KF*: The natural level of capital flows

JOHN BURGER (Loyola University Maryland)

FRANK WARNOCK (University of Virginia—Darden Business School and NBER)

VERONICA CACDAC WARNOCK (University of Virginia—Darden Business School)

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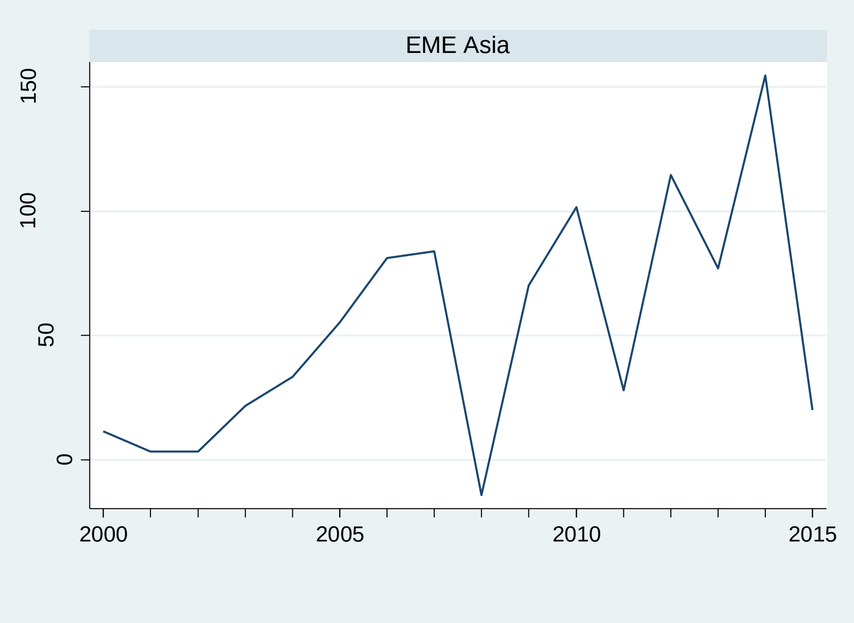
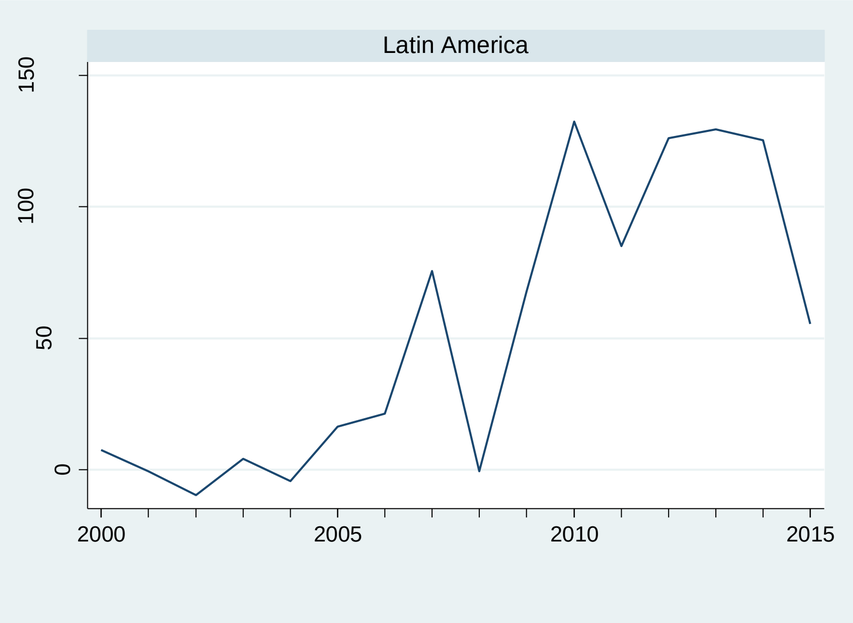
Question posed to us in late 2016:

Was the 2015/16 sharp decrease in EME portfolio inflows temporary or likely to persist?

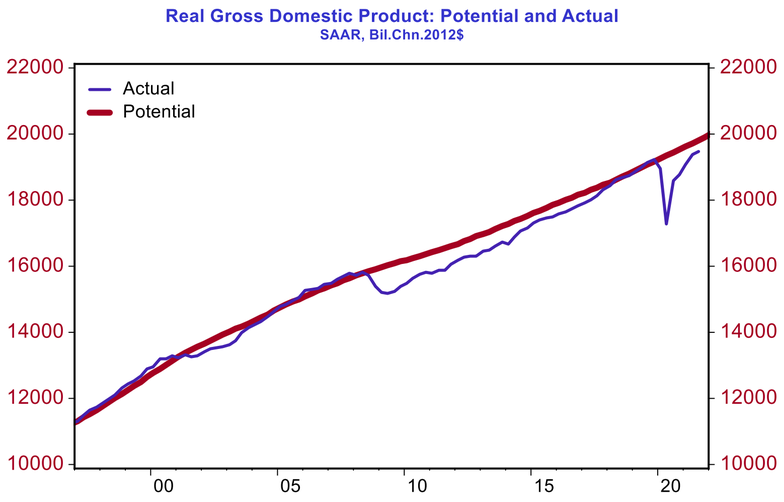




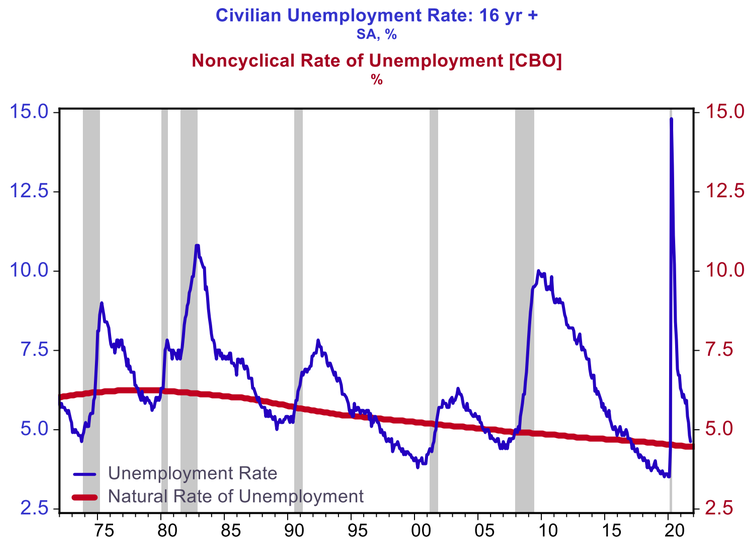
Note: The data in this graph, and in our analysis, are the amount (in billions of USD) of BOP portfolio (ie debt+equity) inflows.

How does one actually go about assessing whether the 2015/16 decrease—or any sharp change in capital flows—was an aberration or the new normal?

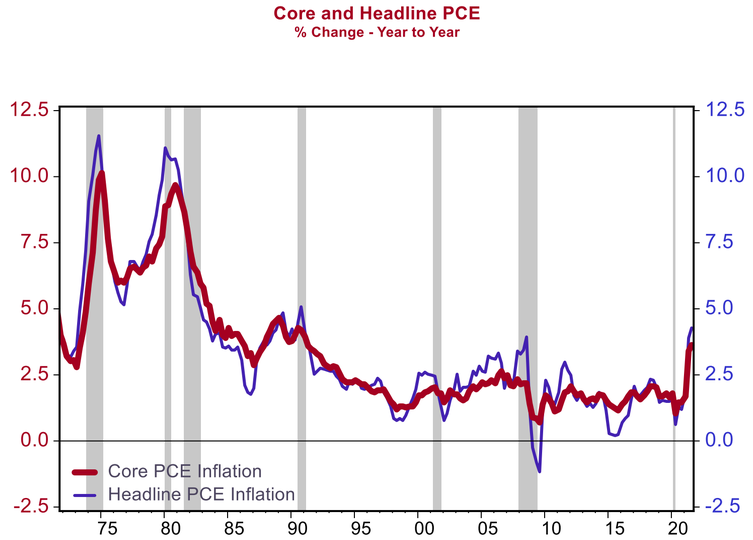
To answer this we consulted some stars



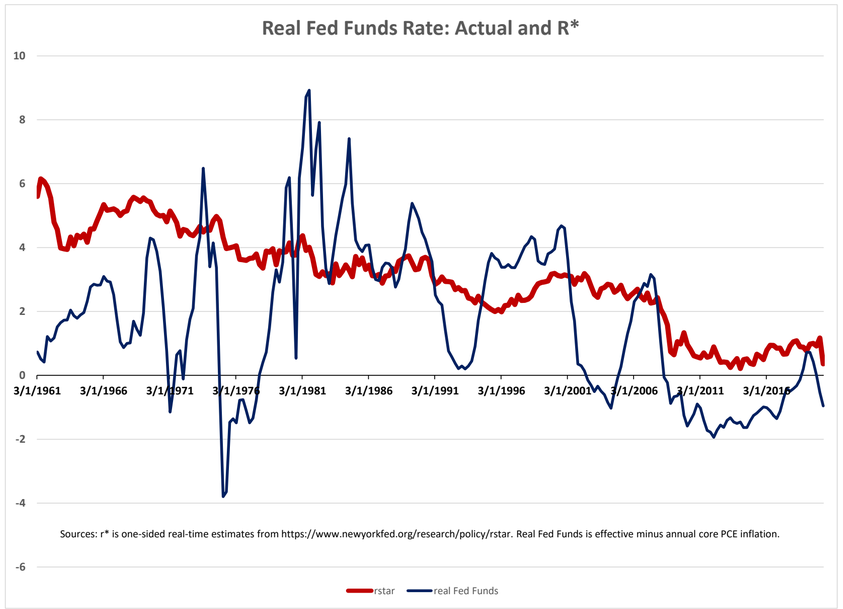
Sources: BEA, CBO/Haver



Sources: BLS, CBO/Haver



Source: Bureau of Economic Analysis/Haver Analytics



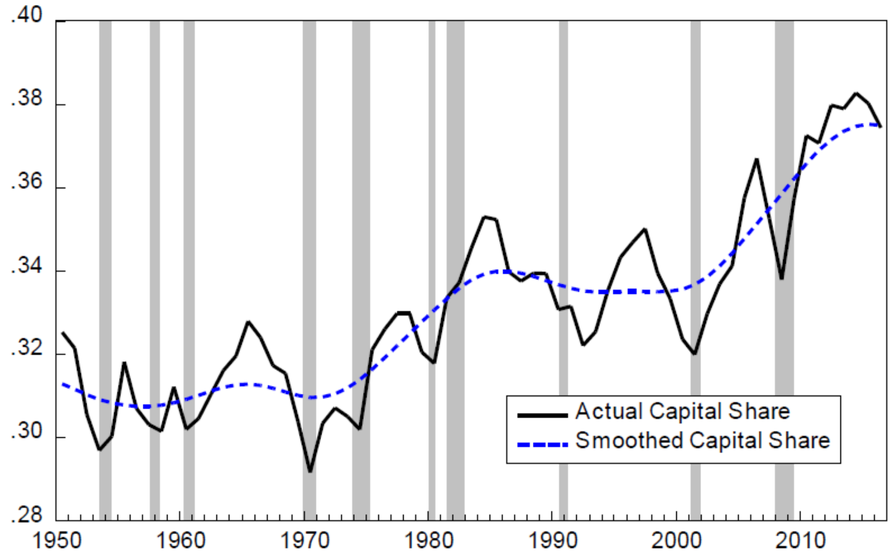
Each is an unobserved, estimated construct with definitions that vary across researchers.

Nonetheless, by providing a real-time measure against which related macroeconomic variables can be assessed, each aids in our understanding of the economy.

Potential GDP is useful to keep in mind as you think about KF*

- In the US, CBO's estimate of potential output relies on a standard economic framework (the Solow growth model) that focuses mainly on the inputs that drive growth in the <u>supply side</u> of the economy rather than on fluctuations in aggregate demand.
  - In implementing $Y = A K^{\alpha} L^{1-\alpha}$, CBO notes that the capital share (α) is volatile and so smooths it.

Figure 4.
The Capital Share in the Nonfarm Business Sector



Source: Shackleton, R., 2018. Estimating and projecting potential output using CBO's forecasting growth model. Congressional Budget Office Working Paper 2018-03.

KF*, The Natural Level of Capital Flows
Underlying Theory

- KF* relies on the theory of Tille and van Wincoop (2010, henceforth TvW), which brought portfolio choice into a DSGE open economy model.[#]
- The model leads to two types of flows: portfolio growth flows and reallocation flows.

- KF* is the portfolio growth flows: the flows that result when savings—the supply of new funds available for capital flows—is invested in line with zero-order portfolio shares.
    - Zero-order weights in theory: the weights absent any shocks to expected returns and expected risk.
    - Zero-order weights in practice: we (and Meng and van Wincoop 2020) use lagged portfolio weights as a proxy.
        - A simple lag suffices but has the potential GDP's α issue…portfolio weights can be volatile. We use a lagged 5-year moving average for our weights; the choice of lag impacts pictures but not empirical results.

- Reallocation flows. Other flows do occur. In TvW, shocks to expected returns and expected risk can lead to reallocations which push allocations temporarily away from zero-order weights.

[#] See also Devereux and Sutherland (2011), Kraay and Ventura (2000, 2003)

What is KF*?

Simply put, KF* is a annual supply-side construct: current period ROW private savings ($S_{ROW,t}$) times a lagged portfolio weight (5yr moving average).

$$KF^*_{d,t} = (\frac{1}{5}\sum_{i=1}^{5} \omega_{ROW,d,t-i})S_{ROW,t}$$

ROW weight on a country's equities and bonds is the stock of that country's portfolio liabilities (that is, ROW holdings of its equities and bonds) divided by ROW wealth.

Required data are easily obtained:

Flow of private savings is from the IMF WEO dataset. Constructed as national saving minus government saving.

Portfolio weights are calculated by scaling a country's portfolio equity and portfolio debt liabilities by ROW wealth.

ROW portfolio holdings in country *d* are from Lane and Milesi-Ferretti (2018) External Wealth of Nations II dataset.

ROW wealth are from Davies, Lluberas, and Shorrocks Credit Suisse data on household wealth.

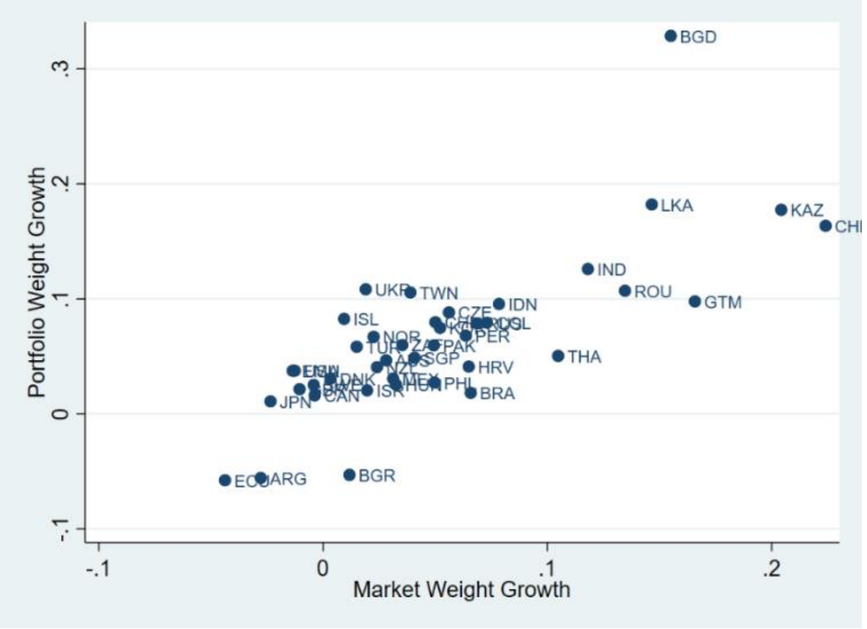
We can create KF* for 184 countries (including many that don't have flow data).

Sample sizes are smaller in applications due to limitations of other data (including flows themselves).

The drivers of changes in $KF^*_{d,t}$

Changes in $\omega_{ROW,d,t-i}, S_{ROW,t}$

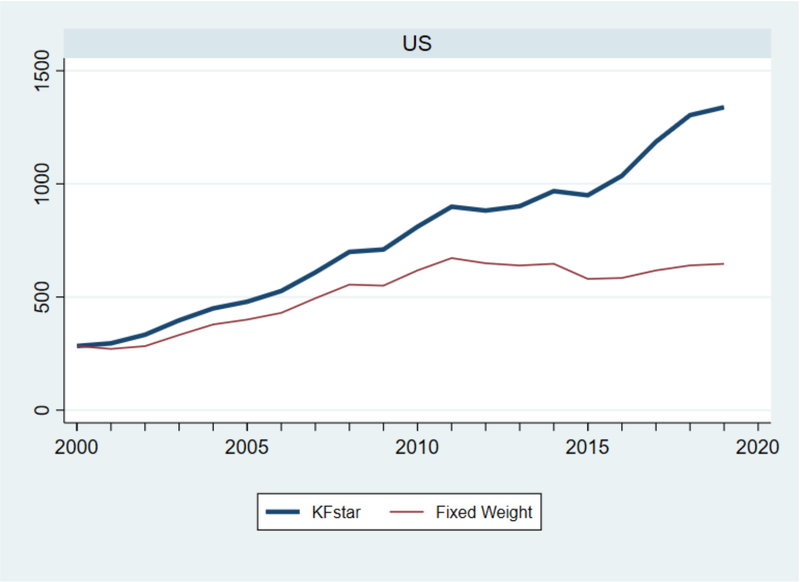
ω_{ROW} has increased since 2000 for almost all countries in our sample (the reduction of home bias), even more so for countries whose markets got larger (relative ICAPM?).

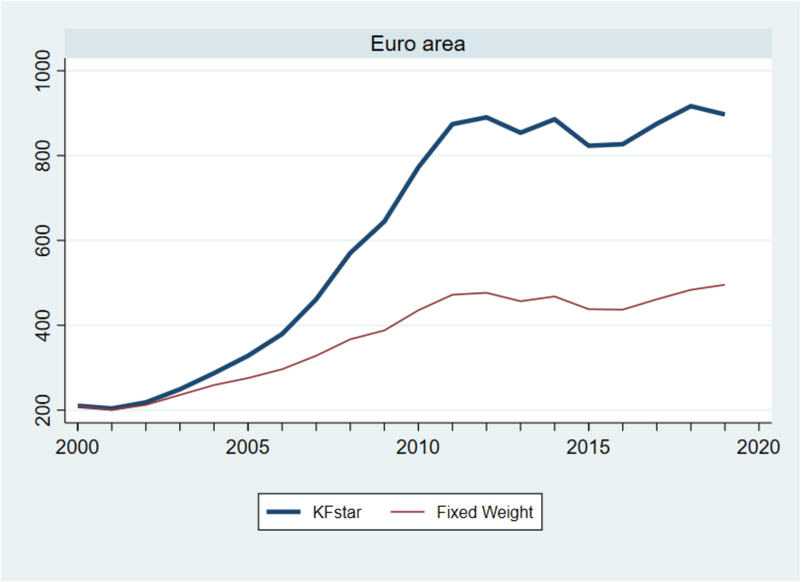


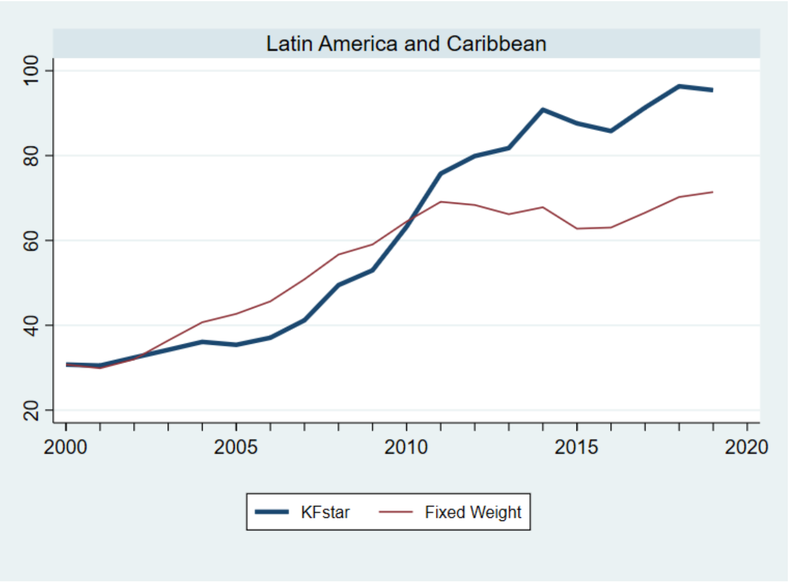
S_{ROW} grew strongly through 2011, so all else equal KF* for most countries should have increased strongly, and has since been flat.

KF*: Actual and Fixed Weights

Graphs depict actual KF* (thicker blue line) and if portfolio weights were held at 2000 levels (thin red line). Fixed weight version only grows with growth in S_{ROW} and hence mirrors S_{ROW}. Difference between the lines represents portfolio weight growth.







Applications of KF*

- Burger, Warnock and Warnock (2018) showed, using annual data, that there is a significant in-sample long-run relationship between actual portfolio flows and KF* (with flows adjusting to the benchmark) and KF* predicts the direction of one-period-ahead changes in inflows about two-thirds of the time.

- Current paper pushes this further by applying to notoriously volatile QUARTERLY portfolio inflows.

Outline for the rest of the talk

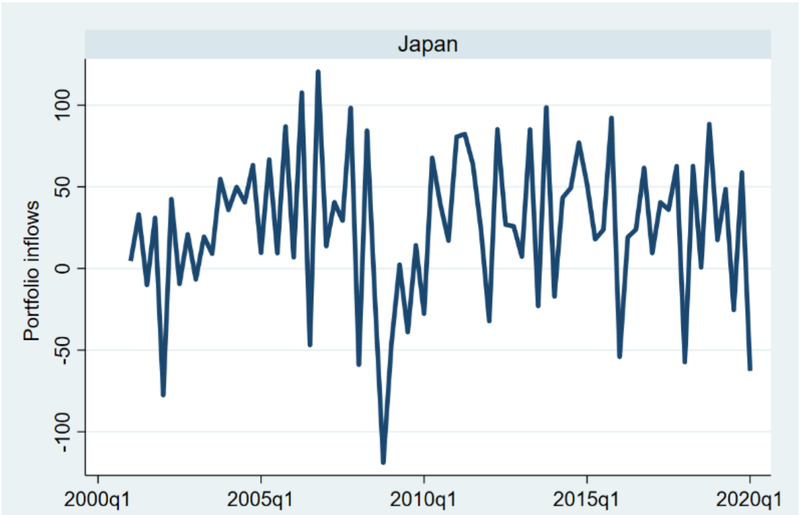
Use KF* to understand notoriously volatile quarterly portfolio flows

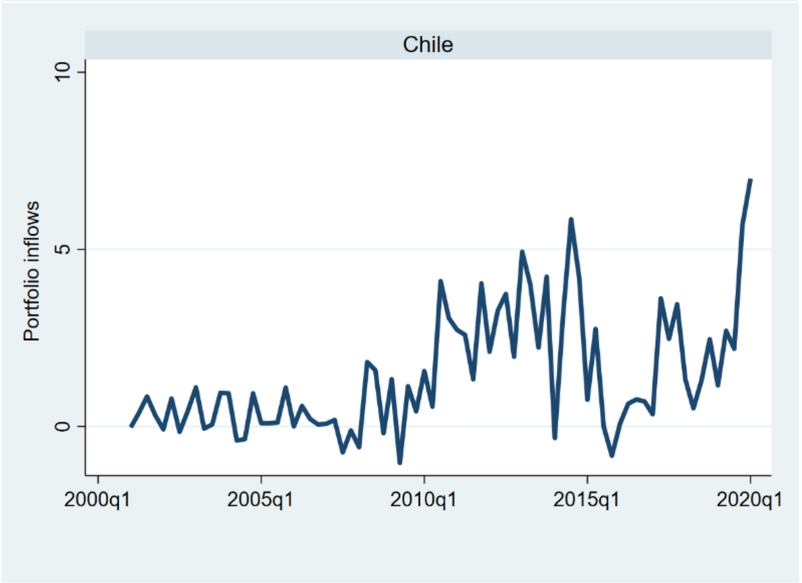
- Focus on out-of-sample medium-term (4-8 quarters) ahead forecasting ability
- Compare to various out-of-sample and in-sample filtering methods

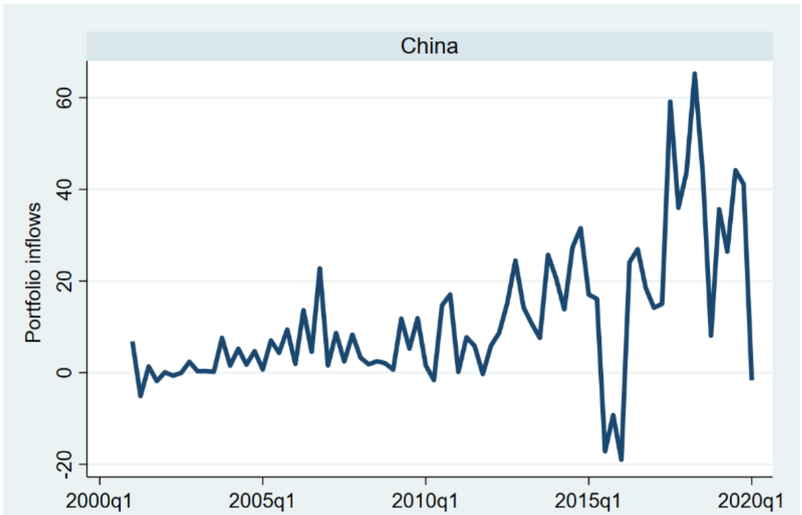
Applications: Use KF* to predict

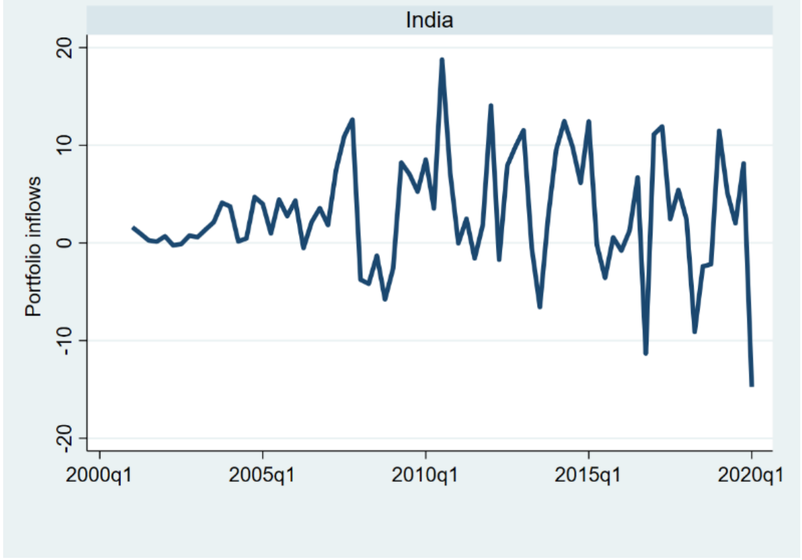
- 6-quarter-ahead Sudden Stops
- annual equity returns
- flows during the GFC and Pandemic

CAN WE PREDICT FUTURE PORTFOLIO INFLOWS?







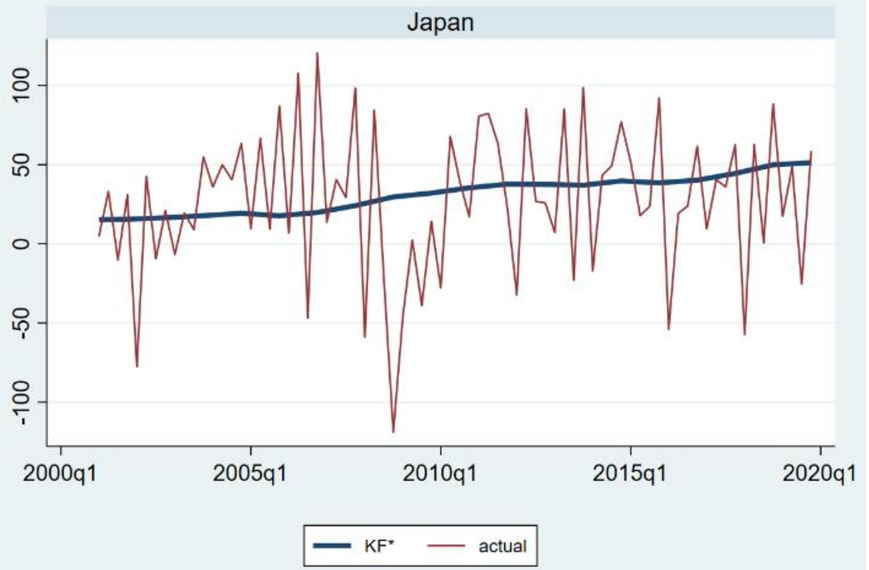


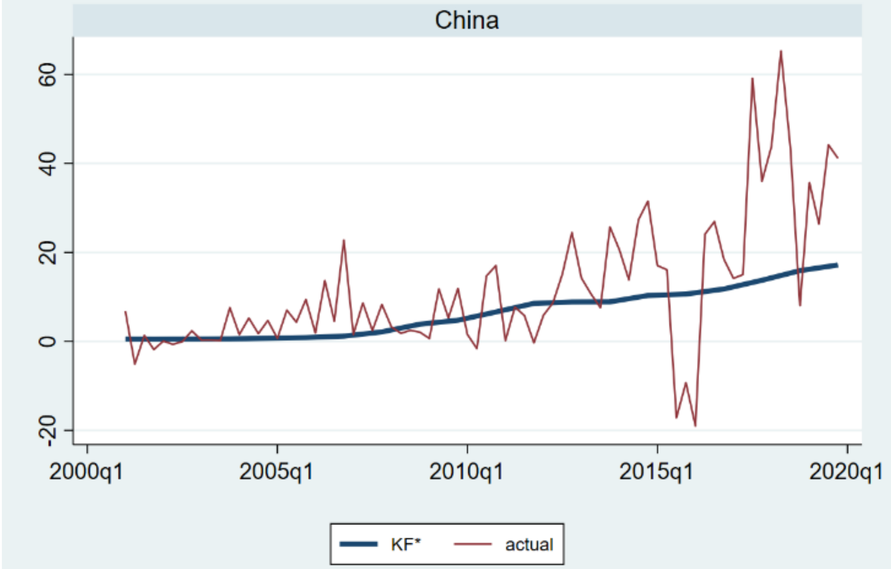
Quarterly, billions of USD

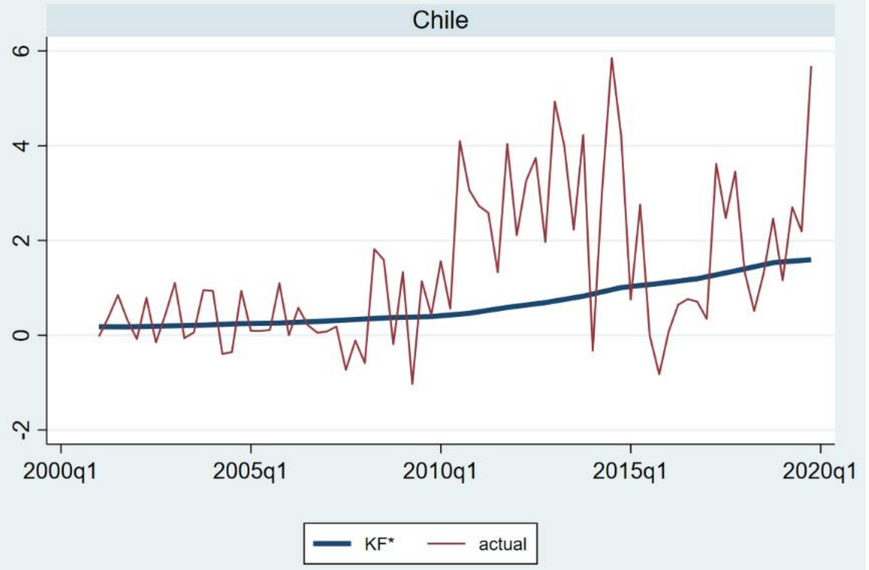
PREVIEW: KF*, THE NATURAL LEVEL OF CAPITAL FLOWS, IS A STRONG PREDICTOR OF FUTURE FLOWS.

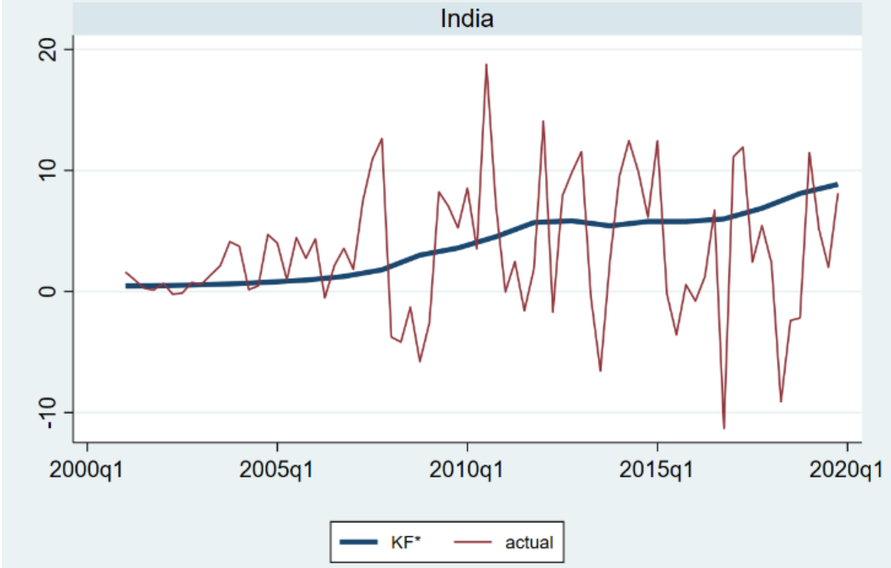
- Portfolio inflows oscillate around KF*. Deviations of actual flows from KF* are transitory.
  - Flows revert strongly to KF* over 1-2 year horizon.
  - The explanatory power of KF* -- it explains about 40% of the medium-run variation in portfolio flows -- is substantially greater than traditional push/pull factors.
  - KF* also outperforms various univariate filtering techniques and performs about as well as the in-sample Hamilton (2018) linear projection explicitly designed to make such predictions.
- Applications
  - Predicts 6-quarters ahead sudden stops, as well as next year's equity returns.
  - At the eve of the GFC, predicted flows during the crisis.
  - At the eve of the pandemic, predicted that any sharp decreases in portfolio inflows would be short-lived.

PORTFOLIO INFLOWS OSCILLATE AROUND KF*









It's apparent from the graphs and, as we show, empirically.

Cogley Test of Predictive Power of Core Inflation

- Inflation targeting central bank looking for a way to extract the “true” inflation signal from the noise of volatile period-to-period fluctuations.
- Core inflation (π*) should eliminate transient price variation and identify component expected to persist over medium-run.

$$\pi_t^* = E[\pi_{t+h}]$$

- Deviations from core inflation should be inversely related to subsequent changes in inflation:

$$E[\pi_{t+h}] - \pi_t = -(\pi_t - \pi_t^*)$$

- Cogley proceeds to test relationship between deviations of inflation from core and subsequent changes in inflation:

$$\pi_{t+h} - \pi_t = \alpha_h + \beta_h(\pi_t - \pi_t^*) + \varepsilon_t$$

Applying Cogley Test to KF*

- Natural level of capital flows (KF*) should help policymakers identify the component of flows expected to persist over medium-run.

$$KF_t^* = E[flows_{t+h}]$$

- Deviations from KF* should be inversely related to subsequent changes in flows:

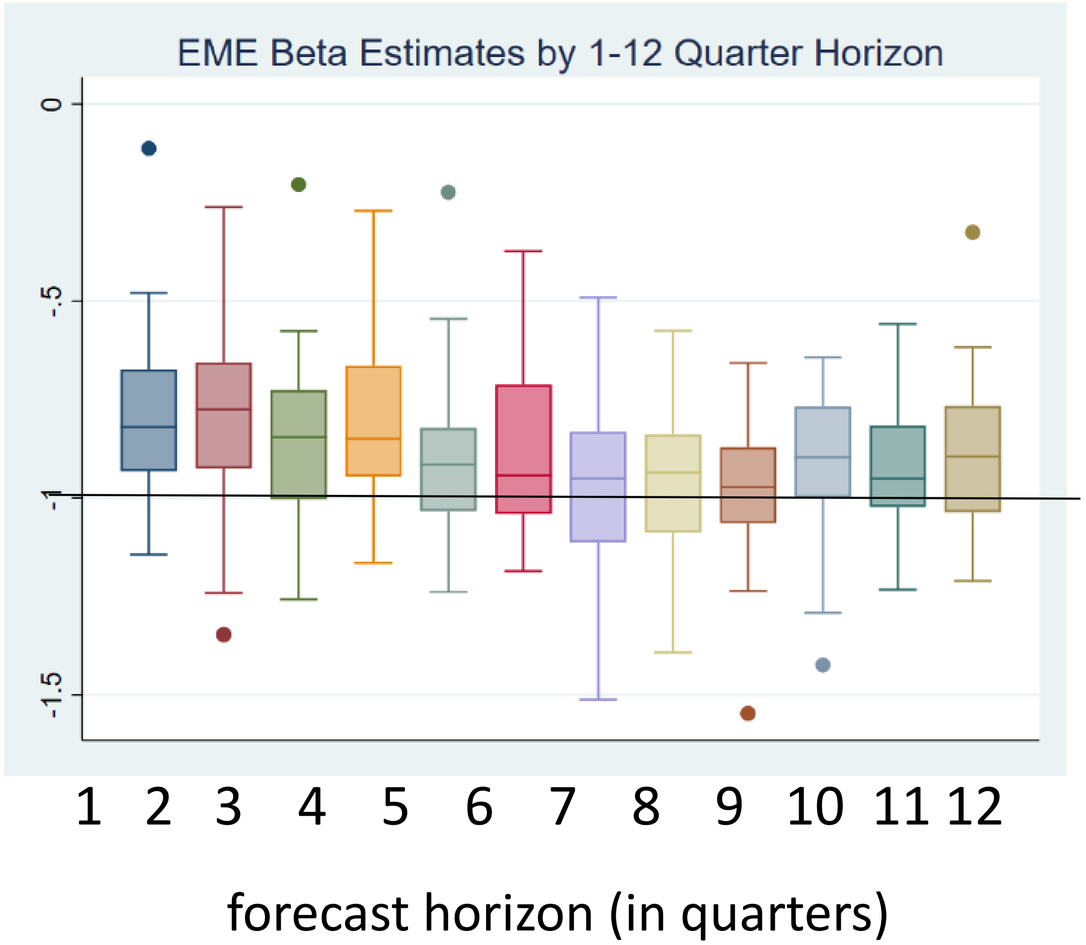
$$E[flows_{t+h}] - flows_t = -(flows_t - KF_t^*)$$

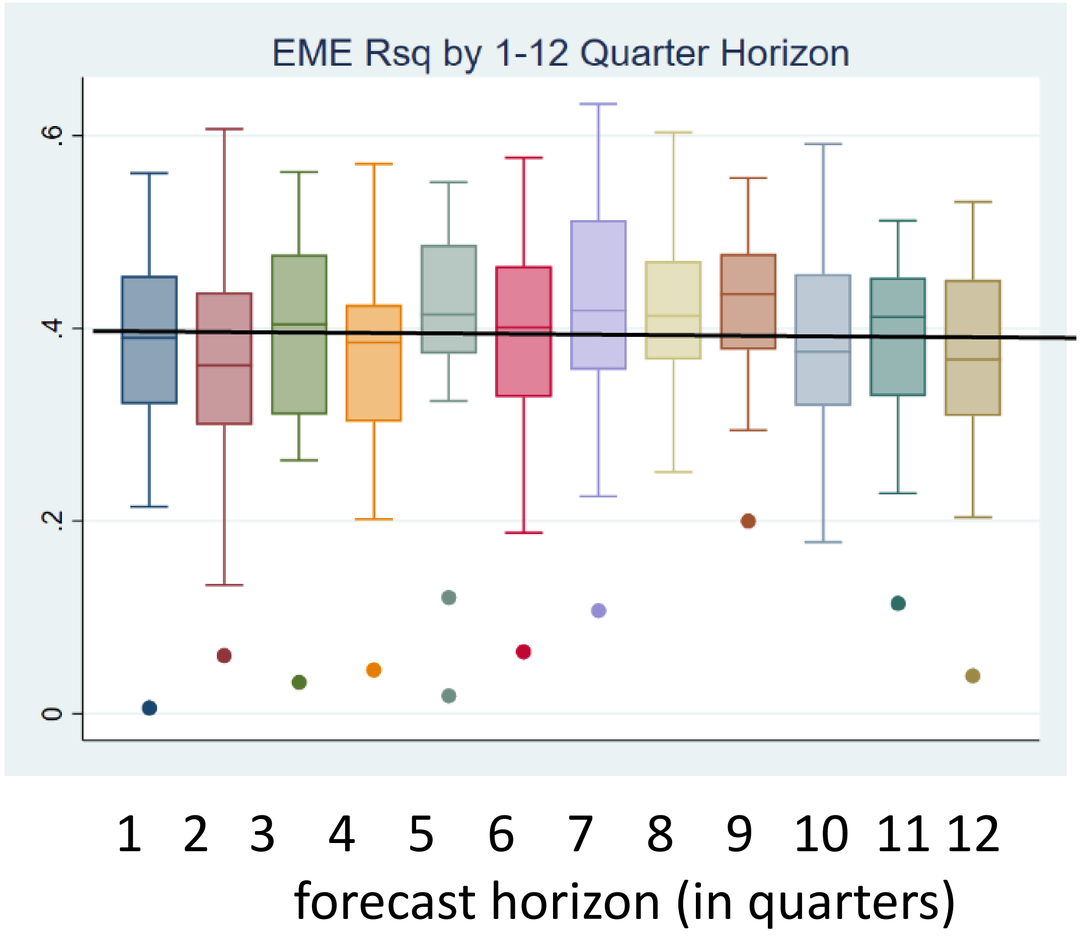
- Estimate following regression for horizons of 1 to 12 quarters for each of 16 Aes (Euro Area is one unit) and 28 EMEs:

$$flows_{t+h} - flows_t = \alpha_h + \beta_h(flows_t - KF_t^*) + \varepsilon_t$$

- If KF* represents the natural level of flows, we expect to estimate β_h =-1 for medium-run horizons.

FLOWS REVERT STRONGLY TO KF* OVER 1-2 YEAR HORIZON, AND THE EXPLANATORY POWER OF KF* IS SUBSTANTIALLY GREATER THAN TRADITIONAL PUSH/PULL FACTORS.

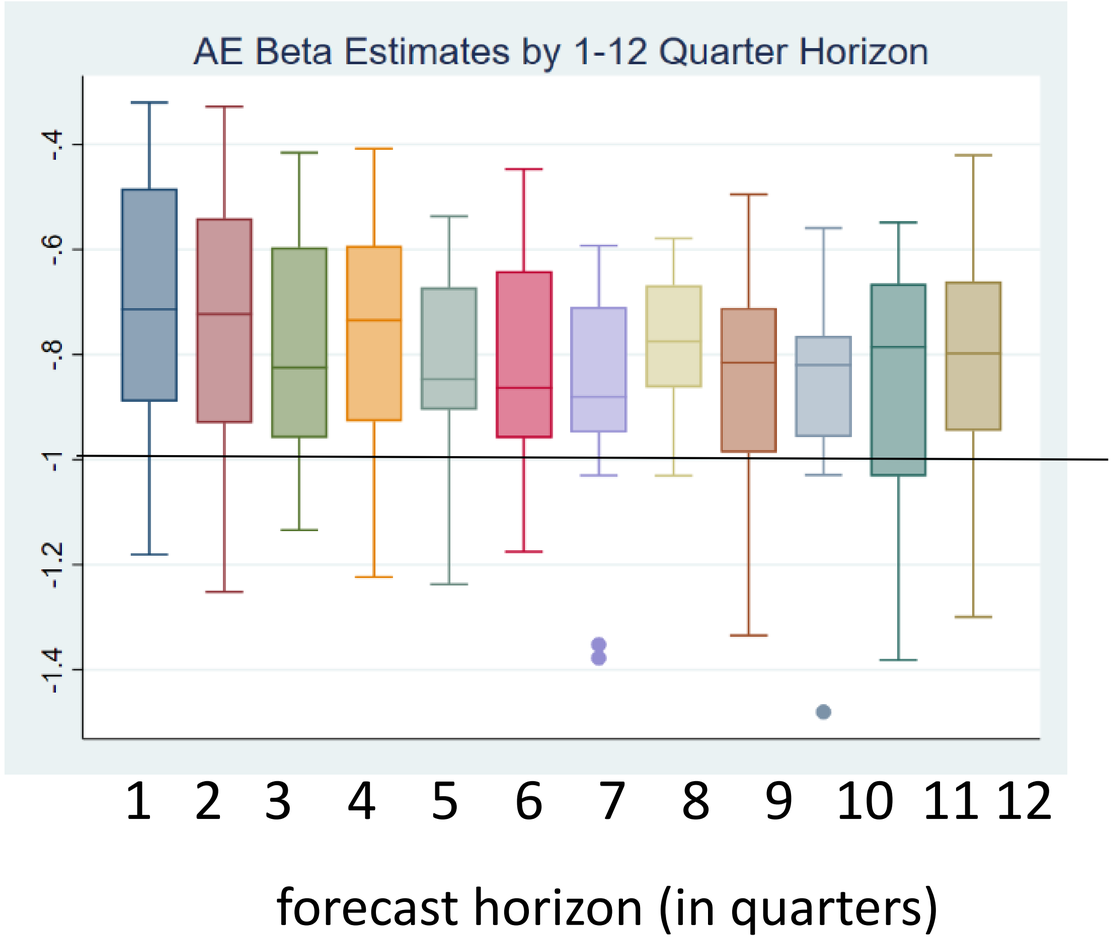


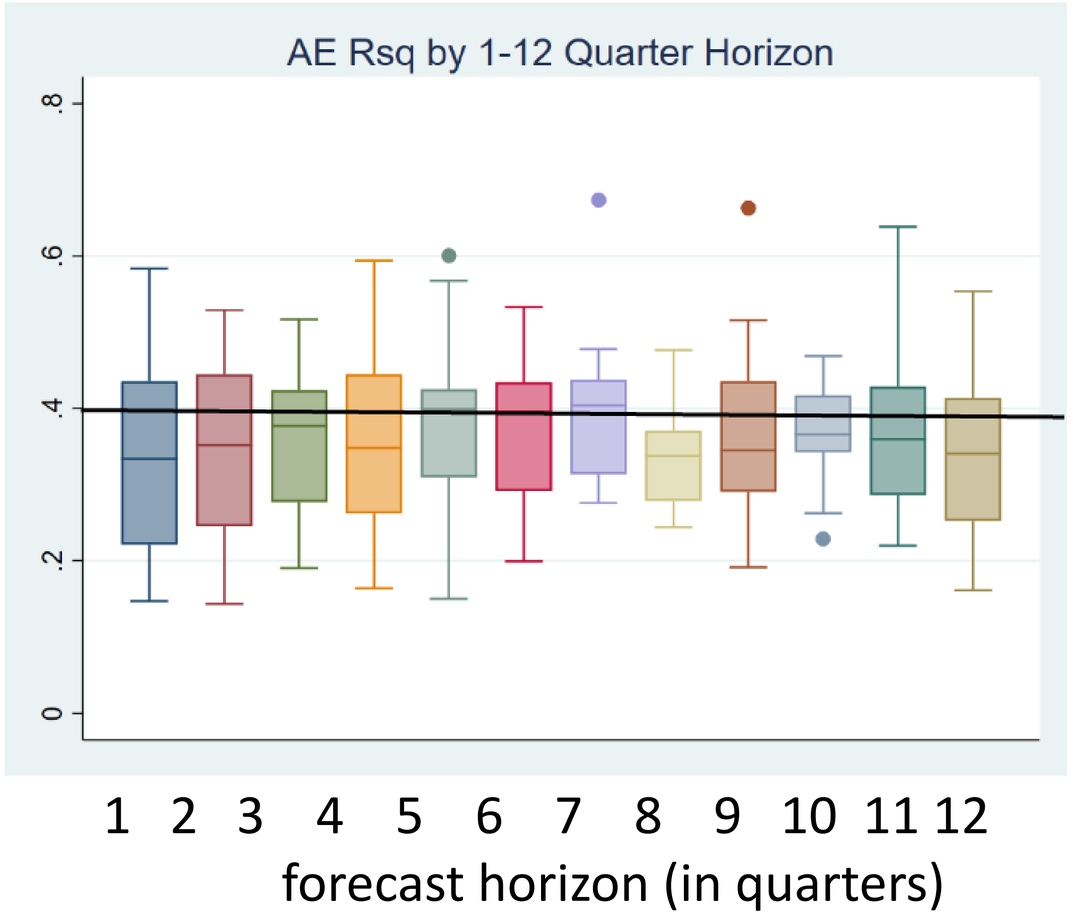


Beta = -1 means flows fully adjust to KF in h quarters.*

R^2 around 0.4, when 0.15 would be considered good for push/ pull factors.

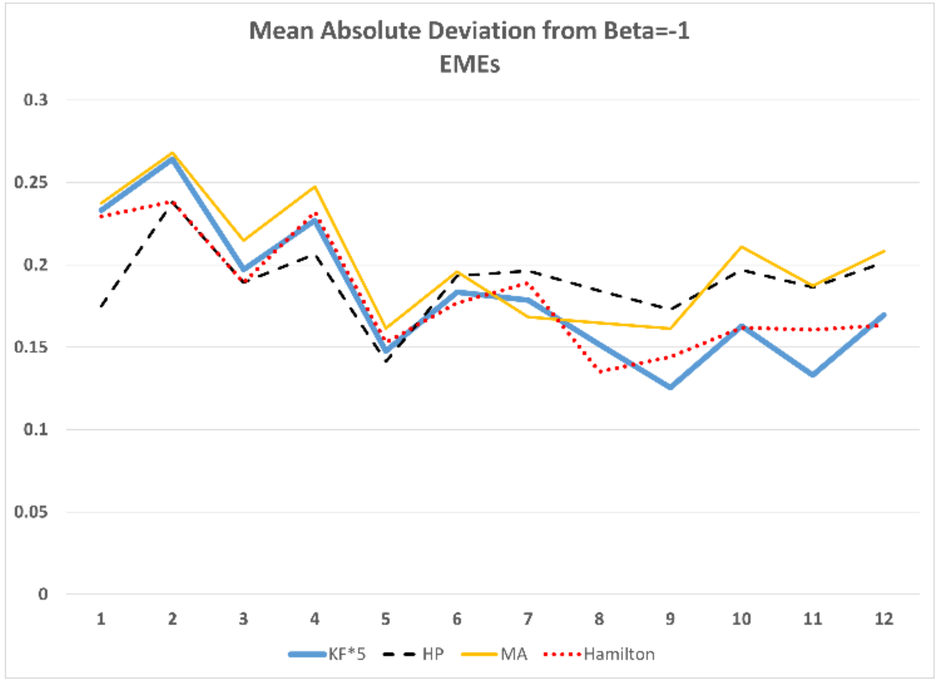
FLOWS REVERT STRONGLY TO KF* OVER 1-2 YEAR HORIZON, AND THE EXPLANATORY POWER OF KF* IS SUBSTANTIALLY GREATER THAN TRADITIONAL PUSH/PULL FACTORS.

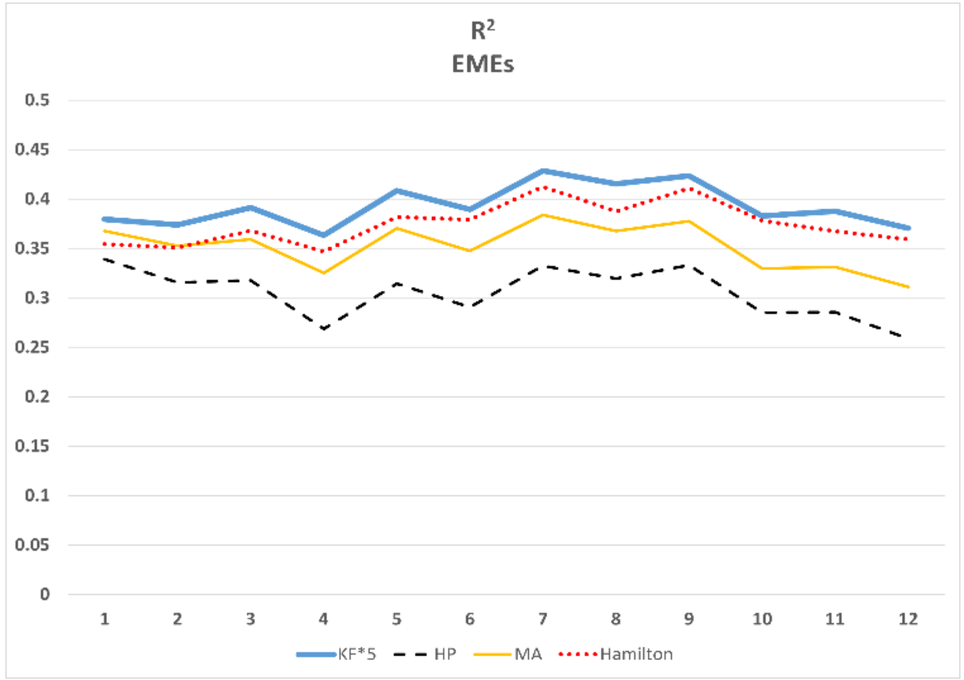




For AEs, results are less stellar but still pretty good.

k-quarter-ahead forecasting performance vs MA12, HP, Hamilton: EMEs



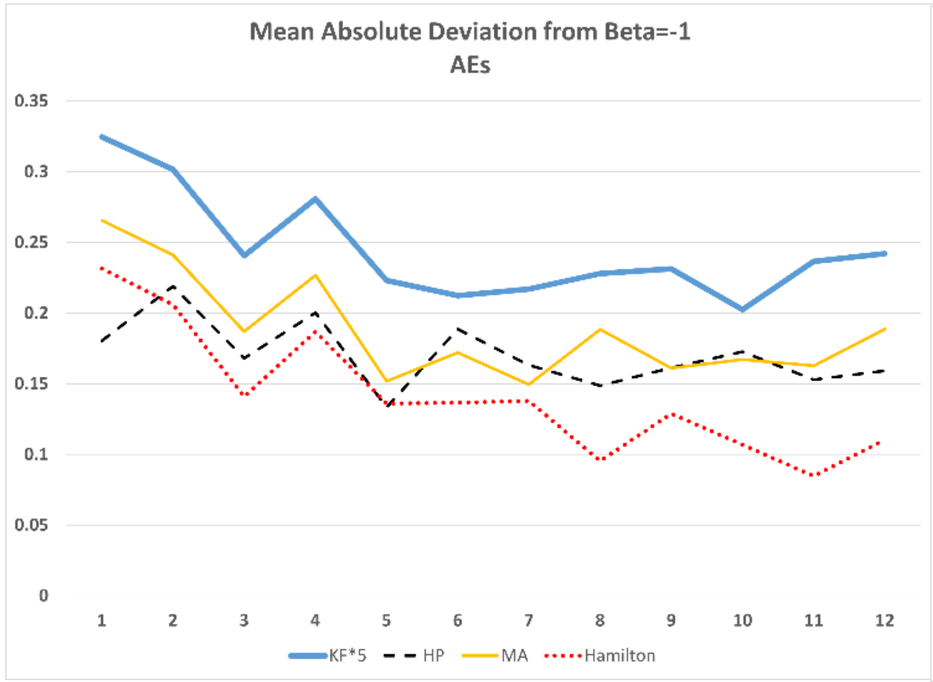


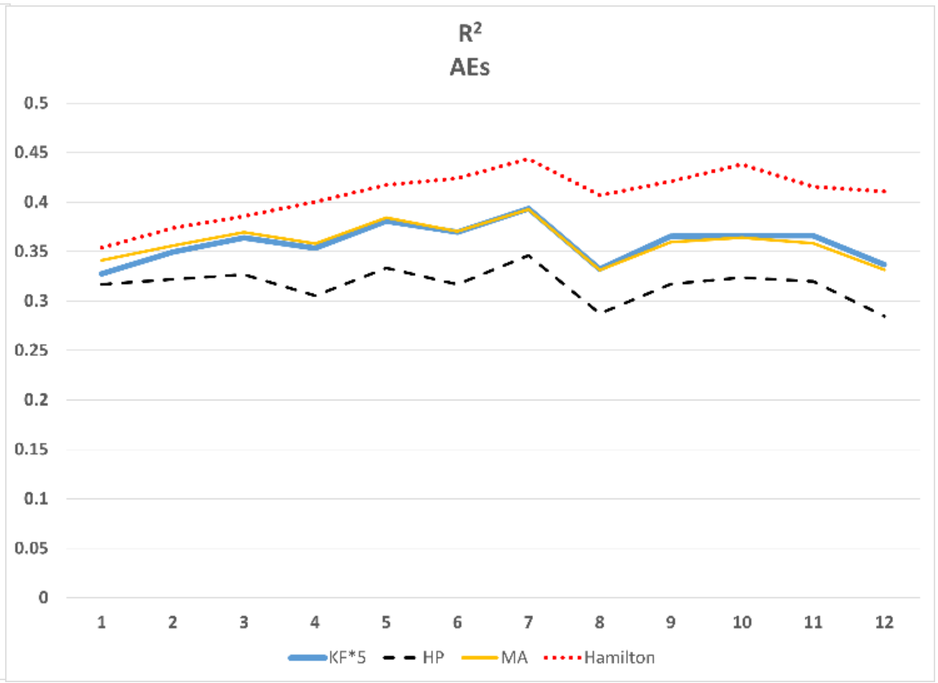
Sample is of 28 EMEs 2000q4-2018q1 with k=1,…,12 quarters ahead forecast horizons (so last forecast period is 2019q4).

MA (thin yellow line) is a 12-quarter moving average; HP (dashed black line) is a one-sided HP filter; Hamilton (dotted red line) is an in-sample linear projection.

For EMEs, over the medium-term KF* (the thick blue line) performs quite well in that it produces beta estimates that have small absolute deviation from negative 1 and a high mean R^2. Only the in-sample Hamilton (2018) method performs as well.

k-quarter-ahead forecasting performance vs MA12, HP, Hamilton: AEs



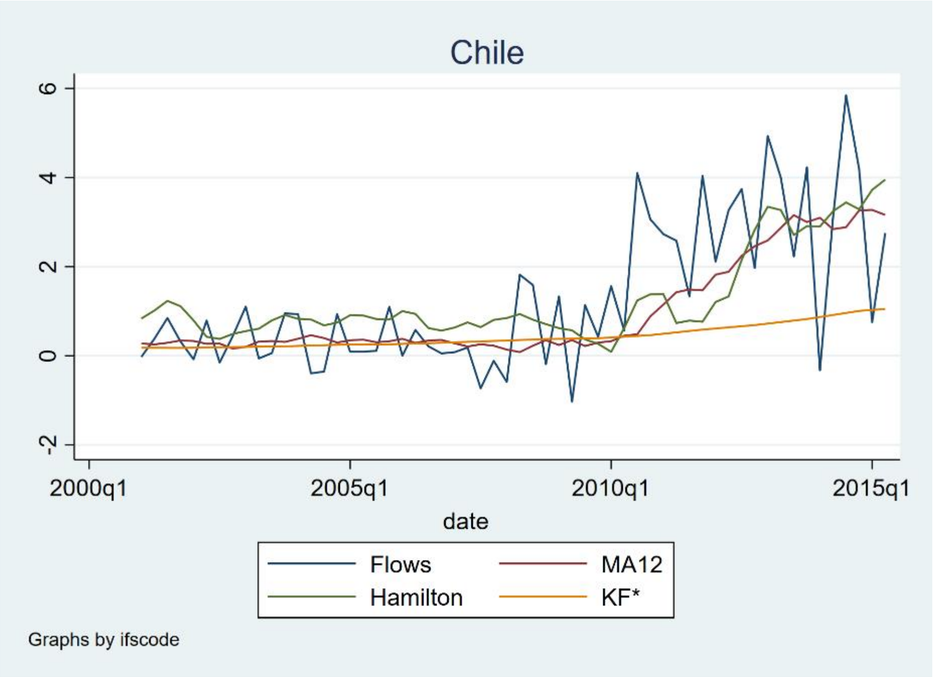


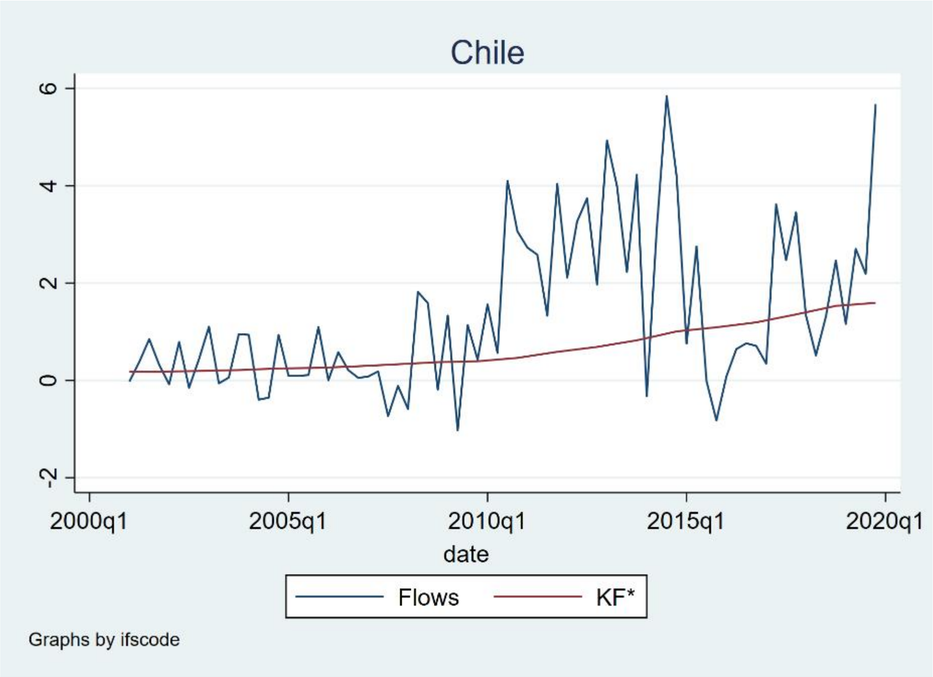
Sample is of 16 AEs 2000q4-2018q1 with k=1,…,12 quarters ahead forecast horizons (so last forecast period is 2019q4).

MA (thin yellow line) is a 12-quarter moving average; HP (dashed black line) is a one-sided HP filter; Hamilton (dotted red line) is an in-sample linear projection.

For AEs, KF* performs less well (but still has a high R^2). We conjecture, but do not know for certain, that the relative underperformance of KF* for AEs compared with EMEs might be due to international reserve accumulation, which was quite strong through 2014q2 (increasing the weights on recipients such as the US, Euro area, and the UK) and has since ceased (leading to lower inflows for some recipient countries).

KF* performs quite well, better for EMEs than AEs. Some filtering techniques perform well too. Takeaway? There is a natural level of capital flows, with various reasonable proxies. But we like KF*.





Filters fit data well but are sensitive to recent flows. Left graph ends 2015q2; filters suggest flows were oscillating around recent averages (i.e. volatile but normal), but KF* indicated flows were abnormally high. Right graph goes through 2019; flows did indeed revert back to KF*. Filtering methods can be useful—flows seem to revert to some benchmark—but we prefer a theory-based construct.

Outline

Use KF* to understand notoriously volatile quarterly portfolio flows

- Focus on out-of-sample medium-term (4-8 quarters) ahead forecasting ability
- Compare to various out-of-sample and in-sample filtering methods

Applications: Use KF* to predict

- 6-quarter-ahead Sudden Stops
- annual equity returns
- flows during the GFC and Pandemic

For each application, we start with 44 countries and lose some due to additional data limitations.

Using KF* gap to predict sudden stops

We use $KF^{*}gap_{i,t}$, the gap between current flows and KF* scaled by GDP, averaged over the last 4 quarters, to predict a sudden stop 6 quarters hence.

Follow Forbes and Warnock (2021) but instead of predicting one quarter ahead we predict 6 quarters ahead (and the results also hold for t+4 to t+8).

$STOP_{i,t+h}$ is an indicator variable that takes the value of 1 if country i is experiencing a sudden stop in capital flows at time *t+h*. $SURGE_{i,t+h}$ is similarly defined.

Use all Forbes Warnock variables.

Global variables: global GDP growth (year-over-year), risk (measured as the change in the VIX), liquidity (measured as the year-over-year percentage growth in the 'global' broad money supply, where global is the sum for the US, UK, euro area and Japan), monetary policy (measured as the year-over-year change in the average shadow short rate for the US, UK, euro area and Japan), and the year-over-year percentage change in oil prices.

Local factor: local year-over-year real GDP growth

Regional contagion measure (an indicator equal to one if another country in the region has an episode).

Using KF* gap to predict sudden stops

Panel A	**Prob(Stop) t+ 6 quarters**	**Prob(Surge) t+ 6 quarters**
KF* gap	16.109***	-0.532
	(4.984)	(3.064)
Global Variables		
Global GDP Growth	0.541***	-0.178*
	(0.208)	(0.103)
Risk	0.067***	-0.003
	(0.021)	(0.076)
Liquidity	0.115	-0.002
	(0.070)	(0.041)
Oil Prices	-0.004	0.003
	(0.003)	(0.004)
Monetary Policy	0.286	0.213
	(0.187)	(0.141)
Local and Contagion Variables		
Local GDP Growth	0.022	0.065***
	(0.028)	(0.024)
Regional Contagion	-0.129	0.219
	(0.167)	(0.167)
Observations	1783	1783
Countries	26	26

Panel B	**Prob (Stop) t+6 quarters**
KF* gap = 0%	8.4%
KF* gap = 3.4%	14.1%
KF* gap = 6.8%	23.1%
KF* gap = 3.4% & Global growth = 4.2%	30.7%

1. Even controlling for all Forbes Warnock factors, KF*gap helps predict future sudden stops (but not surges). *Stops preceded by periods of booming flows but surges do not necessarily begin from periods of depressed flows.*

2. Actual flows and KF* combine to be a powerful predictor of sudden stops.

- When global growth is 1stdev above its mean (i.e., is 4.2%), then global savings is increasing strongly and thus KF* is increasing strongly.
- If in that situation actual flows are growing even faster (i.e., KF*gap 1stdev above its mean, or 3.4%), **30.7% chance of sudden stop in 6 quarters**.

KF* gap to predict sudden stops

The story that emerges is similar to the ‘gap’ analysis that the BIS uses to predict banking crises.

BIS (see Aldasoro et al. 2018) uses two ‘gaps’ as predictors, each defined as an underlying—corporate debt-to-GDP or debt-service ratio—growing faster than trend, where trend for the BIS credit gap is estimated by an HP-filter and for the debt-service ratio is a 20-year moving average.

The BIS indicators are not based on whether debt levels or debt servicing burdens are high, but whether they are growing faster than in the past.

A similar ‘gaps’ analysis seems at work with predicting sudden stops.

When KF* is growing (because global growth and hence global savings are growing) and actual flows are growing even faster (i.e., both global growth and *KF*gap* are above their sample means), a sudden stop is likely in 6 quarters.

One difference from the BIS indicators: Our ‘trend’ is not a mechanical trend but KF*.

Using KF* to predict next year's equity returns

Lagged Dependent Variable	-0.124**
	(0.055)
KF* Gap / GDP	-1.379***
	(0.452)
Global Variables	
Global GDP Growth	-4.486***
	(1.417)
VXO	0.738**
	(0.291)
Local Variables	
Dividend Yield	1.624
	(1.454)
Returns Volatility	0.925
	(0.811)
Local GDP Growth	0.715
	(0.846)
Country Fixed Effect	YES
Within R^2	0.141
Observations	617
Countries	34

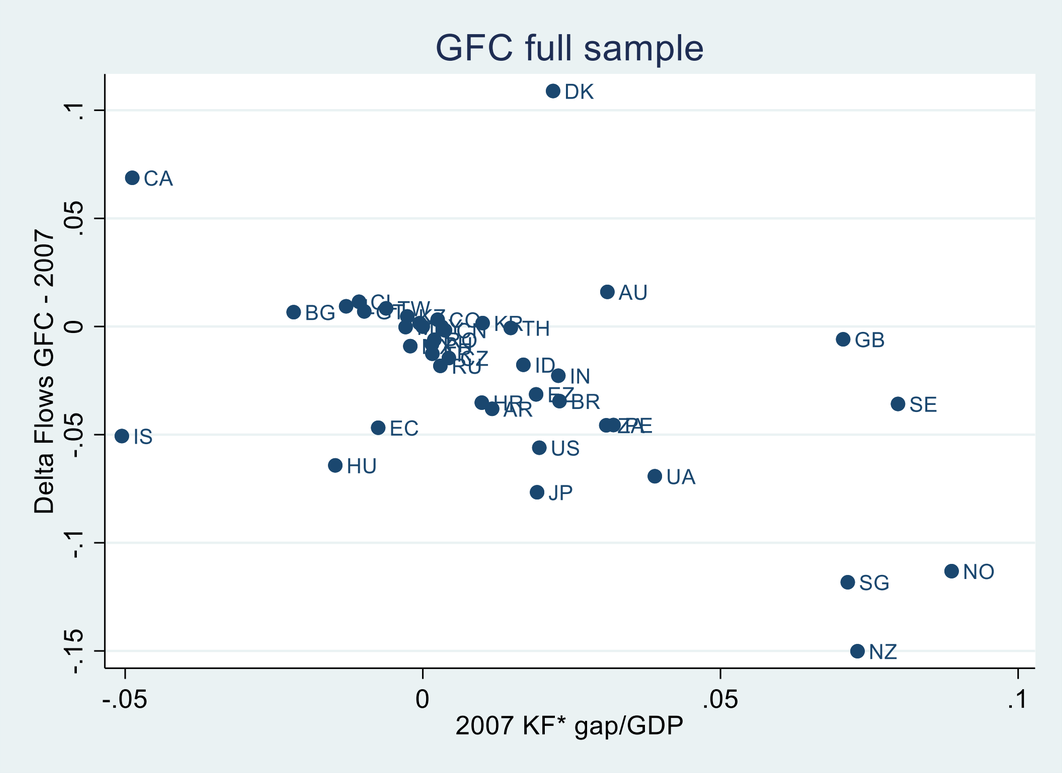
Controlling for standard factors (see, for example, Bekaert, Harvey and Lundblad (2007)), the impact of KF*gap is quantitatively significant; a one standard deviation gap in flows from KF* is associated with a 4.5 percentage point reduction in annual (excess) equity returns.

Again, the combination of strong global growth and flows above KF* predicts future trouble. A country that is experiencing KF* gap/GDP that is 1 stdev above average during a year of strong global growth (also 1 stdev above average) is predicted to experience a subsequent annual decline in equity returns of 10 percentage points, a substantial decline given that mean annual excess returns in our sample are 11.2%.

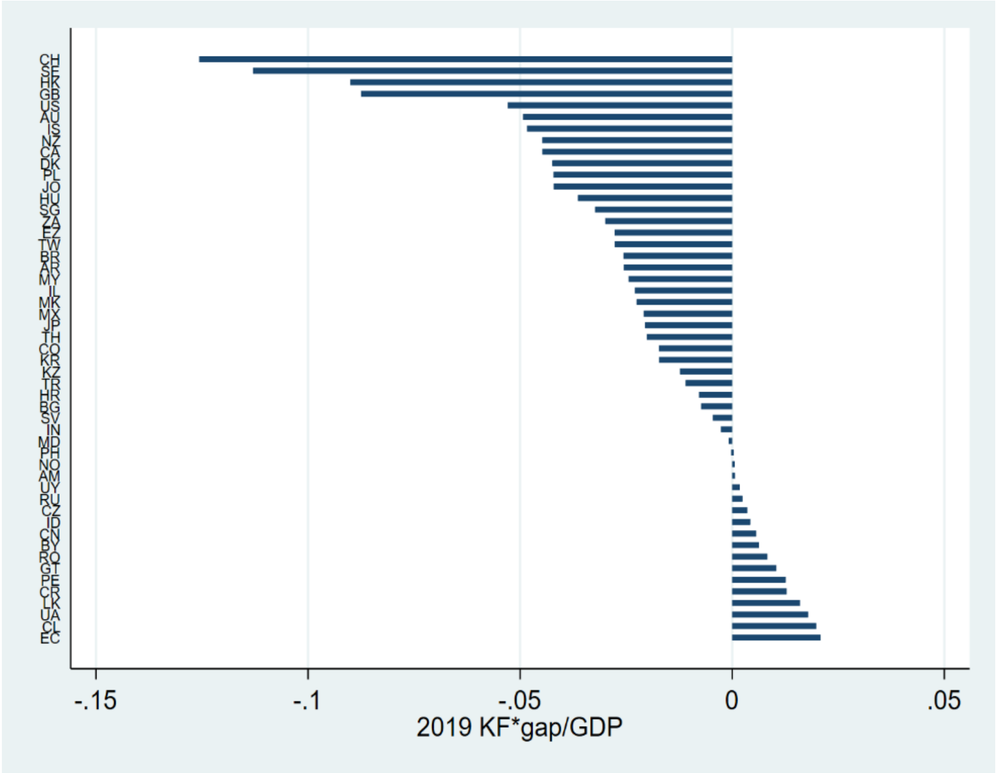
Sample: Year end 2002-2019, 20 EMEs 14 AEs.
All explanatory variables are lagged.

KF* DURING CRISES (GFC AND PANDEMIC)

Countries with a larger KF*gap/GDP in 2007 had larger declines during the GFC period (2008Q4-2009Q3).



At the eve of the pandemic, very few countries had positive KF* gaps (and those gaps were pretty small).

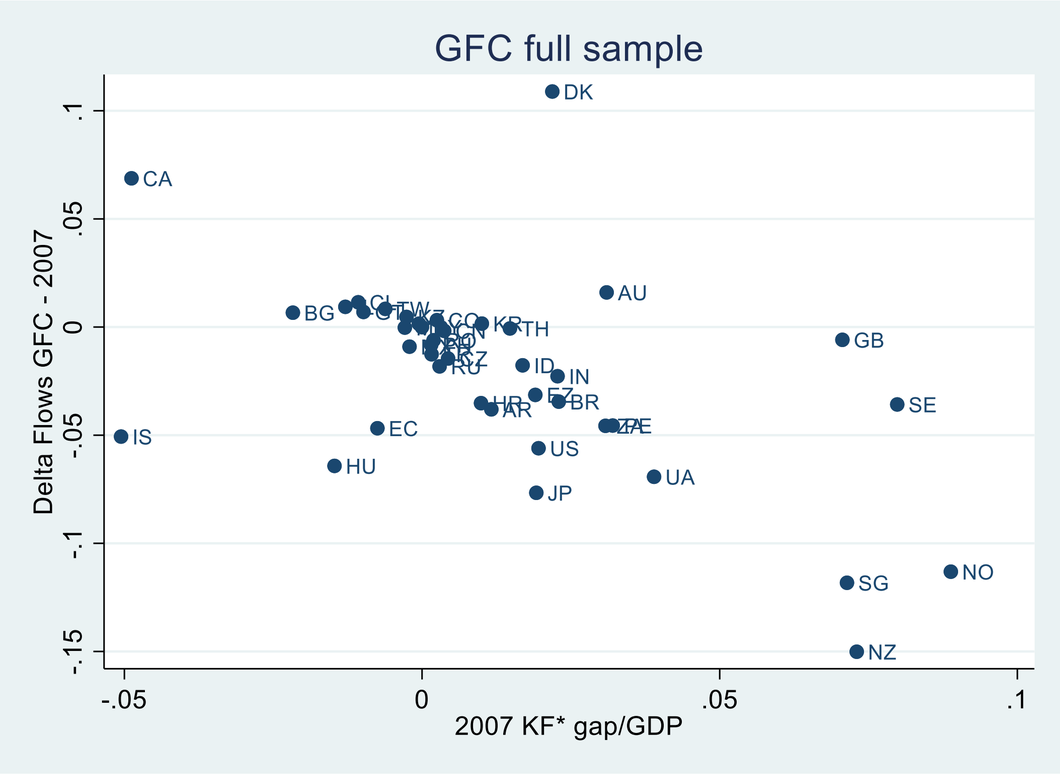


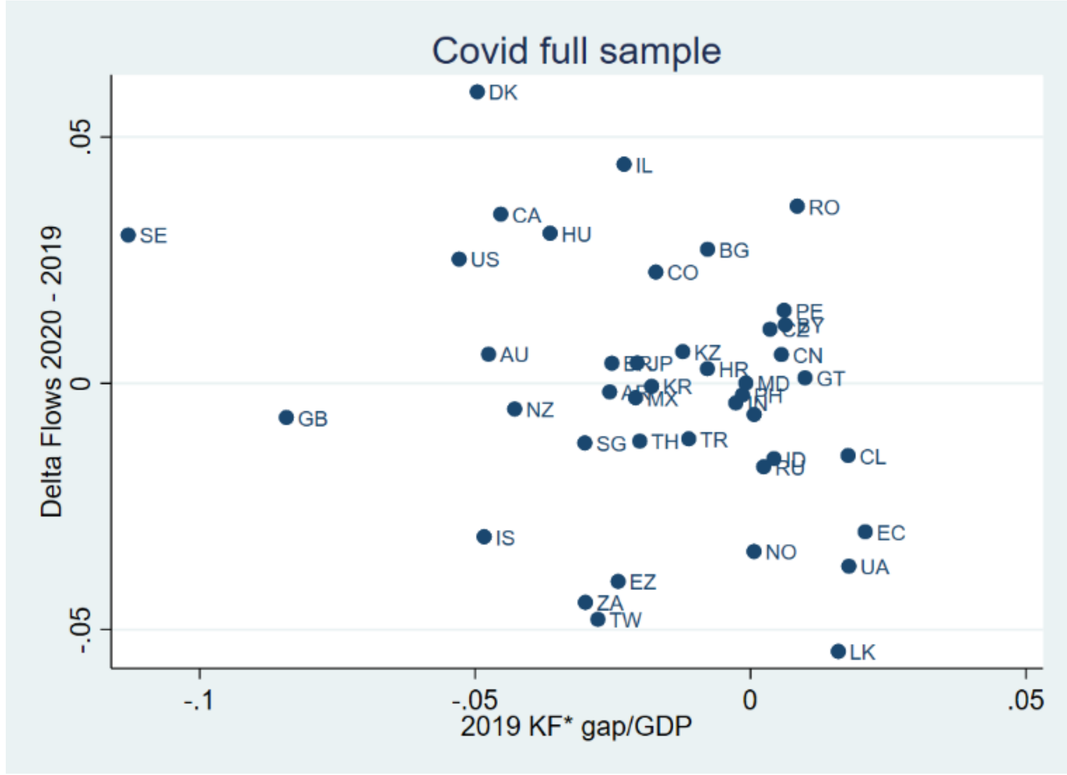
We wrote early in the pandemic that in 2020/21 (i) flows had less room to fall as many countries were below KF* at the eve of the pandemic shock, (ii) for most countries any drop in flows experienced during the crisis would likely to be temporary as a rebound toward KF* should be expected in the intermediate term, and (iii) a few countries (Ecuador, Chile, and Ukraine) seemed more vulnerable than others.

KF* DURING CRISES (GFC AND PANDEMIC)

Countries with a larger KF*gap/GDP in 2007 had larger declines during the GFC period (2008Q4-2009Q3).

At the eve of the pandemic, very few countries had positive KF* gaps (and those gaps were pretty small), suggesting medium-term flows wouldn't drop sharply. Evidence for 2020 suggests that was correct. We didn't see massive sudden stops as during the GFC, and countries with higher pre-pandemic KF* gaps had larger outflows..



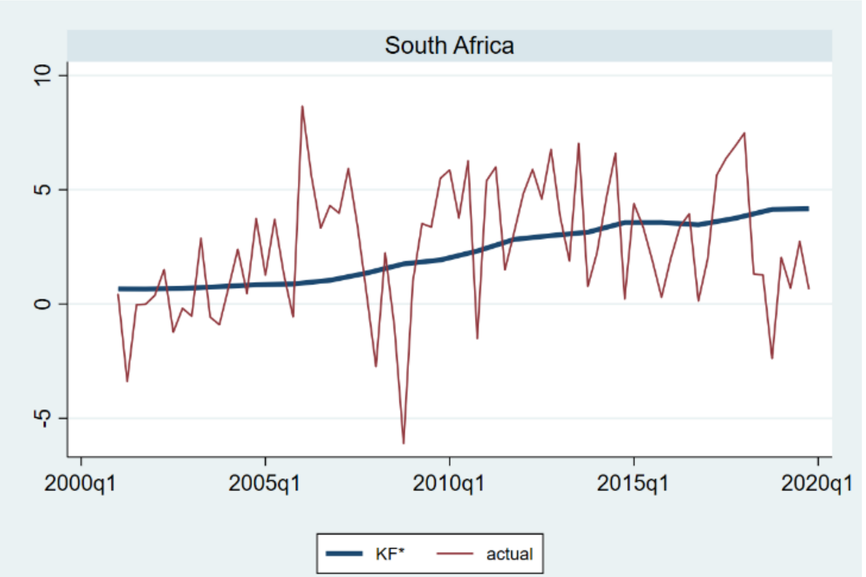


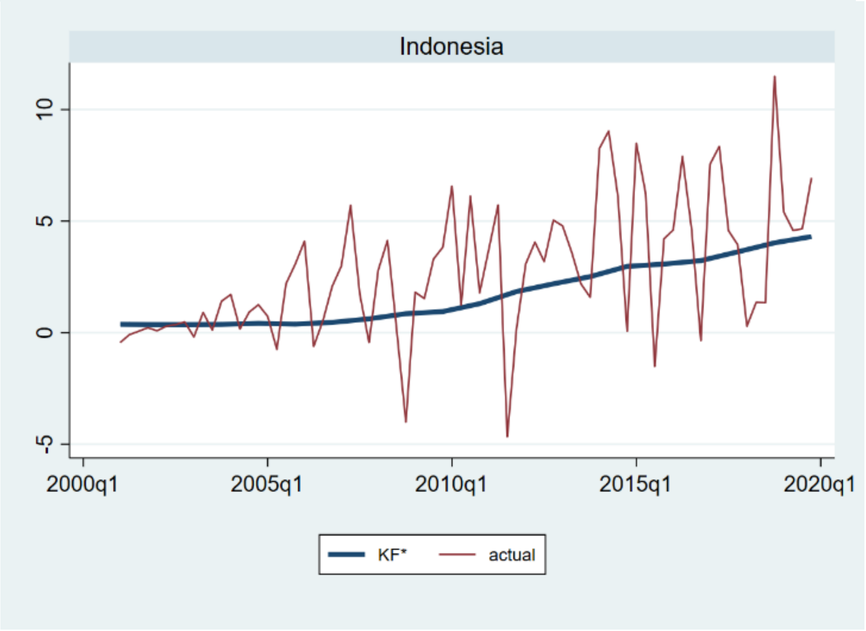
Summary

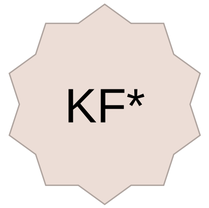
KF* appears to represent a natural level of flows.

- Quarterly flows are quite volatile – but they oscillate around KF*.
- Cogley tests indicate deviations of actual flows from KF* are transitory: Flows revert strongly to KF* over 1-2 year horizon.
- The tendency of the transitory element in quarterly flows to dissipate over time grants KF* significant explanatory power over medium-run.
- KF* performs well against various filter methods, even in-sample ones.
- KF* gap predicts 6-quarters-ahead sudden stops and next year's equity returns, and predicted the countries that had the largest declines in portfolio inflows during the GFC and pandemic.

Looking ahead, the long-run outlook for flows depends crucially on a post-crisis rebound in global growth (and hence global savings) which, along with steady-state portfolio weights, are the underlying components of KF*.







Thank you!

JOHN, FRANK, VERONICA