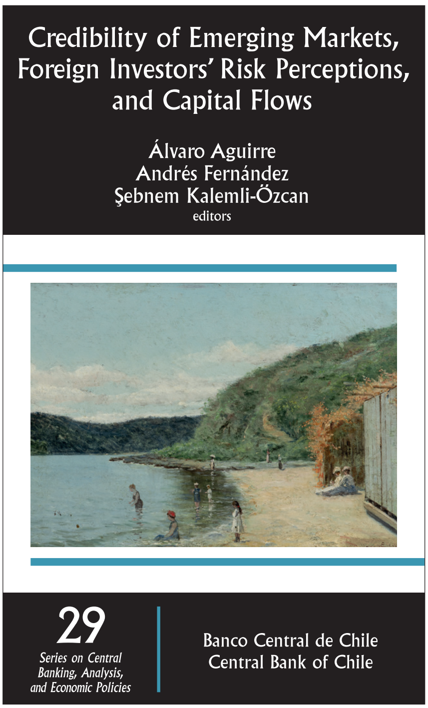
*KF*star and Portfolio Inflows: A Focus on Latin America

John D. Burger
Loyola University Maryland

Francis E. Warnock
University of Virginia
National Bureau of Economic Research

Veronica Cacdac Warnock
University of Virginia

Pages 185 – 204 | Chapter printout



The views and conclusions presented in the book are exclusively those of the authors and do not necessarily reflect the position of the Central Bank of Chile or its Board Members.

Published in Santiago, Chile
by the Central Bank of Chile
Manufactured in Chile

ISBN (print) 978-956-7421-71-8
ISBN (digital) 978-956-7421-72-5
Intellectual Property Registration 2020-A-2881

ISSN 0717-6686 (Series on Central Banking, Analysis, and Economic Policies)

*KF*STAR AND PORTFOLIO INFLOWS: A FOCUS ON LATIN AMERICA

John D. Burger
Loyola University Maryland

Francis E. Warnock
University of Virginia
National Bureau of Economic Research

Veronica Cacdac Warnock
University of Virginia

Policymakers faced with volatile capital flows may desire a method to identify the level of flows likely to persist in the medium run. In a series of papers (Burger, Warnock, and Warnock, henceforth BWW, 2018, 2022), we have developed an estimate of the natural or equilibrium level of capital flows (*KF*star or *KF**) that provides guidance on the likely amount of portfolio inflows countries can expect over a one- to two-year period.

*KF** is an easy-to-construct slow-moving supply-side benchmark that approximates the level flows should converge to over a medium-term horizon and thus helps gauge the amount of gross portfolio inflows countries can expect to receive. *KF** is a supply-side measure in that it is derived from the supply of rest-of-the-world (*ROW*) savings; in simple terms, it is a lagged portfolio weight, constructed by using portfolio liabilities data from Lane and Milesi-Ferretti (2018), multiplied by current *ROW* savings (from the IMF). The underlying theory is from the Tille and van Wincoop (2010) and Devereux and

Burger acknowledges support from the France-Merrick Foundation. Francis Warnock thanks the International Finance Division of the Board of Governors of the Federal Reserve System for its ongoing hospitality. The *KF** measure is posted at https://sites.google.com/view/francis-warnock/kfstar.

Credibility of Emerging Markets, Foreign Investors' Risk Perceptions, and Capital Flows edited by Álvaro Aguirre, Andrés Fernández, and Şebnem Kalemli-Özcan, Santiago, Chile.

Sutherland (2011) incorporation of portfolio choice in open-economy DSGE models and, specifically, their notion of zero-order weights and portfolio growth flows.

In this paper we focus on *KF** applications to Latin American countries. First, we document that Latin American portfolio inflows converge strongly to *KF** over medium-run horizons. Second, we demonstrate that deviations from *KF** help anticipate sudden stops in the region. Third, we show that *KF** acts as an indicator of vulnerability in the face of global shocks. Case studies of the Global Financial Crisis (GFC), post-GFC surge, and Covid-19 pandemic each indicate that, for Latin American countries, *KF** provides useful real-time information on the vulnerability of flows (well beyond that of alternative statistical proxies). Last, we analyze the drivers of short-run deviations in flows from *KF** and document interesting heterogeneity: flows to Brazil, Chile, and Mexico appear closely linked to commodity prices, while flows to Argentina, Costa Rica, and Peru are linked to global risk tolerance.

In Section 1 we present a brief introduction to *KF**. Section 2 documents the tendency of Latin American flows to revert to *KF** over the medium run. BWW (2022) demonstrated, for a large sample of countries, the usefulness of *KF** as an indicator for sudden stops and vulnerability to large global shocks; in Section 3 we show that it also helps predict stops and vulnerability in Latin American countries. Section 4, following analysis in BWW (2018) using annual data, analyzes factors associated with quarterly deviations from *KF**. Section 5 concludes.

1. *KF**

In this section we briefly present *KF**, the natural level of capital flows.[1]

1.1 The Theory behind *KF**

The construction of *KF** is motivated by the open-economy DSGE models with portfolio choice of Tille and van Wincoop (2010).[2] The model leads to two types of flows. *Portfolio growth flows* are simply the gross flows that would occur if new funds are allocated according

1. For more details, see BWW (2022).
2. See also Devereux and Sutherland (2011).

to zero-order portfolio weights. A positive productivity shock leads to increased savings that are deployed mostly at home (there is a portfolio home bias) but also abroad. If the productivity shock is persistent, these so-called portfolio growth flows are also persistent. The other type of flows—*reallocation flows*—is due to time variation in expected returns and risk. Time variation in expected returns impacts cross-border flows only through the effect of savings, as new home savings are invested mainly at home, thus pushing up home asset prices and requiring a decrease in expected returns (and, thus, capital outflows) to clear the asset markets. Time variation in second moments (risk) impacts optimal portfolio weights through changes in two hedge components: the covariance between excess returns (of home relative to foreign equities) and the real exchange rate and the covariance between excess returns and future expected portfolio returns. It is the change in these covariances that generates reallocation flows so, after a potentially large initial shock, the impact on reallocation flows quickly dissipates as future changes become a function of the persistent portfolio growth flows. In sum, zero-order portfolio growth flows—essentially the flows that would occur when the volatility of shocks becomes arbitrarily small—are persistent, owing to the persistence of underlying real-side shocks and hence savings. Reallocation flows can be substantial (and volatile) but, arising primarily from time variation in second moments, transitory.

1.2 Construction of *KF**

*KF** is based on the portfolio growth component of flows. The notion of portfolio growth flows is intuitively appealing, as the flow of new savings is precisely the amount of new funds available for foreign (or domestic) investment. Put another way, new savings are an important source of funds that would be potentially invested, some at home and some abroad. Portfolio growth flows are simply the gross flows that would occur if those new funds are allocated according to zero-order portfolio weights. Accordingly, the natural level of portfolio inflows at time t for a destination country d is

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

where $\omega_{ROW,d,t-i}$ is the lagged weight of destination country d in rest-of-the-world (ROW) portfolios, defined as ROW holdings of country d

bonds and equities divided by *ROW* financial wealth, and $S_{ROW,t}$ is the contemporaneous flow of *ROW* private savings. Portfolio weights in equation (1) are formed by using Lane and Milesi-Ferretti (2018) data on *ROW* holdings of the destination country's equities and bonds (in balance-of-payments terms, the country's portfolio equity and portfolio debt liabilities), available annually for almost 200 countries starting in roughly 1995 and scaling these investment positions by *ROW* wealth (Davies and others, 2018). Savings, from the IMF's World Economic Outlook (WEO) dataset, is private savings (that is, national savings minus fiscal savings or "General government net lending/borrowing" in the IMF's WEO terms). *ROW* savings is world savings minus the recipient country's savings, and *ROW* wealth is world wealth minus the recipient country's wealth. Throughout, our *ROW* savings and weights (and flows) are 'ex-China' because, over the past two decades, there has been a substantial disconnect between China's savings (sizeable) and its outward portfolio investment (miniscule).[3]

As indicated in equation (1), we operationalize zero-order portfolio weights as a trailing five-year moving average of past portfolio weights. This ad-hoc decision is one that we are comfortable with for a number of reasons.[4] We employ a smoothed portfolio weight that abstracts from volatile transitory demand shocks. Filtering a weight has precedence in another measure, potential GDP: the Congressional Budget Office (CBO) applies a filter to the capital share so the volatility in the capital-share series does not create volatile estimates of potential GDP (Shackleton, 2018). Similarly, in our setting, asset price movements produce period-to-period volatility in portfolio weights; a filter dampens this volatility.[5]

We construct *KF** annually for the 2000 to 2021 period and form a quarterly version by linearly interpolating between year-end values. The number of countries for which we can form *KF** is limited primarily by Lane and Milesi-Ferretti (2018) data on portfolio liabilities; if a country has portfolio liabilities data, *KF** can be created even if the country does not publish flow data. Ninety-one countries

3. See BWW (2022) for details.

4. An alternative of using a theory such as CAPM to construct zero-order portfolio weights is possible but runs into the practical limitation that there is a sizeable home bias in actual data. And modeling higher frequency fluctuations in portfolio weights as in Koijen and Yogo (2019, 2020) would run counter to our focus on the longer-run natural level of flows.

5. It turns out that the smoothing of portfolio weights has no material impact on the performance of *KF**.

have portfolio liabilities data starting in 1995; for these, we can form a five-year lagged rest-of-the-world portfolio weight ($\omega_{ROW,d,t}$) starting in 2000 (i.e., the average weight from 1995 through 1999). For 90 other countries, we can form *KF** beginning later. In all, we create *KF** for 181 countries. This paper provides analysis for Latin American economies.

1.3 *KF** and its Decomposition

By definition,[6] trends in *KF** are given by *ROW* private savings, which is largely common to all destinations, and foreigners' (lagged) weights on stocks and bonds, which can vary substantially across investment destinations.

These components are presented in figure 1. The top left graph shows global (excluding China) private savings, which increased 8.5 percent per year over the 2005 to 2011 period and then was essentially flat from 2011 to 2018, increasing only 0.2 percent per year, before resuming strong increases. Thus, *ROW* savings tended to increase *KF** through 2011, maintained a level effect until 2018, and has since increased.

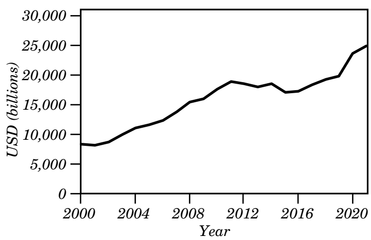
The other component is the portfolio weight (top right graph). The vertical height in the scatterplot shows the average annual increase in portfolio weight from 2000 to 2017. India's portfolio weight, for example, grew about 12 percent per year over that period, while Argentina's portfolio weight fell about five percent per year. While detailed analysis of factors behind countries' changing portfolio weights is beyond the scope of this paper, we note (and display in the scatterplot) that portfolio weights grew with market weights. For example, Peru's market weight increased at an annualized rate of 6.4 percent, while *ROW* investors increased their portfolio weight on Peru by 6.8 percent annually. The coefficient in a simple bivariate regression associated with the scatterplot is 0.85 with R^2 of 0.53.[7]

6. See equation 1.

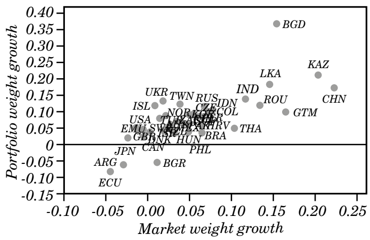
7. A cross-sectional regression (not shown) of the annualized growth rate in *ROW* portfolio weights over 2000–2017 on the average annual growth rate in the market weight (calculated as the sum of country *i*'s equity and bond-market relative to global-market capitalization), the average annual growth rate in country *i*'s share of global GDP, and the 2000–2017 change in the country's financial openness—by using the Chinn Ito (2006) KA measure—indicates that the most powerful explanatory variable is market weight. There is also a positive and statistically significant constant term that represents the broad-based trend toward financial globalization (or reduced home bias), suggesting that, independent of country-specific factors, average *ROW* portfolio weights increased by 2.4% annually.

Figure 1. *KF** and Its Decomposition

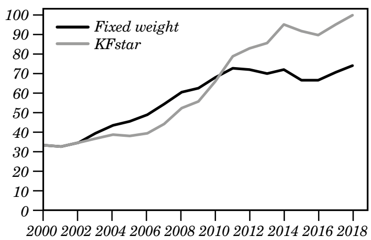
(*a*) *Global Private Savings (ex-China)*



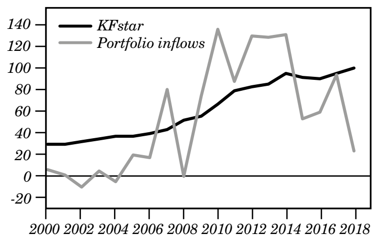
(*b*)



(*c*) *Latin America and Caribbean*



(*d*) *Latin America*



Source: Authors' calculations.
Note: Shown in the top row are two components of *KF**: global private savings (ex-China) and the change in portfolio weights. The scatterplot (upper right) shows the relationship between the growth in portfolio weights and market weights (both expressed as average annual growth rate from 2000–2017). The bottom left graph shows, in billions of U.S. dollars, Latin America's *KF** and *KF** with weights fixed at the 2000 level. The difference between the two lines is a visual representation of the effect of increased weights on *KF**. The bottom right graph shows Latin America *KF** and actual portfolio inflows.

There is a great deal of endogeneity in a regression of portfolio weight on market weight, as inflows can enable market growth, so we view the relationship as illustrative not causal. Nonetheless, one might interpret this result as evidence of 'relative' (as in 'relative' PPP) international capital asset pricing model or international CAPM. We know that portfolio weights are far below market weights (i.e., home bias leads to failure of absolute international CAPM), but the growth rates in portfolio and market weights are highly correlated in the long run. Overall, we conclude that there are persistent movements in portfolio weights that appear to be associated with long-run changes in relative market size and reduced home bias.

The bottom left graph displays annual *KF** and a "fixed-weight" version of *KF**, which together provide a visual depiction of the relative contribution of global savings and changing portfolio weights. *KF** increases through 2011 and especially in the period starting in 2005, in part because of the strong growth in global (excluding China) private savings. The difference between *KF** and the fixed-weight version is a representation of the effect of increased portfolio weights on *KF**. For most regions around the world, portfolio weights increased, but here Latin America is an outlier because its portfolio weight actually decreased in the 2000s, driven mainly by a sharp decrease in Argentina's.

2. *KF** and Medium-Run Capital-Flow Forecasts

The volatility of international capital flows makes it difficult to discern what level of flows will likely persist going forward. figure 2 provides plots of quarterly portfolio flows and *KF** for eight Latin American economies. Visual inspection of the time-series plots in figure 2 reveals that quarterly portfolio flows are extremely volatile, yet they tend to oscillate around *KF** over time. Currently, *KF** suggests that each quarter Argentina, Chile, and Colombia should receive about $2 billion in portfolio inflows, whereas Mexico and Brazil should receive about $10 billion in quarterly inflows.

It is important to note that *KF** in figure 2 is *not* a statistical filter of flows but rather formed by projecting global savings based on historical portfolio weights.[8] A formal statistical assessment of *KF**, following Cogley (2002), is provided by analyzing whether current deviations of flows from *KF** help predict future changes in portfolio flows over the medium run. Focusing on the Latin American region, country-level regressions of the following form are estimated:

$$flows_{i,t+6} - flows_{i,t} = \alpha_i + \beta_i\,(flows_{i,t} - KF^{*}_{i,t}) + \varepsilon_{i,t}. \quad (2)$$

Equation (2) provides a test of whether flows revert to *KF** over a six-quarter horizon. If current flows are above (below) *KF**, then we expect a future decline (increase) in flows. If flows revert precisely to *KF**, we expect to obtain estimates of $\beta_i = -1$. Note that this analysis is out of sample, as it uses the period t gap between actual flows and the predetermined *KF** to predict the *six-quarter*-ahead change in flows; the closeness of β_i to -1 is in effect a summary measure of its performance.

8. See equation 1.

Figure 2. *KF and Gross Portfolio Inflows**
(2000.IV–2021.IV, billions of U.S. dollars)

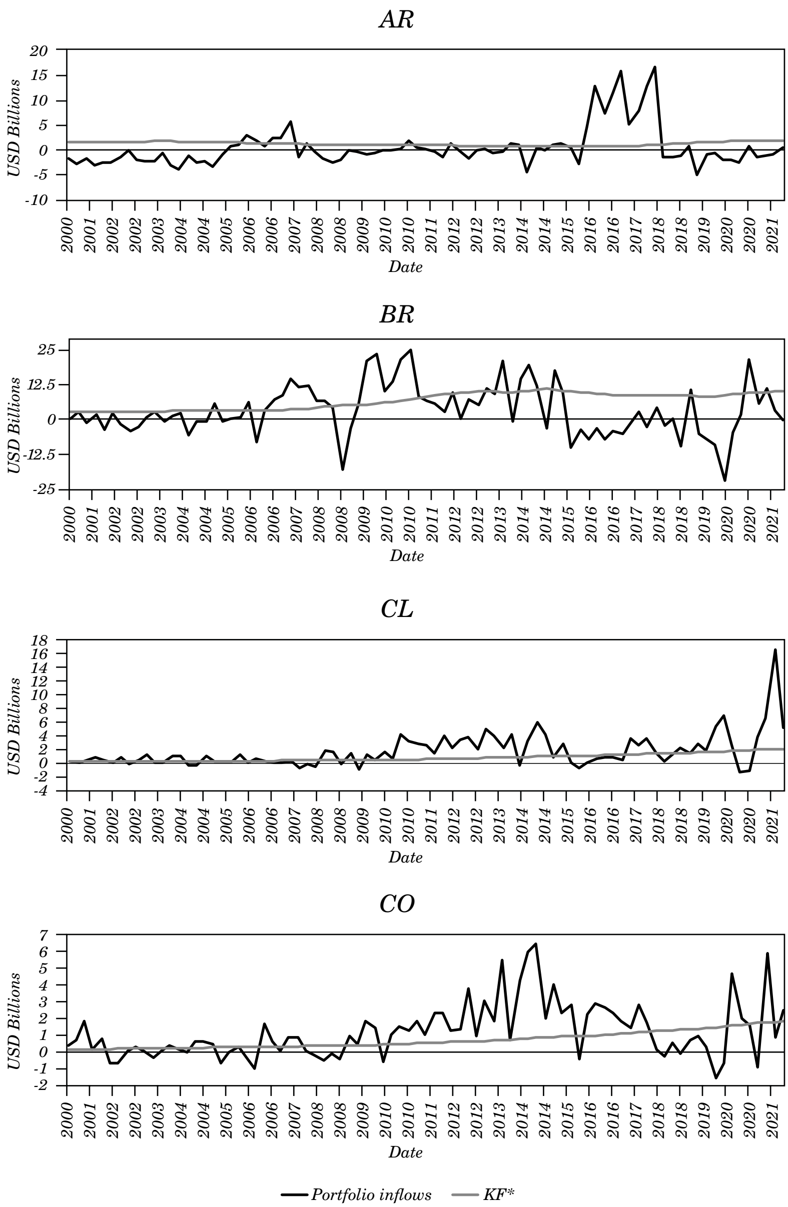
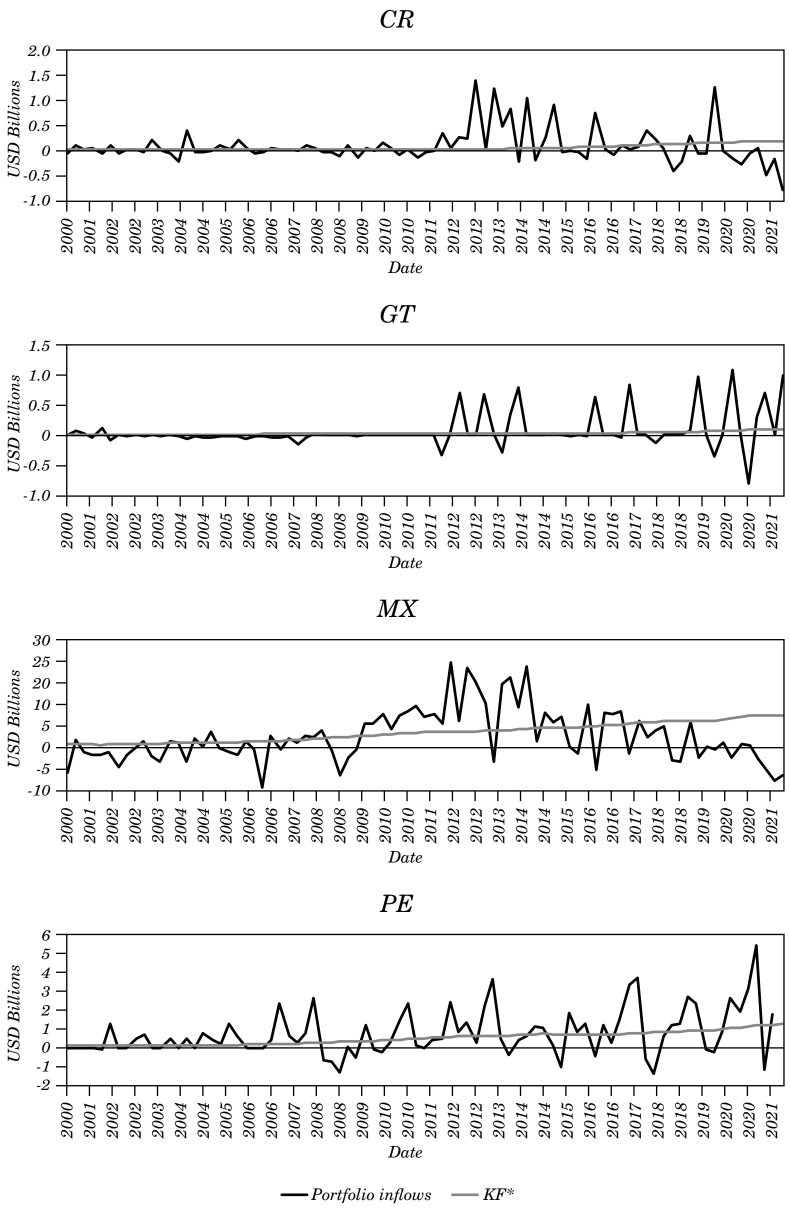


Figure 2. *KF and Gross Portfolio Inflows**
(2000.IV–2021.IV, billions of U.S. dollars) (*continued*)



Source: Authors' calculations.
Note: The graphs show quarterly portfolio inflows (the volatile line) and *KF** (the slow-moving line).

Table 1 provides results from the estimation of equation (2) for the eight Latin American economies with sufficient time-series data for quarterly portfolio flows. The simple regressions presented in Table 1, which forecast the *future* six-quarter change in portfolio flows as a function of the *current* gap in flows from *KF**, generate impressive levels of explanatory power (R^2). Remarkably, for most of the Latin American economies, the tendency of flows to revert to their natural level can explain 34–43 percent of medium-run variation. And for seven of the eight countries, we fail to reject a null hypothesis of β equal to –1, suggesting portfolio flows revert to *KF** over a six-quarter horizon. *KF** performs relatively poorly for Chile although the lack of fit appears driven primarily by recent volatility in flows including an outlier of $16.5 billion in inflows during 2021.III. In fact, truncating the sample at end-2020 greatly improves the fit for Chile (R^2 = 0.31) and yields a β estimate of –0.78.

Table 1. Reversion of Flows to *KF**

Country	*Beta (s.e.)*	R^2	*Observations*
Argentina	-0.788*** (0.159)	0.40	79
Brazil	-0.840*** (0.110)	0.39	79
Chile	-0.413 (0.317)	0.08	79
Chile*	-0.778*** (0.167)	0.31	75
Colombia	-0.748*** (0.160)	0.34	79
Costa Rica	-0.762*** (0.172)	0.34	79
Guatemala	-1.039*** (0.256)	0.43	79
Mexico	-0.503*** (0.131)	0.20	79
Peru	-0.819*** (0.129)	0.34	78

Source: Authors' calculations.
Note: The table presents Cogley regression results based on equation (2): $flows_{i,t+6} - flows_{i,t} = \alpha_i + \beta_i\,(flows_{i,t} - KF^*_{i,t}) + \varepsilon_{i,t}$. The proximity of β_i to –1 effectively summarizes the degree to which portfolio flows revert to *KF** in the medium run (in this case, over six quarters). Sample period for t+6 is 2002.II–2021.IV, except * which is truncated at 2020.IV. *** denotes significance at the 1% level.

3. Applications: *KF** as a Warning Indicator for Sudden Stops and Vulnerability to Large Global Shocks

In the previous section we demonstrated that, for Latin American countries, *KF** helps identify the component in portfolio flows that is expected to persist over medium-run horizons. BWW (2022) showed that, for a large sample of countries, *KF** helps forecast sudden stops and flows during large global shocks. This section assesses whether those results apply to Latin America economies.

3.1 Predicting Sudden Stops

We test whether portfolio flows that are well above *KF** predict an upcoming sharp decline in flows, focusing on the Forbes and Warnock (2012, 2021) extreme capital-flow episodes updated through 2021.IV. That is, does *KF*gap*—the gap between actual flows and *KF**—help predict future sudden stops in Latin America? Following BWW (2022), we estimate models of the form:

$$Prob\ (STOP_{i,t+h} = 1) =$$
$$F\ (KF^{*}gap_{i,t}, Global\ Factors_{t}, Local\ Factors_{i,t}) \quad (3)$$

where $STOP_{i,t+h}$ 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,* and $KF^{*}gap_{i,t}$ is the gap (scaled by GDP) between current flows and *KF**, averaged over the last four quarters. Everything is as in Forbes and Warnock (2021) with three exceptions: our forecast horizon is medium term, whereas Forbes and Warnock (2021) focus on one-quarter-ahead episodes; we extend the dataset through 2021.IV; and we include *KF*gap*. Global factors include global risk (measured as year-over-year change in the volatility index, VIX), global liquidity (measured as the year-over-year percentage growth in the 'global' broad money supply, where global is the sum for the Eurozone, U.S., U.K., and Japan), global monetary policy (measured as the year-over-year change in the average shadow short rate for the U.S., U.K., Eurozone, and Japan), global growth (measured as year-over-year global GDP growth from the IMF's WEO dataset), and the year-over-year percentage change in oil prices. Local factors are, as in Forbes and Warnock (2021), limited to local year-over-year real GDP growth and a regional contagion measure (an indicator equal to one if another country in the region has an episode). Because extreme capital-flow episodes are rare, following Forbes and Warnock (2021), we estimate equation (3) by using the complementary logarithmic framework, which assumes F(·) is the cumulative distribution function of the extreme value distribution.

Results from panel estimation of equation (3) at a six-quarter forecast horizon are presented in table 2. Merging our *KF** dataset with the Forbes and Warnock (2021) capital-flow episodes leaves a sample of eight Latin American economies (same countries listed in Table 1) and 595 quarterly observations. The results in panel A, which are similar to but stronger than those in BWW (2022), indicate flows above *KF**, strong global growth, rising global risk, and rapid growth in the global money supply are each associated with an increased likelihood of a sudden stop in capital inflows in six quarters.

Table 2. *KF and Extreme Capital-Flow Episodes**

Panel A	*Prob (Stop)* *t*+6 *quarters*
*KF*gap*	52.196***
	(10.341)
Global Variables	
Global GDP Growth	0.483***
	(0.158)
Risk	0.079***
	(0.022)
Liquidity	0.080***
	(0.022)
Oil Prices	-0.008*
	(0.005)
Monetary Policy	0.141
	(0.255)
Local and Contagion Variables	
Local GDP Growth	5.716
	(6.184)
Observations	595
Countries	8

Table 2. *KF and Extreme Capital-Flow Episodes (continued)**

Panel B	*Prob (Stop)* *t+6 quarters*
*KF*gap / GDP* = 0%	6.7%
*KF*gap/GDP* = 2.4%	21.9%
*KF*gap/GDP* = 4.8%	56.6%
*KF*gap* = 2.4% &	
Global growth = 4.2%	40.6%

Source: Authors' calculations.
Note: Panel A presents regressions forecasting *t*+6 sudden stops for the sample (*t*) 2001.IV–2019.IV. Explanatory variables include period *t KF*gap* (the deviation of actual flows from *KF**, expressed as a share of GDP) and global and local variables. Global variables include 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 U.S., U.K., Eurozone, and Japan), monetary policy (measured as the year-over-year change in the average shadow short rate for the U.S., U.K., Eurozone, and Japan), and the year-over-year percentage change in oil prices. Local factors are year-over-year real GDP growth and a regional contagion measure (an indicator equal to one if another country in the region has an episode). Panel B shows, by using marginal effects from those regressions, the probability of a period *t*+6 sudden stop when (i) *KF*gap* is at its mean (0%) and one and two standard deviations above its mean (2.4% and 4.8%), holding all other variables at their means, and (ii) both *KF*gap* and global GDP growth are one standard deviations above their means.

To get a sense for economic magnitudes we calculate the model's estimated probability of a future stop when *KF*gap* is at its mean (zero) and one and two standard deviations above its mean (2.4 percent and 4.8 percent of GDP), holding all other variables at their means. When *KF*gap* is zero—that is, current flows are equal to *KF**—there is a 6.7 percent probability of experiencing a stop episode six quarters in the future. But when *KF*gap* is one or two standard deviations above its mean, the probability of a stop increases to 21.9 percent and 56.6 percent, respectively. We also find evidence that the combination of strong global growth and a large positive *KF*gap* is a particularly powerful predictor of a coming sudden stop: When *KF*gap* and global growth are both one standard deviation above their respective mean, the probability of a future stop climbs to 40.6 percent. These probabilities are similar to but slightly higher than those reported in BWW (2022) for a broader set of countries.

As in BWW (2022), the story that emerges is similar to the 'gap' analysis that the Bank for International Settlements (BIS) uses to predict banking crises.[9] For example, the BIS uses two 'gaps' as predictors, each defined as an underlying—corporate debt-to-GDP

9. See Aldasoro and others (2018).

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 is 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 six quarters. One difference from the BIS indicators: Our 'trend' is not a mechanical trend but *KF**.

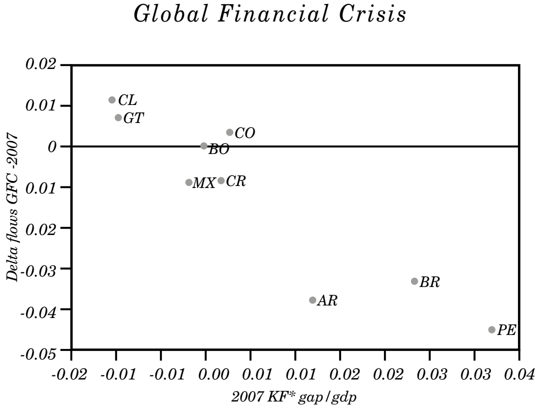
3.2 Vulnerability to Large Global Shocks

The results in Section 3.1 suggest that for Latin America *KF** can be used as a warning signal for future sudden stops. In this section we take a deeper dive to determine how deviations of flows from *KF** provide an indicator of the region's vulnerability to global shocks.

If *KF** represents the natural level of portfolio flows, Latin American countries receiving flows well above *KF** are most likely to experience a sharp reduction in flows in response to an external global shock. For analysis of the GFC, for each country we calculate the average *KF*gap/GDP* over the four quarters of 2007 as a measure of pre-GFC vulnerability. We then calculate the GFC impact of the crisis on flows as average *flows / GDP* during the GFC period (2008.IV—2009.III) minus *flows / GDP* during 2007. Figure 3 provides strong visual evidence in support of the hypothesis that countries with flows well above *KF** during 2007 (e.g., Peru, Brazil, and Argentina) subsequently suffered the largest (scaled by GDP) reductions in flows during the crisis. On the other end of the spectrum, we note that Chile and Guatemala were receiving flows *below* *KF** during 2007 and subsequently experienced increased flows during the GFC.

In the years following the GFC, capital flows to emerging markets rebounded strongly–especially for many Latin American economies. Figure 2 showed that the post-GFC rebound resulted in flows well in excess of *KF** for many Latin American economies (e.g., Brazil, Chile, Colombia, Costa Rica, and Mexico). A policymaker equipped with *KF** would have been concerned about flows well above equilibrium that were ripe for a reversal. And as it turns out, each of these markets experienced a subsequent sudden stop (2015 for most, 2013 for Chile).

Figure 3. *KF and Portfolio Flows during the GFC**

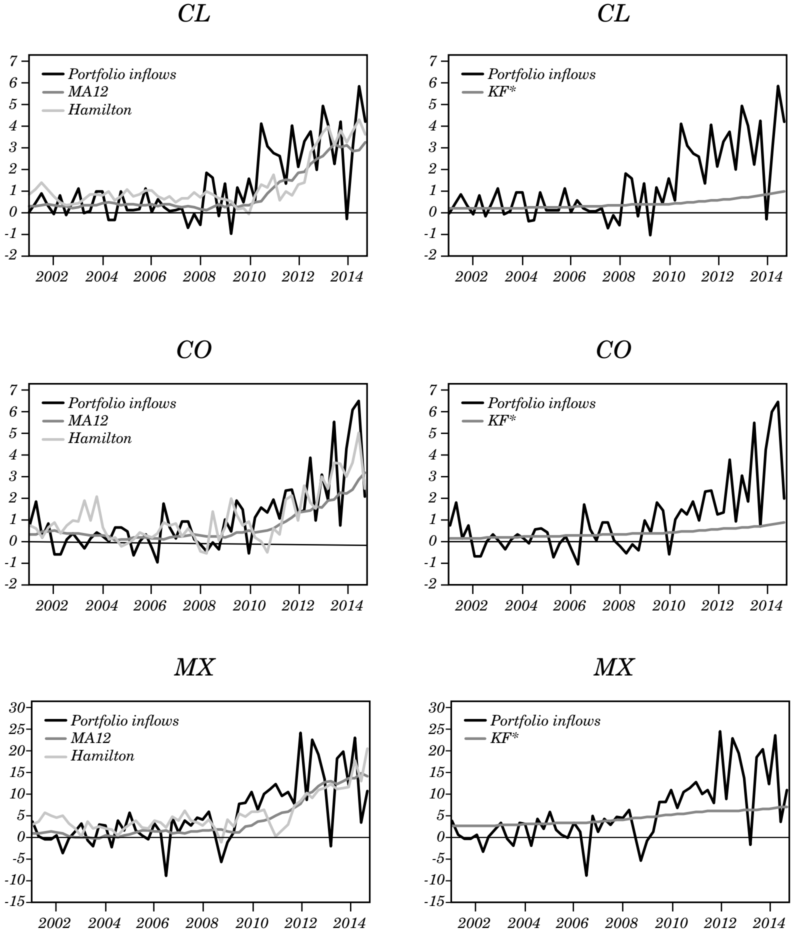


Source: Authors' calculations.
Note: The figure is a scatterplot of the relationship between the average 2007 *KF*gap/GDP* (the deviation of actual flows from *KF**, expressed as a share of GDP) and the subsequent change in portfolio flows during the GFC. The change in flows is calculated as average *flows / GDP* during the GFC period (2008.IV–2009.III) minus *flows / GDP* during 2007.

Although in hindsight it might appear self-evident that Latin American portfolio inflows were unsustainably high in the post-GFC period, real-time analysis is far more challenging. To demonstrate the impressive real-time forecasting properties of *KF**, we compare *KF** with some *statistical* proxies for equilibrium flows. One simple proxy is a 12-quarter moving average of past flows as a proxy for the equilibrium level of flows. If flows surge above the recent past, one might be concerned about the likelihood of a reversal. The Hamilton (2018) linear projection provides a more sophisticated statistical estimate of trend flows that is the fitted values from an OLS regression of a variable at date t on a constant and the four most recent values as of date $t–h$.

The left panel of figure 4 provides plots of actual portfolio flows overlaid against these statistical proxies for the period ending 2014.IV. For Chile, Colombia, and Mexico, we note that a policymaker comparing actual flows to these statistical filters would not have received a clear real-time signal regarding the sustainability of portfolio flows, as flows were oscillating around these filters. By contrast, the plots in the right panel, which overlay actual flows relative to *KF**, give a clear signal: In all three countries, flows greatly exceed their natural level and were therefore susceptible to a shock.

Figure 4. *KF*^*^ and Portfolio Flows post GFC

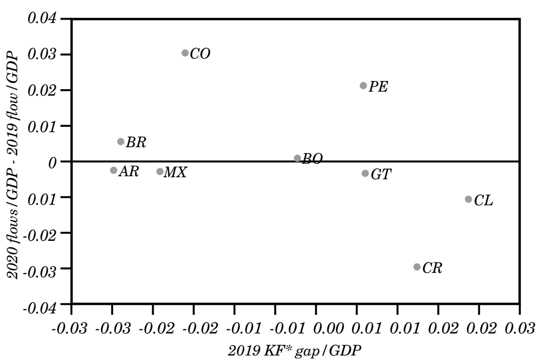


Source: Authors' calculations.

Note: The left panel compares quarterly portfolio flows to two statistical filters: (1) a 12-quarter moving average and (2) Hamilton (2018) linear projection estimated with data through 2014.IV. The right panel compares quarterly portfolio flows to *KF**. The sample for all graphs is 2000.IV–2014.IV.

As a final example of a global shock, we consider the Covid-19 pandemic. Figure 5 plots the relationship between the pre-pandemic (i.e., 2019) deviation of portfolio flows from *KF** (scaled by GDP) and the subsequent change in flows during 2020. Prior to the Covid-19 shock, only Chile and Costa Rica had flows significantly above *KF*,* while Argentina, Brazil, Colombia, and Mexico entered the pandemic with flows already well below *KF**. The Covid-19 shock induced a dramatic period of portfolio outflows—especially from emerging economies—but, consistent with the predictions of *KF*,* the period of outflows was short-lived, and the average change in flows from 2019 to 2020 was relatively small. Moreover, countries with the greatest outflows in 2020 had the largest (positive) *KF*gap* prior to the Covid-19 shock. In other words, *KF** provided a sense of which Latin American countries were most susceptible to outflows in 2020 and, as a guidepost, indicated that for all the countries in the region, the outflows episode should be neither long-lasting nor severe.

Figure 5. *KF and Portfolio Flows during the Pandemic**



Source: Authors' calculations.
Note: The figure is a scatterplot of the relationship between the 2019 (pre-pandemic) *KF*gap/GDP* (deviation of actual flows from *KF**, expressed as a share of GDP) and the subsequent change in portfolio flows during the 2020 pandemic (2020 *flows/GDP* – 2019 *flows/GDP*).

4. An Investigation into Deviations from *KF**

Thus far we have focused on the fact that deviations from *KF** are informative for future changes in flows, especially in the medium run. But these deviations can be sizable and occasionally sustained for significant periods, thus raising the question of what factors might drive flows to stray from their natural level. BWW (2018) conducted such analysis using annual panel data for 19 EMEs and found that higher than normal portfolio inflows occur when growth is strong, equity returns are high, and U.S. Treasury yields and risk measures (BBB-AAA spread or VIX) are low. Here we focus on Latin American countries and, noting that the drivers for deviations from *KF** likely differ by country, we analyze factors associated with the gap between actual and natural flows in country-level regressions. Explanatory variables include the VIX, long-term U.S. interest rates, commodity prices, and local and global GDP growth.

The results in table 3 highlight interesting heterogeneity across Latin American countries. In broad terms, deviations from *KF** are driven by commodity prices for Brazil, Chile, and Mexico—specifically, rising commodity prices are associated with a positive *KF*gap*. In contrast, for Argentina, Peru, and Costa Rica, risk measures are more important. For these countries, 'risk-off' episodes are associated with flows below *KF**.

Table 3. Analysis of deviations from *KF**

	AR	*BR*	*CL*	*CO*	*CR*	*GT*	*MX*	*PE*
Risk	-0.112**	-0.254	-0.012	-0.028	-0.007*	-0.005	-0.108	-0.028*
	(0.056)	(0.191)	(0.023)	(0.020)	(0.004)	(0.003)	(0.123)	(0.016)
U.S. rates	-1.188**	4.421***	-0.224	-0.188	-0.094	-0.042	0.992	-0.066
	(0.588)	(1.448)	(0.213)	(0.284)	(0.064)	(0.036)	(0.882)	(0.150)
Com. prices	0.002	0.044***	0.005**	0.004	-0.000	0.000	0.032***	-0.001
	(0.006)	(0.015)	(0.002)	(0.003)	(0.001)	(0.000)	(0.008)	(0.002)
Local growth	-0.577	102.186***	10.015	11.797	0.910	-1.124	90.317	4.783
	(6.158)	(38.282)	(11.187)	(11.377)	(3.082)	(1.372)	(69.491)	(3.800)
Global growth	0.186	-1.909*	-0.124	-0.221*	-0.023	-0.008	-1.445	-0.002
	(0.280)	(1.014)	(0.170)	(0.122)	(0.036)	(0.015)	(1.227)	(0.090)
R^2	0.20	0.39	0.23	0.16	0.10	0.08	0.21	0.06
N	77	77	77	76	77	72	77	77

Source: Authors' calculations.
Note: The table presents results from country-level regressions (2000.IV–2019.IV), where the dependent variable is *KF*gap* calculated as actual portfolio flows – *KF**. Global explanatory variables include global GDP growth (year-over-year), risk (measured as the change in the VIX), U.S. rates (10-yr Treasury yield), and the yearover-year percentage change in commodity prices. Year-over-year real GDP growth is included as a local factor.
* $p<0.1$; ** $p<0.05$; *** $p<0.01$

5. Conclusion

Latin American portfolio inflows show a strong tendency to revert to a natural level, *KF**, over medium-run horizons. Deviations of actual flows from *KF** provide significant predictive power for future flows – even in the face of large global shocks. Comparing current flows to *KF** provides policymakers with a real-time predictor of future sudden stops and vulnerability to external global shocks. Finally, analysis of short-run deviations of flows from *KF** reveals heterogeneous drivers: commodity prices for Brazil, Chile, and Mexico; risk tolerance for Argentina, Costa Rica, and Peru.

References

Aldasoro, I., C. Borio, and M. Drehmann. 2018. "Early Warning Indicators of Banking Crises: Expanding the Family." *BIS Quarterly Review* (March): 29–45.

Burger, J., F.E. Warnock, and V.C. Warnock. 2018. "Benchmarking Portfolio Flows." *IMF Economic Review* 66(3): 527–63.

Burger, J., F.E. Warnock, and V.C. Warnock. 2022. "A Natural Level of Capital Flows." *Journal of Monetary Economics* 130:1-16.

Chinn, M.D. and H. Ito. 2006. "What Matters for Financial Development? Capital Controls, Institutions, and Interactions." *Journal of Development Economics* 81(1): 163–92.

Cogley, T. 2002. "A Simple Adaptive Measure of Core Inflation." *Journal of Money, Credit, and Banking* 34(1): 94–113.

Davies, J., R. Lluberas, and A. Shorrocks. 2018. *Global Wealth Databook*. Credit Suisse Research Institute.

Devereux, M.B. and A. Sutherland. 2011. "Country Portfolios in Open Economy Macro-Models." *Journal of the European Economic Association* 9(2): 337–69.

Forbes, K.J. and F.E. Warnock. 2012. "Capital Flow Waves: Surges, Stops, Flight and Retrenchment." *Journal of International Economics* 88(2): 235–51.

Forbes, K.J. and F.E. Warnock. 2021. "Capital Flow Waves—or Ripples? Extreme Capital Flow Movements since the Crisis." *Journal of International Money and Finance* 116: 1–24.

Hamilton, J. 2018. "Why You Should Never Use the Hodrick-Prescott Filter." *Review of Economics and Statistics* 100: 831–43.

Koijen, R. and M. Yogo. 2019. "A Demand System Approach to Asset Pricing." *Journal of Political Economy* 127(4): 1475–515.

Koijen, R. and M. Yogo. 2020. "Exchange Rates and Asset Prices in a Global Demand System." NBER Working Paper No. 27342.

Lane, P. and G. Milesi-Ferretti. 2018. "The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis." *IMF Economic Review* 66:189–222.

Shackleton, R. 2018. "Estimating and Projecting Potential Output Using CBO's Forecasting Growth Model." Congressional Budget Office Working Paper No. 2018–03.

Tille, C. and E. van Wincoop. 2010. "International Capital Flows." *Journal of International Economics* 80(2): 157–75.