications

1. Bacchetta and van Wincoop (2021), "Puzzling Exchange Rate Dynamics and Delayed Portfolio Adjustment"

- Simple model with myopic investors and adjustment cost

- Analytically tractable. Implies an AR(2) process for the exchange rate:

$$E_t q_{t+1} - \theta q_t + b\psi q_{t-1} + r_t^D = 0$$

where $\theta = 1 + \psi b + \gamma \sigma^2 b$ and r_t^D is return differential

- Can explain six puzzles of exchange rates including e.g. forward premium puzzle, delayed overshooting, predictability sign reversal, exchange rate forward puzzle, or lack of predictability for long-term bonds

Applications

2. Bacchetta, van Wincoop, and Young (2020,) "Infrequent Random Portfolio Decisions in an Open Economy Model"

- Two-country model with equity portfolio and returns. Assume a probability p of changing portfolios.
- Solved with global methods
- Can match the behavior of equity returns and portfolios. Requires significant financial shocks

Empirical Evidence on Mutual Funds

- Bacchetta, Tièche, and van Wincoop (2020) "International Portfolio Choice with Frictions: Evidence from Mutual Funds"

- We analyze international equity positions of U.S. mutual fund from EPFR database
  - Mutual funds account for 60 percent of U.S. foreign equity holdings

- We use a simple model with portfolio frictions inspired by Gârleanu and Pedersen (2013), where funds maximize a mean-variance utility function with quadratic adjustment costs

- We first estimate expected return differentials

- We then turn to portfolio regressions with fund-level data

Theoretical Framework

- Partial Equilibrium : Mutual funds behavior
- A fund can allocate its portfolio across two country assets with gross returns $R_{1,t+s}$ and $R_{2,t+s}$
- Represents allocation between country *1* and other countries
- $z_t, (1 - z_t)$: Share invested in assets 1 and 2
- σ_1^2, σ_2^2: Variance returns of assets 1 and 2 (covariance σ_{12})

Portfolio Frictions

- Modeled by quadratic adjustment costs with two benchmarks:

1. Past portfolio: $0.5\psi_1(z_t - z_{t-1})^2$
2. Buy-and-hold portoflio: $0.5\psi_2(z_t - z_t^{bh})^2$

- Maximize the present value of future expected returns, penalized for risks and frictions:

$$\sum_{s=0}^{\infty} \beta^s E_t \left(z_{t+s} R_{1,t+s+1} + (1 - z_{t+s}) R_{2,t+s+1}\right)$$

$$-0.5\gamma \sum_{s=0}^{\infty} \beta^s \left(z_{t+s}^2 \sigma_1^2 + (1 - z_{t+s})^2 \sigma_2^2 + 2 z_{t+s}(1 - z_{t+s})\sigma_{12}\right)$$

$$-0.5 \sum_{s=0}^{\infty} \beta^s E_t \left(\psi_1 (z_{t+s} - z_{t+s-1})^2 + \psi_2 (z_{t+s} - z_{t+s}^{bh})^2\right)$$

Portfolio Regression

- Optimal Portfolio

$$z_t = a_1 + a_2 \left(\frac{\psi_1}{\psi_1 + \psi_2} z_{t-1} + \frac{\psi_2}{\psi_1 + \psi_2} z_t^{bh} \right) + a_3 \sum_{s=1}^{\infty} \delta^{s-1} E_t er_{t+s}$$

- Consistent with the model, we consider the following regression:

$$\begin{aligned} z_{i,n,t} &= b_{int} + b_1 \frac{z_{i,n,t-1} + z_{i,n,t}^{bh}}{2} + b_2 \left(z_{i,n,t-1} - z_{i,n,t}^{bh} \right) \\ &\quad + b_3 E_t er_{i,n,t,t+k}^{\delta} + \varepsilon_{i,n,t} \end{aligned}$$

- Parameters can be linked to structural parameters

- Discounted expected excess returns are fund specific (weighted by fund share)

- Need to find a measure for $\sum_{s=1}^{\infty} \delta^{s-1} E_t er_{t+s}$

- We construct $E_t er^{\delta}_{i,n,t,t+k}$

  1. Compute discounted present value of excess returns between US and other 35 countries, with discount rate δ and horizon k
  2. We show results for $k = 24$ and $k = 60$
  3. δ has to be consistent with the estimated parameters: iterative procedure
  4. Linear panel regression of $er^{\delta}_{n,t,t+k}$ on momentum, dividend-price, and earning-price differentials. Compute country-level discounted expected excess return
  5. For each fund, use country shares to compute fund-specific discounted relative returns

Regression Specification

Endogeneity issue:

1. Funds are very small and cannot influence equity returns

2. Country-level factors (e.g. aggregate portfolio shifts) could affect both portfolios and equity price. Can be captured by country-month fixed effect
   - This is possible because of fund-specific excess returns

- Also add fund-country fixed effect: captures differences in funds' style

- First assume same regression coefficients across funds. Then explore various forms of heterogeneity

Sample

- EPFR US-based equity funds with more than USD 5mio at the end of the sample and that report at least 12 months (316 funds)
- 35 investment countries. January 2002 - July 2016
- At the fund level, we drop countries where investment $< 2\%$. We only consider observations where fund *i* positively invests in country *n* both at time *t* and *t-1*
- Pooled regressions, 316'732 observations

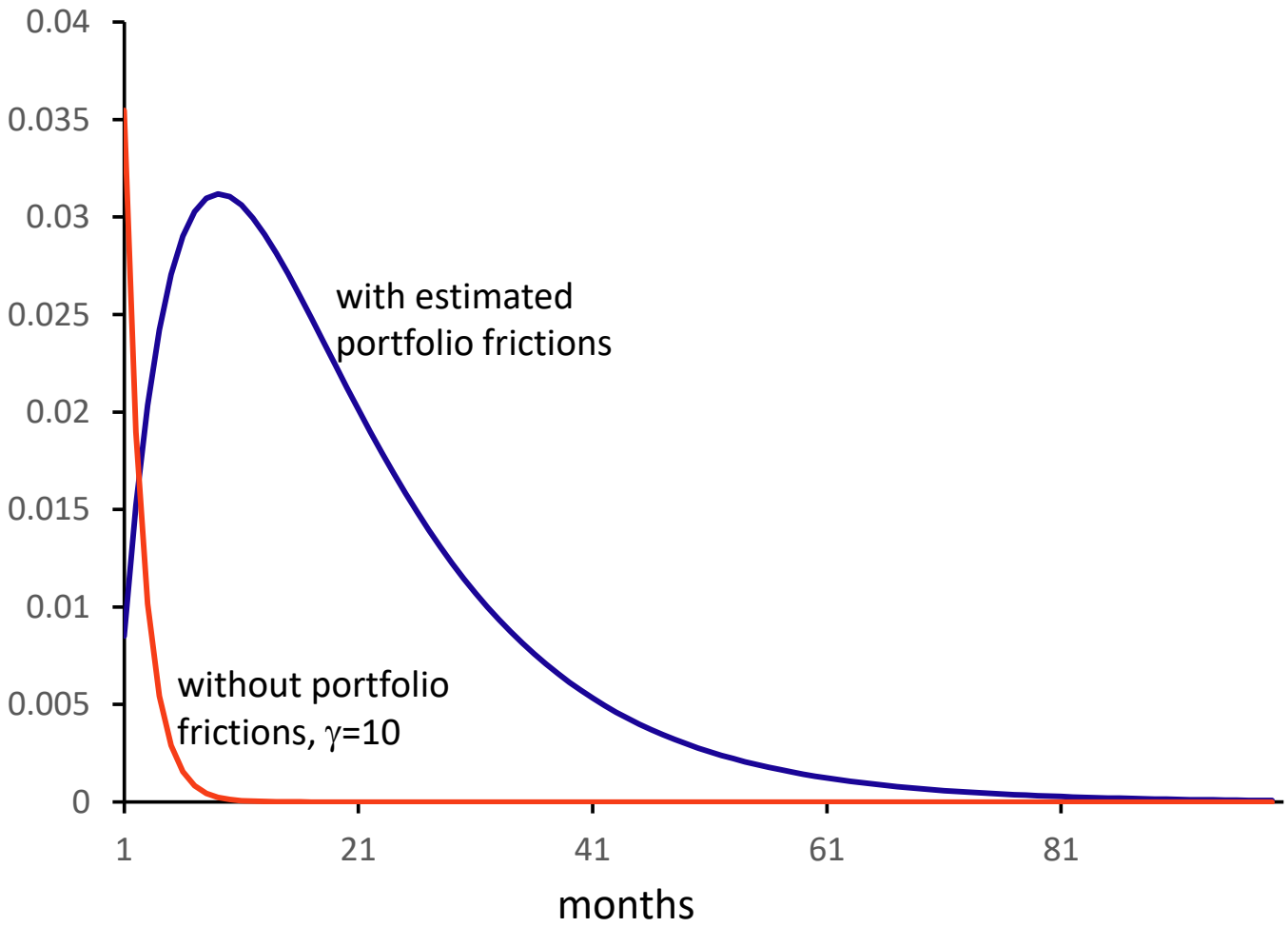
Table: Portfolio Regressions, Benchmark

	Fund-Level			Aggregate
	(1)	(2)	(3)	(4)
$(z_{i,n,t-1} + z^{bh}_{i,n,t})/2$	0.928***	0.916***	0.918***	0.998***
	(0.004)	(0.005)	(0.007)	(0.002)
$(z_{i,n,t-1} - z^{bh}_{i,n,t})$	0.173*	0.313***	0.338***	-0.217***
	(0.090)	(0.069)	(0.068)	(0.012)
$E_t er^{0.89}_{i,n,t,t+24}$	1.082***	2.324***		0.026**
	(0.144)	(0.291)		(0.012)
$E_t er^{0.89}_{i,n,t,t+60}$			5.054***	
			(0.825)	
Fund-Country FE	Yes	Yes	Yes	No[a]
Country-Month FE	No	Yes	Yes	No[a]
Observations	316732	316732	196828	5918
R^2	0.987	0.988	0.990	0.999

Main Lessons

- The model with frictions is fully consistent with the data
  - The two frictions have a significant impact
  - Portfolios react to expected return differentials
- The implied degree of risk aversion is around 2.5. Without frictions, it would be larger than 200
- Cost of frictions is small: 3 basis points in expected portfolio return
- Different results with aggregate data
- Impulse response from an increase in expected return differential

Figure 1 Impulse Response Portfolio Share to Expected Excess Return Shock



Heterogeneity

- We explore various forms of heterogeneity
- More sensitive to excess return for large country shares
- But large funds are less sensitive to excess returns
- Small, more active and emerging market funds give less weight to buy-and-hold portfolio (more rebalancing)

Conclusion

- The evidence on mutual funds is consistent with portfolio frictions
- Gradual portfolio adjustment has implication for the exchange rate, asset prices, and capital flows
- We currently investigate the implications in a more macro model (with M. Davenport). Look in particular at the impact of financial shocks on net capital flows
- Another interesting direction is the delayed impact of monetary policy on exchange rates and portfolio positions