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Capital Flows and Emerging Markets Fluctuations*

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Abstract
In the spirit of Rey's (2015) global financial cycle hypothesis, we estimate a factor model of portfolio capital flows into emerging market economies (EME). Beyond determining the number of statistically relevant factors, we uncover the effects of U.S. interest rates, risk aversion, and commodity price fluctuations onto such estimated model. We use our estimated factors in a factor-augmented VAR in order to figure out the effects of mild fluctuations of capital flows into the macroeconomic performance of a sample of middle-income emerging economies. A shock to the common component of capital flows explains about a third of aggregate activity across our country sample.

Resumen
En la línea de la hipótesis de Rey (2015) sobre el ciclo financiero global, estimamos un modelo de factores sobre flujos de capital de portafolio hacia países emergentes. Más allá de determinar el número estadísticamente relevante de factores, analizamos los efectos de fluctuaciones de la tasa de interés de política monetaria de EEUU, de la aversión global al riesgo, y de los precios de commodities sobre tales factores que identificamos. Utilizamos además estos mismos factores en un VAR aumentado en orden a identificar los efectos macroeconómicos de fluctuaciones de los flujos de capital sobre una muestra de países emergentes de ingreso medio. Una perturbación sobre el componente común que induce los flujos de capital hacia tales países, explica alrededor de un tercio de la varianza del PIB en la muestra.

*The views expressed herein are those of the authors and do not necessarily represent the opinion of Central Bank of Chile or its board. I thank Felipe Beltrán and Tomás Opazo for research assistance. Contact information: jlorca@bcentral.cl

1 Introduction

Two risks for the economic perspectives of emerging market economies (EME) customary mentioned, say in the IMF's World Economic Outlook or in academic papers, are both unanticipated changes in the target range of Federal Funds rate or fluctuations in the price of different commodities. These risks, once effectively materialized, rapidly transmit through portfolio capital flows as either debt or equity instruments and leave their mark on the fixed-income markets, stocks and exchange rates of the countries in question. The exact theoretical consequences of capital flows fluctuations for economic activity in emerging economies are, however, not clearly settled. As Blanchard et al. (2016) states, for instance, the textbook premise is that an inflow of capital induces an erosion of the tradable sector by means of the currency appreciation, although the empirical evidence goes mostly in the opposite direction (e.g. Ghosh et al., 2016). Given this tension, a relevant series of research papers has concentrated on identifying the macroeconomic effects of *large* capital flows fluctuations: inflows, reversals and sudden stops.[1] Although such strand of literature has produced key insights regarding macroeconomic consequences for EME and eventual policy implications, those events take place just occasionally, even when considering a very long time span of two hundred years (Reinhart et al., 2016).

This is the point of departure of our paper: we are interested in understanding the macroeconomic implications of capital flows fluctuation, but focused on *mild*, business cycle frequencies. That is, we try to understand surges and reversals of portfolio flows that frequently occur when interest rate, risk aversion and commodity prices fluctuate suddenly but at scales in the neighborhood of a standard deviation. Since we attempt to understand uniform variations of flows across EME, we specify an approximate dynamic factor model for both debt and equity inflows. In this fashion, we somehow build from the original spirit of Rey (2015) by studying the number of statistical factors that effectively drive the time series path of common capital flows into emerging economies. Once we have such common factors, we of course review their empirical relation with foreign variables that previous literature has pointed out as relevant drivers (e.g. Koepke, 2019). By no means either the empirical model we employ or the data we analyze are new steps in the literature (Calvo et al., 1993; Sarno et al., 2016): there is already a prolific strand of papers uncovering drivers and macroeconomic effects of capital flows fluctuations along different periods, countries and focus of analysis. The step forward we make is to use the common factors behind capital flows as variables that supposedly convey the summary of shocks affecting emerging markets at any point of time.

[1] For instance Calvo et al. (1993, 1996) and Forbes and Warnock (2012).

More formally, we insert those capital flows factors as observable shocks into the factor-augmented VAR setting of Bernanke et al. (2005). Although we pushed our estimated factors into the limit, such bold move paid off. In fact, when we analyzed impulse-response functions along several macroeconomic series for a set of emerging economies—where nearly half correspond to commodity exporters—we get statistically relevant results that are consistent with prominent papers that study fluctuations in emerging economies, namely Uribe and Yue (2006); Akinci (2013). In sum, we conclude that a shock to the common component of capital flows explains about a third of aggregate activity across our country sample

Our paper is related to several strands of literature. We land on the global financial cycle debate (i.e. Rey, 2015 vs. Cerutti et al., 2019) by means of several optimal number of factor tests. We also discuss the effects of commodity prices on our estimated factors in the light of the financialization of commodity prices hypothesis (e.g. Cheng and Xiong, 2014 and Basak and Pavlova, 2016). We compare all of the aggregate activity impulse-response functions with studies on sources of EME fluctuations, specially interest rates vs. commodity prices (Neumeyer and Perri, 2005; Uribe and Yue, 2006; Aguiar and Gopinath, 2007; Maćkowiak, 2007; Chang and Fernández, 2013; Fernández et al., 2017, and Schmitt-Grohé and Uribe, 2018). The nature of this exercise fills a gap in the literature on capital flows into emerging economies in the following sense: while much is known about their foreign and domestic drivers (Fratzscher, 2012; Forbes and Warnock, 2012; Sarno et al., 2016; Byrne and Fiess, 2016), or regarding large inflows episodes (Benigno et al., 2015; Ghosh et al., 2016), or cyclical patterns (Broner et al., 2013; Contessi et al., 2013), or real and benchmarking effects (Kehoe and Ruhl, 2009; Raddatz et al., 2017), or regarding unconventional policy transmission (Anaya et al., 2017; Acharya and Bengui, 2018), there is no clear connection between *mild* capital flows fluctuations and its macroeconomic effects across EME. The general discussion about drivers of capital flows into EME is contained in Koepke (2019).

The rest of the paper organized as follows: in Section 2 we state our data and empirical model, and then carefully analyze the number of statistically relevant factors in addition to formal stability tests. In Section 3 we investigate the drivers of the common factors estimated in the previous section through several exercises: cross-correlations, regressions, Granger causality tests, and finally we run a VAR model so as to elucidate the dynamic relation between multiple drivers inducing our estimated factors. In Section 4 we specify the factor-augmented model where we insert our estimated factors in order to gauge the impulse-response functions and variance decompositions at business cycle frequencies. Here we also perform a battery of robustness exercises to figure out the consistency of the macroeconomic responses we obtain from factor shocks. Specifically, we control for both the observable factor series that we use and the empirical model as well. Section 5 concludes.

2 Factor analysis

The first step of our analysis involves determining our country sample, where—as stated above—we focus on middle-income emerging market economies (EME). For this matter we considered all of those countries classified as EME with an average annual PPP per capita GDP between 8,000 and 23,000 international dollars since the year 2000. By imposing these thresholds we obtained a set of 39 countries that encompasses the usual subjects in this strand of literature. With this country sample in mind, we consequently gathered a threefold dataset: First, from the IMF we collected quarterly net portfolio debt and equity inflows from the Balance of Payment statistics, all since 1990. After carefully checking data availability, we ended up with a set of 13 economies since 1995, which increases to 22 when considering later sample periods. Then, we also put together a series of foreign macroeconomic drivers of capital flows into emerging economies considered in previous research (e.g. Koepke, 2019), namely the Federal Funds rate, the leverage of the U.S. Brokers-Dealers sector, measures of financial and macroeconomic risk and uncertainty, indexes of commodity prices and so on, all of which we describe details and sources for in appendix A. Finally, the last part of our data is a panel that comprises real GDP, exchange rates, monetary aggregates, CPI, sovereign risk, and short and long interest rates for the set of emerging market economies determined above.

With the net portfolio investment data at hand our aim is to disentangle the time series of common paths of capital inflows uniformly across EME versus the idiosyncratic components inducing flows into specific countries, in the original spirit of Calvo et al. (1993, 1996) and Díaz-Alejandro (1983). As is customary in factor analysis—methodological approach—we pre-processed original data by removing outliers, trends and normalizing data to zero-mean, unit variance processes. Therefore, with pre-processed net portfolio inflows for country $i = 1, \dots, N$ in period $t = 1, \dots, T$, CF_{it}, we run the following approximate dynamic factor model (Chamberlain and Rothschild, 1983) for both debt and equity series separately

$$CF_t = \Lambda F_t + u_t, \quad t = 1, \dots, T, \tag{1}$$

$$F_t = \sum_{j=1}^{p} \Phi_j F_{t-j} + w_t,$$

where $CF_t = (CF_{1t}, \dots, CF_{Nt})$. As in Bai and Ng (2002) and Stock and Watson (2002) we pose the model in static form and estimate factors $F_t = (F_{1t}, \dots, F_{qt})$ through principal components. We then identify the number of static and dynamic factors through the methods of Bai and Ng (2002, 2007); Amengual and Watson (2007) and Ahn and Horenstein (2013).

Table 1 shows the number of factors arising from Equation 1 through several methods, time periods and country classifications. The main pattern that emerges is the following: during the whole time sample, that is between the first quarter of 1995 and the last quarter of 2018—where the number of countries with data available is N=13—we get a single dynamic factor inducing capital flows into emerging economies. This result is robust across both debt and equity flows, and also across econometric tests, and such a single factor behind capital inflows, moreover, is consistent with Miranda-Agrippino and Rey (2015), who use an asset price perspective instead on capital flows considered here to analyze emerging economies.

Table 1: Statistical Number of Factors in EME Portfolio Inflows

	1995 - 2018				2005 - 2018			
	N	BN	AH	AW	N	BN	AH	AW
I. Debt								
All countries	13	1	1	1	22	1	1	1
Commodity exporters	5	3	1	3	7	3	1	3
II. Equity								
All countries	13	1	1	1	20	1	2	1
Commodity exporters	5	3	1	3	7	3	2	3

Notes: BN: Bai and Ng (2002), IC_{p2} information criterion; AH: Ahn and Horenstein (2013), eigenvalue ratio criterion; AW: Amengual and Watson (2007) estimate of dynamic factors given BN. Commodity exporters according to World Commodity Exporter Database from IMF.

When we estimate the factor model in Equation 1 for commodity exporters exclusively, using IMF's World Commodity Exporter Database classification, we get higher factors at stake for both equity and debt flows between 1995 and 2018 for BN. Yet when using Ahn and Horenstein's (2013) construct, however, which has better finite sample properties, instead of the asymptotic focus of Bai and Ng (2002), we still get a unique factor inducing debt and equity capital inflows for commodity exporters.

Even though the size of our capital inflows dataset is relatively small when compared to the time span or N size of recent studies in the dynamic factor models literature (e.g. Stock and Watson, 2016), our estimated factors capture reasonably well the time series of factors arising from models of asset prices in emerging markets with much bigger sample size. As Figure 1 shows, in fact, the estimated factors arising from Equation 1 for both debt and equity flows fairly resemble the trend of Miranda-Agrippino and Rey's (2015), where shaded areas represent U.S. recessions.

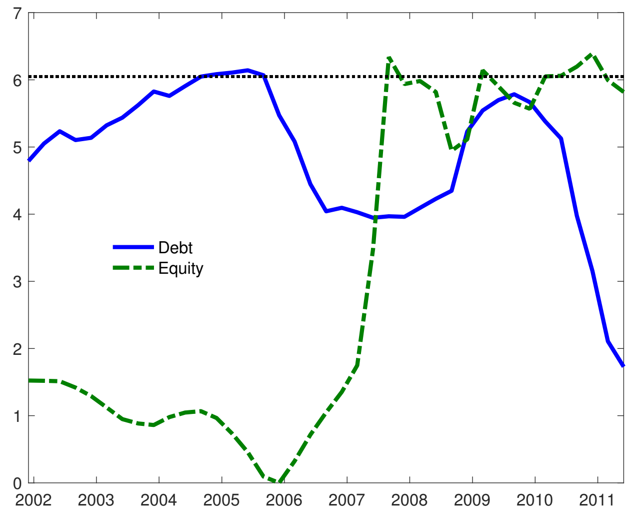
Figure 1: Portfolio Factors vs. Miranda-Agrippino and Rey (2015)

Notes: The figure shows the time series of factors estimated in Equation 1 for the 1995Q1–2018Q4 sample versus Miranda-Agrippino and Rey's (2015) global factor in risky asset prices.

Despite such similarities though, a key feature to gauge in a dynamic factor model setting is given by the stability of parameter estimates, and here accordingly we follow Chen et al. (2014) to figure out an eventual break in factor loadings with unknown break points in the spirit of Andrews (1993). As Figure 2 points out, Andrews's (1993) Sup-Wald test—reframed into a factor setting by Chen et al. (2014)—reveals a break in factor loadings around 2005 for debt inflows and roughly during 2007 for equity portfolio investment, where the dotted line comes from Andrews, 1993, Table 1 for a trimming parameter of 0.3. at the 10% level, even though results are robust to number of factors and smaller confidence levels when we perform robustness checks by changing the number of factors.

Both the single factor captured by optimal number of factor tests for the 1995-2018 period in Table 1 and the instability detected in Figure 2 end up begging the question of whether there are recently higher factors at stake in Equation 1, or just the very same first factor identified as relevant is loading at different scale on individual country inflows. To disentangle this key point we follow Chen et al.'s (2014) prescription and reestimate Equation 1 starting from 2005, which coincides with the first break detected through the Sup-Wald test. As Table 1 displays—using again the better finite sample properties of Ahn and Horenstein (2013) as guidance—while the single factor for debt flows holds still, there is a second factor determining equity capital inflows into EME since 2005, which is robust along a yearly neighborhood of such period.

Figure 2: Stability of Factor Loadings, Sup-Wald Test



Notes: The figure shows the Sup-Wald test in Chen et al. (2014) applied to our dynamic factor model. The dotted line comes from Andrews (1993) for a trimming parameter of 0.3 at the 10% level.

An additional remark is in order: the second factor for equity inflows that appears statistically relevant after the first quarter of 2005 is not a mere artifact of the larger country data availability from that yearly threshold, but rather such second factor comes up even when we hold constant the initial country sample ($N = 13$) after 2005. We performed additional controls when estimated the factors: altering sample periods and the filtering methods for removing outliers, none of which changed results materially.

The dynamic factor model we estimate, in sum, points toward a single factor inducing portfolio debt flows into EME, and the presence of a second factor as well in the case of equity flows. While these statistical results are partially consistent with the Global Financial Cycle premise of Rey (2015)—given the historical importance of fixed-income markets compared to equity—the quantitative relevance of a single factor is far from depicting the whole story behind the portfolio inflows we consider. Actually, as Table 2 shows, the variance of net portfolio flows into EME explained by the first estimated factor in our sample lies between roughly 20 and 40%, which is consistent with both previous studies with different datasets (e.g. Reinhart et al., 2017), and also with the ubiquity of idiosyncratic, *pull* factors emphasized by previous research.[2]

[2] For instance Calvo et al. (1993, 1996); Fratzscher (2012); Forbes and Warnock (2012); Sarno et al. (2016) and Byrne and Fiess (2016).

Table 2: Variance of Portfolio Inflows Explained by Factors

	1995 - 2018			2005 - 2018		
	1st	2nd	*All*	1st	2nd	*All*
I. Debt						
All countries	0.23	0.12	0.55	0.20	0.10	0.47
Commodity exporters	0.37	0.21	0.90	0.33	0.18	0.80
II. Equity						
All countries	0.24	0.12	0.57	0.17	0.12	0.47
Commodity exporters	0.28	0.23	0.88	0.30	0.23	0.83

Notes: *All* corresponds to the cumulative variance explained with 4 dynamic factors.

3 Drivers of flows

The study of capital flows into emerging economies is extensive. By and large there is a fairly accurate knowledge about their main foreign drivers in a body of literature that is thoroughly summarized in Koepke (2019). By precisely using those previous findings, now our aim is to map such leading, external forces—customary known as *push* factors—onto the specific common factors we identified as statistically relevant in the preceding section. The reason for this exercise is twofold: on one hand, the specific, least-squares procedure we used to estimate the factors—i.e. principal components—rests upon the *sine qua non* condition of mutual orthogonality between them, and therefore, since we have a second factor in play for equity inflows, we need to understand the eventual, different drivers between the first and second common component. On the other hand, since our final purpose is to quantitatively evaluate the macroeconomic impact of mild fluctuations of capital flows into EME—by introducing shocks to our factors into a factor-augmented VAR—we need to understand the way in which the usual drivers of emerging market cycles correlate with our estimated common factors from Equation 1.

The way in which we proceed therefore is as follows: we first gaze at cross-correlations of factors with respect to a broad set of formerly studied drivers, and then formally test two-way Granger causality in order to arrive at a set of exogenous drivers to be used as explanatory variables in factor regressions. The main insight of the section comes from the following exercise: since previous regressions look at at driver-factor relationships one at a time, we attempt to disentangle the effects of multiple drivers on factors in a multivariable setting by means of a vector autoregression. Particularly, we unravel the way in which interest rates, risk aversion and commodity prices affect our capital flows factors dynamically.

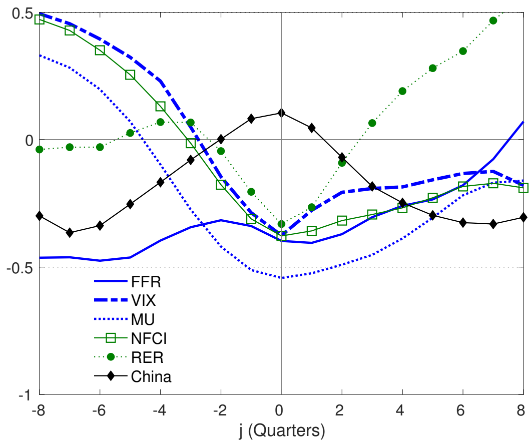
The first batch of drivers we considered consists of those utilized by Bruno and Shin (2015), namely the real Federal Funds Rate target rate of the U.S. Federal Reserve, the leverage of the U.S. Brokers-Dealers sector, the Cboe VIX index of implied volatility on the S&P index options and the real effective exchange rate of the U.S. dollar. We gathered additional measures of financial markets liquitidy and risk aversion such as the Chicago Fed national financial conditions index (NFCI), Jurado et al.'s (2015) measures of macroeconomic and financial uncertainty, Etula's (2013) measure of risk aversion, and Baker et al.'s (2016) proxy of economic policy uncertainty. Next we built from the insights of Reinhart et al. (2016) and Clark et al. (2019), and collected a series of commodity price indexes both from the IMF, and also the S&P GSCI, data that we transformed into deviations from trend. We also considered China's GDP growth and Hamilton's (2019) index of global economic activity. In all, we take into account an initial set of 24 measures previously considered as *push* factors of capital flows into EME to figure out its association with the factors we already found as statistically relevant in the former section.

Figure 3 shows a summary of the cross-correlations of several drivers with respect to the factors coming from Equation 1 for the period 2005Q1–2018Q4. The main noticeable pattern that appears is the intuitive sign of the correlations, even for the diverse nature and sources of the drivers we compare our factors with. For instance, when we contrast our debt factor with the Federal Funds rate, measures of financial conditions, uncertainty, risk aversion and the real exchange rate of the U.S.—as panel 3a shows—we observe lower net capital inflows into EME in periods of tighter liquidity constraints, risk-off episodes and real currency appreciations, all broadly documented facts across different studies.[3] We see additionally a small, positive correlation between the same first debt factor and Chinese growth, but more importantly—as panel 3b shows—there is a uniform, positive association between commodity price surges and factor flows, which is also present in the case of equity inflows. Such latter correlations with respect to commodity prices are consistent with Clark et al.'s (2019) results and also ring a bell regarding the heatedly debated, so-called *financialization hypothesis* of commodities (e.g. Cheng and Xiong, 2014), an issue that we will tackle at the end of this section. Finally, some remarks about the first equity factor are in order. First, even though the sign of correlations in panel 3c, as in the case of the first debt factor, are intuitive and fit previous literature, the cross-correlations with respect to the Federal Funds rate is the opposite we expected. Moreover, the correlation with commodity prices is at odds with those reported for first-debt and second-equity factors. This first equity factor somehow, as the rest of the section will confirm, ends up being more directly linked to macroeconomic uncertainty, while the second equity factor is more clearly associated with commodity prices.

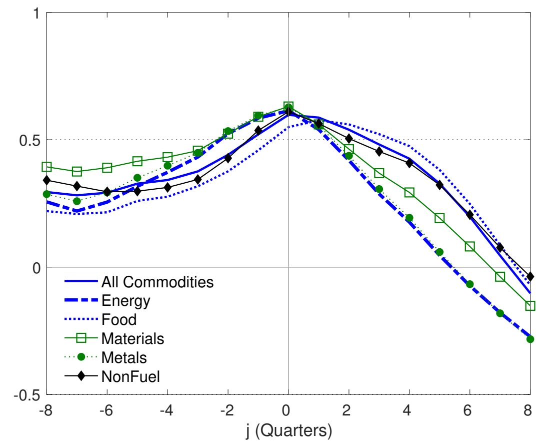
[3]For example Cetorelli and Goldberg (2012); Bruno and Shin (2015); Aizenman et al. (2016); Choi et al. (2017); Cesa-Bianchi et al. (2018) and Temesvary et al. (2018).

Figure 3: Cross-correlations Between Factors and Drivers

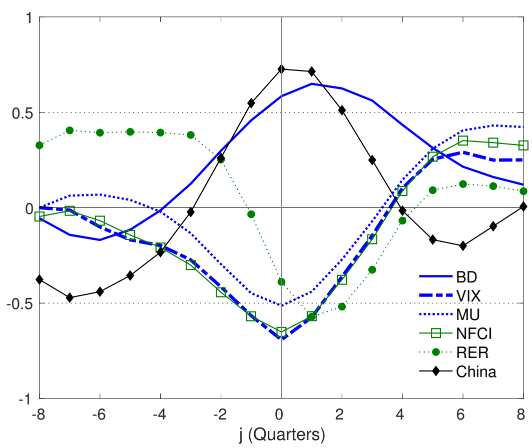
(a) 1st Debt Factor



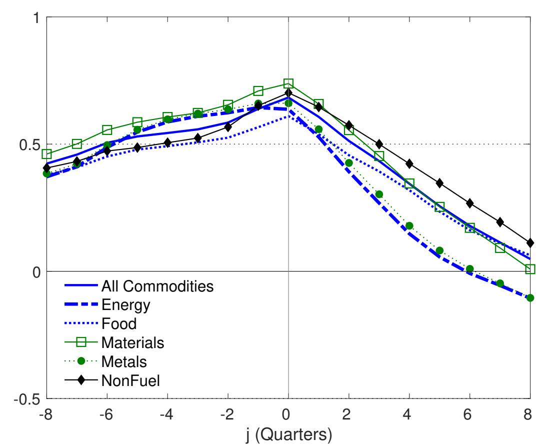
(b) 1st Debt Factor



(c) 1st Equity Factor



(d) 2nd Equity Factor



Notes: All correlations are calculated between the factors estimated between 2005 and 2018 with respect to drivers with j periods of lags/leads. FFR: Federal Funds rate. VIX: Cboe index of implied volatility on the S&P index options. MU: macroeconomic uncertainty from Jurado et al.'s (2015). NCFI: national financial conditions index. RER: U.S. real exchange rate. China: China GDP growth. BD: Leverage of the Brokers-Dealers sector. Commodity indexes from IMF.

3.1 Exogenous drivers

Given the diverse nature of drivers we considered, and specially the high correlation between themselves, now our purpose is to figure out which drivers are exogenous to our estimated factors, so as to get a smaller set of conditioning variables that summarizes all of the previous information in a set of regressions. In this fashion, we carry out the following exercise: for each of the 24 drivers we gathered, we run a two-way Granger causality test against all of the factors we identified in Table 1 for the 2005–2018 period; once we have a list of exogenous drivers for each relevant factor, we get the intersection between them, and use this final group as a strongly exogenous (e.g. Ericsson et al., 1998) set of explanatory variables in a series of regressions for individual factors.

Table 3 shows the results of such exercise. Consider the first two columns, which correspond to the first debt factor as dependent variable. What we find is a marked, statistically significant impact of liquidity conditions, uncertainty and commodity price fluctuations on the common factor of net portfolio debt inflows into EME. Moreover, the signs these impacts contrast starkly depending on the nature of the conditioning variable: indeed, while an increase of the Federal Funds rate or a spike in macroeconomic uncertainty induce a reversal of net inflows, a surge in commodity prices goes in the opposite direction, explaining up to 40% of the variance of this factor.

Those results for the first debt factor also, are smoothly resembled by the second equity factor, as the last two columns of Table 3 show. The only noticeable difference lies in the impact of macroeconomic uncertainty, which ends up reduced along both the size of the coefficient and the R-squared. We notice, however, that the first equity factor seizes the role of Jurado et al.'s (2015) macroeconomic uncertainty, although as we explained, the effects of the Federal Funds rate and commodity prices go in the opposite direction for this factor.

When we estimate this first equity factor using commodity exporters countries exclusively though, we obtain similar regression results compared to those of the first-debt and second-equity factors, and the effect of macroeconomic uncertainty persists. So what we conjecture regarding the behavior of the whole equity factors is as follows: the linear combination of the columns of $CF = (CF_1, \ldots, CF_T)$ in Equation 1 that attains the highest variance, i.e. its first principal component, is associated with macroeconomic uncertainty because the set of countries included have more diverse idiosyncratic factors, particularly in the neighborhood of the Great Recession, and this relegates the role of the Federal Reserve policy and commodity prices to the second factor. When we get a set of relatively more homogeneous countries, by clustering commodity exporters for instance, we ushered in the intuitive landscape of the first debt factor.

Table 3: Drivers of Capital Flows Factors

	1st Debt Factor		1st Equity Factor		2nd Equity Factor	
	Coef.	R^2	Coef.	R^2	Coef.	R^2
Fed Funds Rate	-0.41^{**}	0.16	0.39^{**}	0.20	-0.43^{**}	0.28
All Commodities	4.45^{**}	0.37	-1.73^{*}	0.08	3.91^{**}	0.46
Metals	3.86^{**}	0.40	-0.07	0.00	3.04^{**}	0.39
Energy	3.15^{**}	0.31	-1.28^{*}	0.07	2.68^{**}	0.36
Non Fuel	5.85^{**}	0.41	-2.03^{*}	0.07	5.28^{**}	0.54
Food	7.34^{**}	0.38	-3.04^{*}	0.09	6.60^{**}	0.48
Macro Uncertainty	-8.01^{**}	0.30	-6.48^{**}	0.27	-3.72^{*}	0.10
DJ Commodity Index	4.90^{**}	0.31	-1.20	0.03	4.29^{**}	0.38

Notes: This table reports the output of linear regressions of factors against all of those drivers identified as strongly exogenous from Granger causality exercises. Factors sample: 2005Q1—2018Q4. Except for the bottom line, all commodity indexes come from IMF quarterly data. Macroeconomic uncertainty index is from Jurado et al. (2015). *,** mean significant at 5% and 1%, respectively.

Furthermore, the variance of capital flows explained by the successive factors of equity in Table 2 is much more even compared to those of the debt factors, which lead us to think that in latter sample periods, there should be a single equity factor arising from statistical tests, a step we did not take though, in order to preserve our N, T combination as big as possible for estimating our factors. Finally, the evidence of Bekaert et al. (2013) supports the imperfect passthrough of U.S. monetary policy into risk aversion, which is an avenue to fathom the opposite signs of the coefficients for the Federal Funds rate and macroeconomic uncertainty in the case of the first equity factor (third column in Table 3). In sum, regardless of the miscellaneous nature of the drivers we considered, we obtained rather consistent results with respect to the effects of liquidity, uncertainty and commodity price fluctuations onto our factors.

3.2 Disentangling effects

While the punchline from the previous subsection is promising, in the sense that our estimated factors correlate with traditional drivers of EME cycles in the way we expected, we got ourselves into an scenario in which either a jump in commodity prices or a risk-on episode will imply higher capital flows across EME, although we ignore the way in which both shocks relate to each other. Our purpose then, before we get into the factor-augmented model, is to elucidate the relationship between our factors and the drivers behind them in a multivariate setting. For this matter we build from the VAR model of Bruno and Shin (2015) expanded into commodity prices and our capital flows factors.

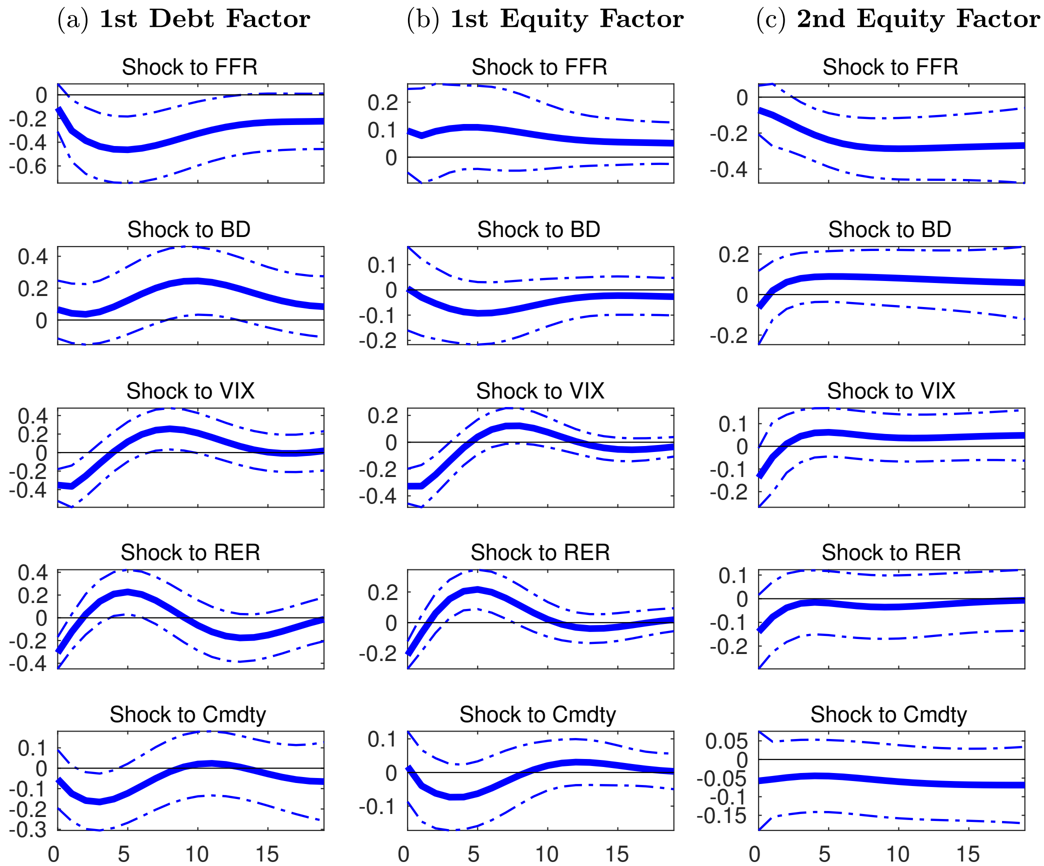
The VAR we ran therefore, includes the Federal Funds rate, the leverage of the U.S. Brokers-Dealers sector, the VIX, the U.S. real exchange rate—all of those on their original functional forms—in addition to log deviations from trend of the IMF aggregate commodity price index, and our statistically relevant factors, one at a time. That is, we run three different VAR models for the time period between 2010Q1 and 2018Q4, one model for each factor of Table 3. The sample period we chose is because of Bruno and Shin's (2015) insights regarding their original exercise: when they included the years of the Great Recession in their formulation, they reported specification problems, and they ended up trimming their data beyond 2007.

As in the original paper, we proceed to the structural formulation of the model through a recursive identification. The order of the variables is as follows: Federal Funds rate, leverage of the Brokers-Dealers, VIX, and U.S. real exchange rate, like the original paper, and we then adhere commodity prices and finally the factors, which of course conveys an scenario in that all preceding variables impact common capital flows concurrently, which is roughly consistent with Table 3. The positioning of the commodity price index into the recursive ordering deserves some comments. First, there is some evidence regarding the impact of U.S. monetary policy on commodity prices (e.g. Frankel, 2006), but more importantly there is also a prolific strand of literature pointing towards the financialization hypothesis of commodities, which is a proposition that attributes to index investing on the part of institutional investors the increased correlation of commodity prices themselves and along different asset classes also, all occurring after 2005.[4] Given both pieces of evidence—Frankel's and the Financialization hypothesis—we pushed the commodity prices to the bottom of Bruno and Shin's (2015) ordering.

Figure 4 shows the results of the exercise. Each column represents the responses of each driver to one standard deviation shocks in the respective variables. We omit the impulse-response functions for the rest the VAR, although results are broadly consistent with the insights of Bruno and Shin (2015). The first row of the Figure, that is, the responses of factors to Federal Funds rate shocks are in fact consistent with the univariate regressions of Table 3: there is a statistically significant, persistent drop of capital flows into EME in the case of the debt factor and second-equity-factor. The case of shocks to the Brokers-Dealers leverage also agrees with previous results because this variable did not qualify as an exogenous driver in the Granger causality tests. In the case of uncertainty shocks, as the third row of figures depicts, there is a dynamic, negative effect in capital flows factors, which is statistically significant for both first factors, as it was the case too in Table 3.

[4]Some leading advocates of the financialization hypothesis include Jensen et al. (2002); Tang and Xiong (2012); Adams and Glück (2015) and Basak and Pavlova (2016), while Hamilton and Wu (2015) and Chari and Christiano (2017) mark its dismissal.

Figure 4: Bruno and Shin's (2015) VAR Expanded Into Commodity Prices and Factors



Notes: The figure shows the estimation of three versions of Bruno and Shin's (2015) VAR model expanded into commodity prices and capital flows factors: each column represents the response of different times series of capital flows factors estimated in Equation (1)—namely (a)-(c) on top—with respect to shocks indicated. FFR: Federal Funds rate; BD: Leverage of the Brokers-Dealers sector; VIX: Cboe index of implied volatility on the S&P index options. RER: U.S. real exchange rate. Cmdty: IMF commodity price index. Sample: 2010Q1—2018Q4. Dashed lines indicate 90% bootstrapped confidence intervals.

As the fourth row of Figure 4 shows, a real dollar appreciation also leads to negative net inflows captured by the first factors, effects that roughly persist just for a couple of quarters. The main insight from the figure, however, comes from the last row, where we depict the responses of factors to commodity price shocks. What we find is that the dynamic response of all relevant factors is statistically null. In other words, when we control for the dynamic relationship between U.S. monetary policy and commodity price fluctuations, we arrive into the scenario in which the prime source of variation of capital flows factor come ultimately from liquidity fluctuations induced by the Federal Reserve, a result that is consistent as well with the financialization of commodities.

4 Shocks to capital flows

Given the grasp of common factors behind capital inflows into EME from previous sections, now we dwell into the main exercise of the paper which is to perform an empirical evaluation of the effects of shocks to our estimated factors onto the macroeconomic results of emerging economies. In contrast with macroeconomic evaluations around extreme capital flows fluctuations—like sudden stops—the phenomena we try to focus on comprises custumary, *mild* oscillations in the common component of portfolio flows into EME at business cycle frequencies. The specific toolkit that we deploy corresponds to the original concept of Bernanke et al.'s (2005) factor-augmented VAR model, in which we introduce one standard deviation shocks of the common factors we identified in order to observe the responses of a set of macroeconomic variables in emerging countries.

The point of this exercise is twofold: on one hand, we just want to have an empirical evaluation of the effects of capital flows variations at the scale that we observe most of the time, roughly associated with one standard deviations. On the other, and more prominently, we embark ourselves in this endeavor because we may additionally end up in an scenario in which factors better summarize the propagation of traditional external shocks that emerging economies are subject to.[5] So in this fashion, given the high frequency information of capital flows, this exercise could be an early warning indicator to watch before quarterly macro data is realized, but for this matter we need to compare our estimates with respect to the effects of usual drivers of EME cycles. For this matter we will contrast the output of shocks to our estimated capital flows factors with respect to both Federal Funds rate shocks and commodity price shocks, all in the same factor-augmented setting. Finally, in order to control for the methodological tool that we utilize, we will use Uribe and Yue's (2006) VAR in order to compare the business cycle effects of shocks in both settings.

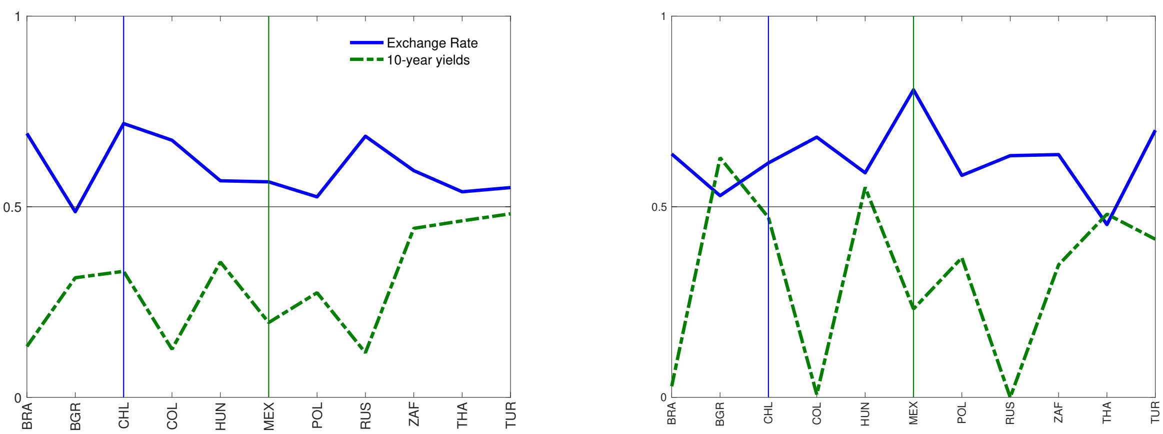
The dataset we put together for our factor-augmented VAR estimation involves real, seasonally adjusted gross domestic product (GDP), nominal exchange rates (FX), consumer price indexes (CPI), monetary aggregates ($M1$), 10-year yields ($10Y$), and Uribe and Yue's (2006) measure of real gross country interest rates (r), all for the set of 20 economies included in the factor estimations of Table 1, although just 10 economies have full data availability, namely Brazil, Chile, Colombia, Hungary, Mexico, Poland, Russia, South Africa, Thailand and Turkey. The period of analysis is the same from the previous section: 2010Q1 up to 2018Q4. We additionally update Uribe and Yue's (2006) data in order to update their estimates for the same sample period of the FAVAR we consider.

[5]Prominent papers in the are include Neumeyer and Perri (2005); Uribe and Yue (2006); Aguiar and Gopinath (2007); Maćkowiak (2007); Chang and Fernández (2013); Fernández et al. (2017), and Schmitt-Grohé and Uribe (2018).

Just before we unfold the specifics of the empirical model we estimate, two final remarks: First, in view of the results of Table 3 and Figure 4, we will circumvent our analysis just to the first debt factor and the second equity factor (see the discussion in section 3.1). Second, an avenue to gauge the eventual macroeconomic relevance of factors is given by Ludvigson and Ng's (2009) marginal R-squared, which is just a regression of variables of interest against estimated factors. We plot such marginal R-squared in the case of exchange rates and 10-year yields in Figure 5 for the EME sample we gathered: there is a noticeable fraction of exchange rates explained by both factors, which drops to about a third for the case of Yields.

Figure 5: Ludvigson and Ng's (2009) Marginal R-squared

(a) 1st Debt Factor (b) 2nd Equity Factor



Notes: The figure shows the R-squared of simple linear regressions of both the exchange rate and 10-year yields against the respective first-debt and second-equity factors, between 2010 and 2018.

Now following Bernanke et al.'s (2005) setting, and using both the dataset of macroeconomic variables for EME described above and our identified factors, we estimate

$$X_t = \Lambda^o Y_t + \Lambda^u G_t + u_t, \tag{2}$$

$$\begin{pmatrix} Y_t \\ G_t \end{pmatrix} = \Phi(L) \begin{pmatrix} Y_{t-1} \\ G_{t-1} \end{pmatrix} + Be_t, \quad \mathrm{E}(e_t e_t') = I_q, \tag{3}$$

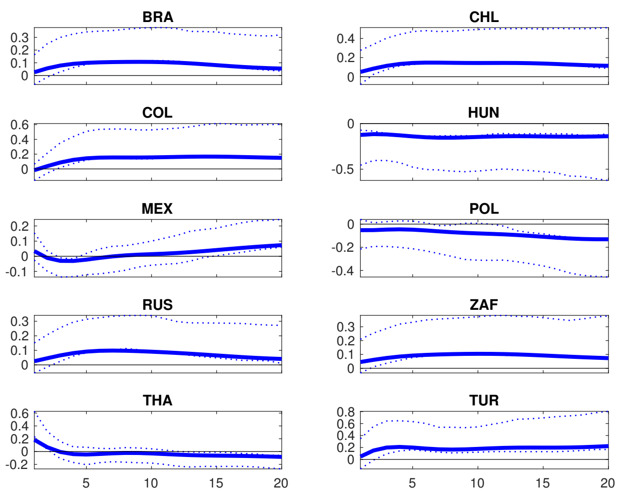
where $X_t = ((GDP_{it}, FX_{it}, CPI_{it}, M1_{it}, 10Y_{it}, r_{it})_{i=1,\ldots,N})$, Y_t corresponds to the estimated factors from Equation 1, G_t are the unobserved factors, $\Phi(L)$ is a finite lag polynomial, and B transfors the structural shocks e_t into the reduced-form factor errors.

We estimate Equations 2–3 through the algorithm of Abbate et al. (2016), and we construct the confidence intervals for impulse-response functions using Yamamoto's (2019) bootstrap Procedure A. We also compute variance decompositions for the long-term horizon of 60 quarters, and we carry out all of this procedures for each factor separately for the sample period 2010Q1–2018Q4.

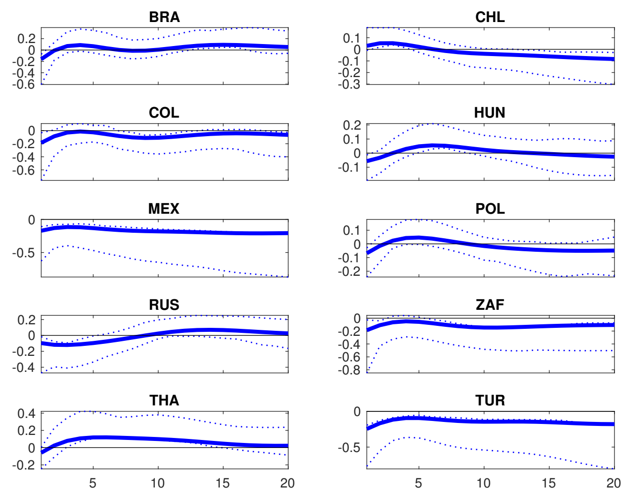
Figure 6 shows the estimation output of the factor-augmented VAR model in the case of shocks to the first debt factor. Panel 6a shows the responses of GDP across our EME sample, and what we find is a positive, statistically significant reaction of GDP—measured as normalized deviations from trend—after a one standard deviation shock to the debt factor in nearly 80% of cases, specially for commodity exporters countries, namely Chile, Colombia, Mexico, Russia and South Africa according to IMF definition in our sample. In the case of Poland and Hungary, the responses are mildly negative, which is a foreseeable consequence of debt inflows if they lead to excessive appreciations that erode the tradable sector, as Blanchard et al. (2016) clearly states. Panel 6b reveals some contrasting patterns again between commodity exporters versus the rest: the former set of countries present a compression of 10-year yields after the increase of debt inflows, which is consistent with the higher demand for local instruments in an environment with higher foreign liquidity. In the case of Hungary and Poland again—and Thailand as well—yields go up, consistent with the direction of GDP. Panel 6c shows mostly nominal appreciations after the inflow of portfolio debt inflows, which seem mild in most cases, although relatively more pronounced for the Hungary-Poland case. Finally, Panel 6d shows the variance decompositions for the whole dataset at the 20-quarters horizon. Consider the case of GDP and recall the association between the factors and the VIX in Figure 4; in this case a remarkable result ensues: despite the difference in both sample and empirical methods we employ, we end up obtaining similar orders of magnitude with previous literature regarding the explanatory power of foreign shocks for GDP forecast-error variance in EME. In fact, we observe that about 35% of fluctuations of GDP are explained by the first debt factor, which compares to the 40% of GDP variance explained by global financial shocks and country spread shocks in Akinci (2013). On top of this, there is another consistency with previous literature in the case of 10-year yields: the factor shock explains nearly twice as much variance in the case of Mexico compared to Chile, a point that is compatible with Marcel (2018) and Albagli et al. (2019) in different settings. The results of Figure 6, in sum, entail a sweeping view of the effects of capital flows factor shocks across our EME sample. For the case of debt inflows, a one standard deviation shock induces higher economic activity, currency appreciations and compression of long-term yields along most countries, specially commodity exporters, with relevant, consistent-with-literature explanatory power, specially regarding GDP fluctuations.

Figure 6: Factor-Augmented VAR — Shock to 1st Debt Factor

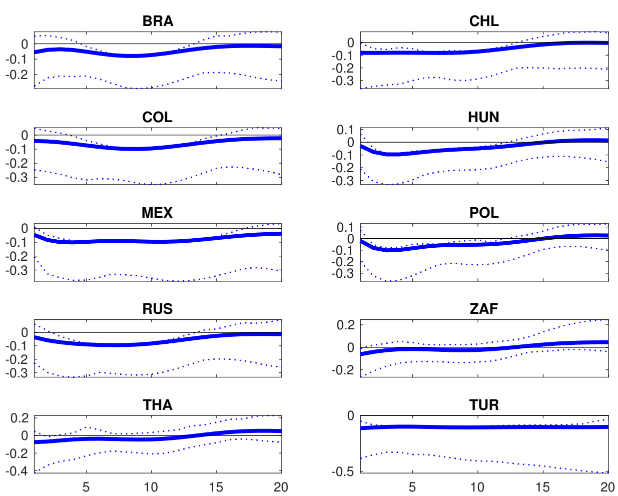
(a) Response of GDP



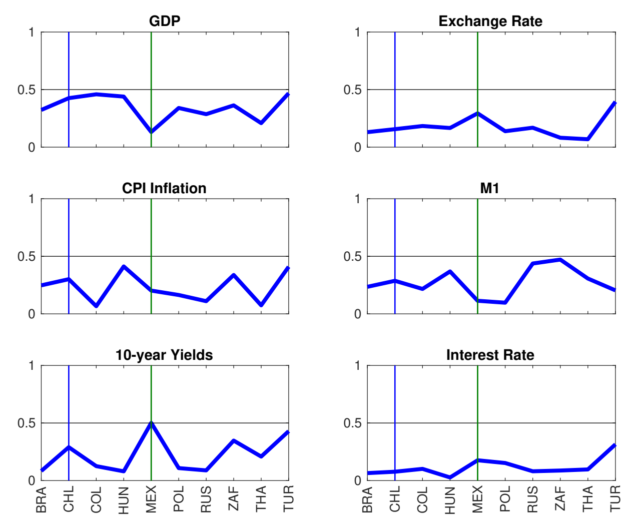
(b) Response of 10-year yields



(c) Response of Exchange Rate



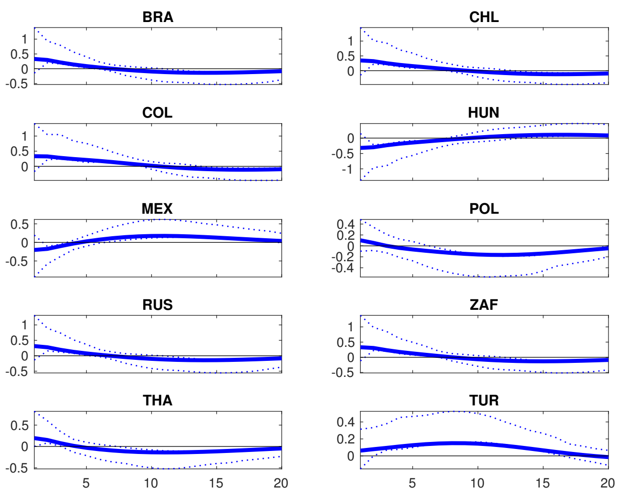
(d) Variance Decompositions



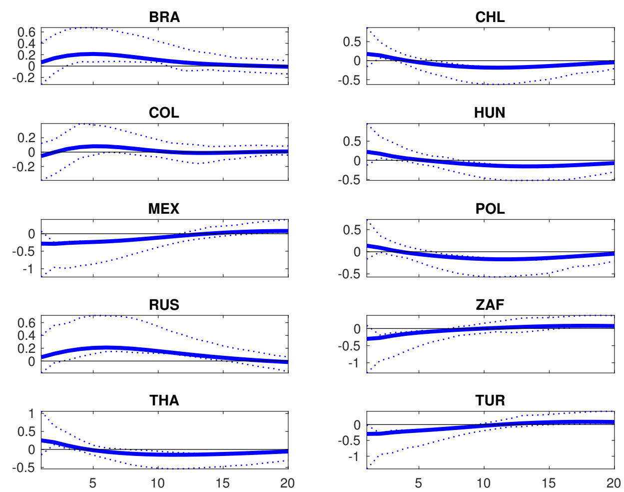
Notes: The figure shows impulse-response functions and variance decompositions from model (2)–(3). Dotted lines in figures (a)–(c) indicate 95% bootstrapped confidence intervals using Yamamoto's (2019) Procedure A.

Figure 7: Factor-Augmented VAR — Shock to 2nd Equity Factor

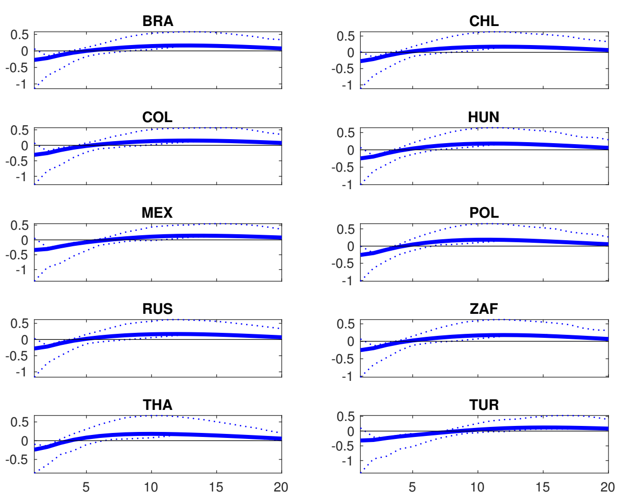
(a) Response of GDP



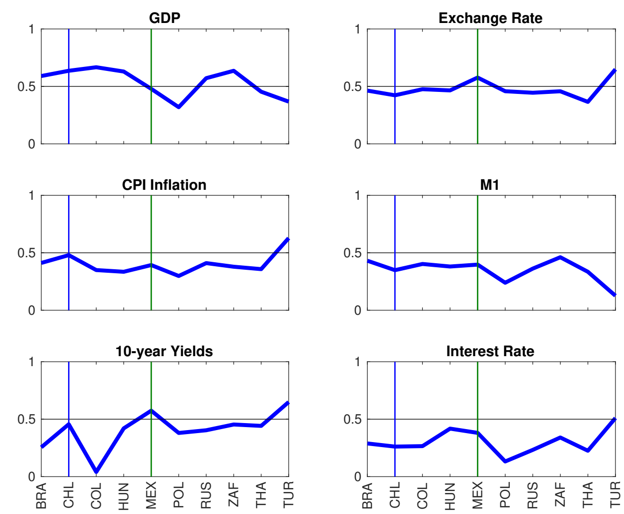
(b) Response of 10-year yields



(c) Response of Exchange Rate



(d) Variance Decompositions



Notes: The figure shows impulse-response functions and variance decompositions from model (2)–(3). Dotted lines in figures (a)–(c) indicate 95% bootstrapped confidence intervals using Yamamoto's (2019) Procedure A.

Figure 7 shows the estimation output of the factor-augmented VAR model in the case of shocks to the second equity factor. The main takeout of Panel 7a compared to its debt-factor counterpart entails higher GDP reactions during shorter time intervals. In other words, GDP deviates more strongly from its trend after a shock to the equity factor, but such reactions dissipate more quickly compared to persistent GDP deviations in the case of debt-factor shocks. The impulse-response functions of both 10-year yields and exchange rates—Panels 7b and Panel 7c—equally show less persistent effects, while variance decompositions in Panel 7d show similar patterns as those of debt-factor shocks, with important explanatory power regarding exchange rate and interest rate fluctuations in the case of Turkey.

4.1 Robustness

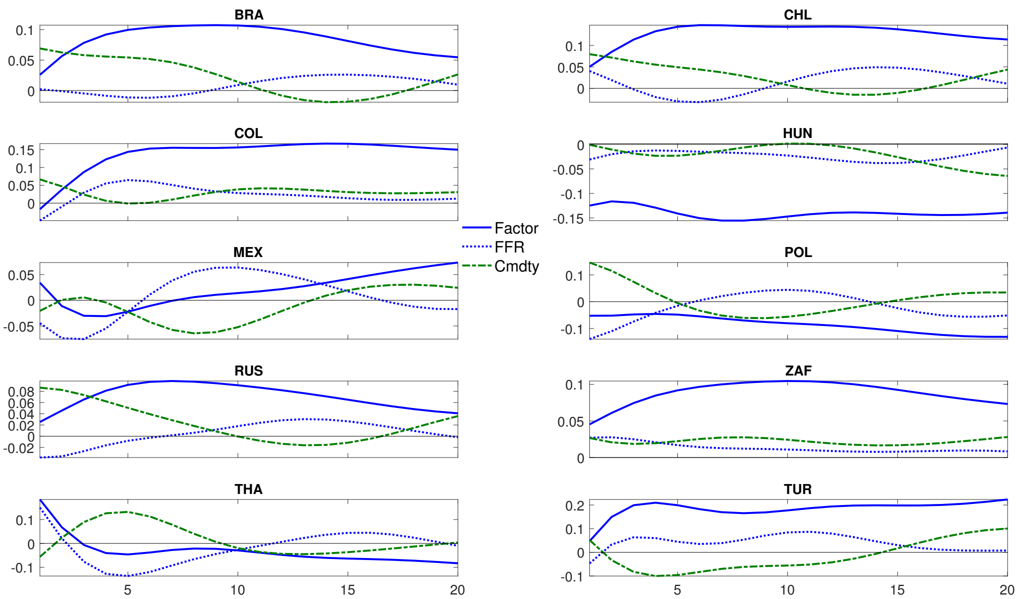
In order to make a reality check of our results, we perform two additional exercises. First, instead of introducing the estimated factors from Equation 1 as Y_t into (2)–(3), we reestimate the factor-augmented model using the series of effective Federal Funds rate (FFR) and the commodity price index (Cmdty) from the IMF—in log deviations from trend—as observed factors. The second exercise is to compare the impulse-response functions of GDP to factor shocks with respect to the VAR estimates of Uribe and Yue (2006), using both the same time-sample and transforming their variables into the zero-mean, unit variance processes as in the case of our factor-augmented model. In this fashion we are controlling for the nature of the shocks and also for the empirical model to figure out the consistency of our results.

Figure 8 shows the results of the first exercise. Panel 8a compares the responses of GDP to the debt-factor, Federal Funds rate and commodity price shocks. What stands out is the general, intuitive signs of the effects: a one standard deviation increase of the Federal Funds rate leads the GDP to fall below its trend in most cases, and for jumps in commodity prices the GDP response is generally positive. Panel 8a shows similar patterns, although the scale of the effects contrast more markedly. In commodity exporting countries, except for Mexico, GDP responses from factor shocks go in the opposite direction of positive deviations from trends in commodity prices.

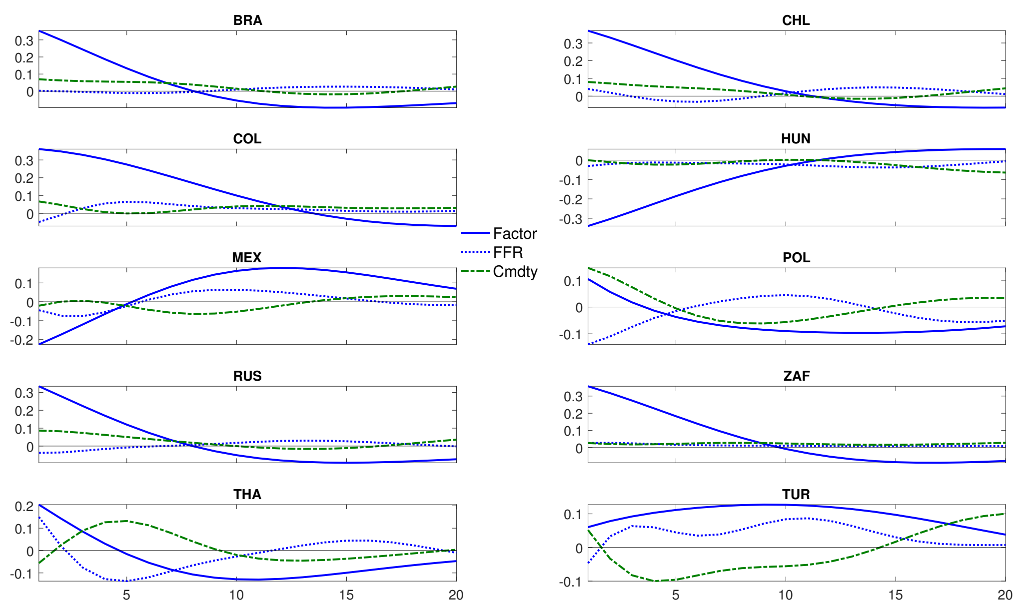
Figure 9 shows the results of the second exercise. Panel 9a compares Uribe and Yue's (2006) country spread (EMBI) and U.S. interest rate (FFR) shocks to the GDP response after a shock to the debt factor. In nearly half of countries, the GDP response to the factor shock goes in the middle of the impulse-response functions of Uribe-Yue. For these countries, given that know the scale of Uribe-Yue results without demeaning and normalizing data, it implies that the factor shock induces GDP to drop by roughly half a percentage point at business cycle frequencies.

Figure 8: GDP Response to Different Macroeconomic Shocks

(a) 1st Debt Factor



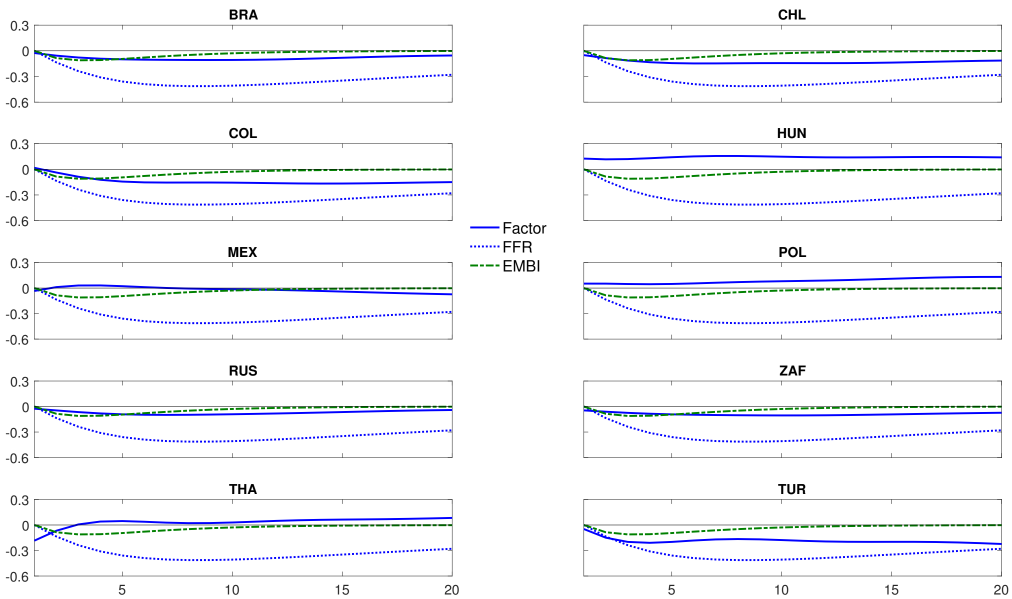
(b) 2nd Equity Factor



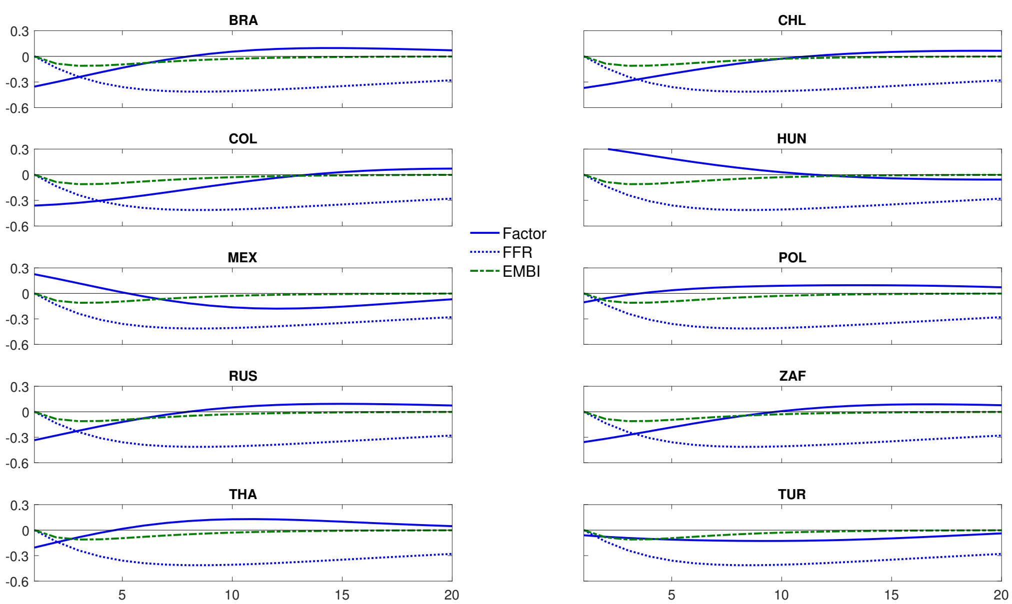
Notes: The figure compares impulse-response functions from model (2)–(3) using both the estimated factors in (a)–(b) and different macroeconomic shocks, namely a negative Federal Funds rate shock (FFR), and a shock to IMF commodity price index (Cmdty).

Figure 9: GDP Response to Factor Shocks vs. Uribe and Yue (2006)

(a) 1st Debt Factor



(b) 2nd Equity Factor



Notes: The figure compares impulse-response functions from model (2)–(3) using both the estimated factors in (a)–(b) with respect to Uribe and Yue's (2006) shocks to country spreads (EMBI) and U.S. interest rate (FFR).

5 Conclusion

In this paper we identified common factors behind capital flows into middle-income emerging economies, and subsequently use them to analyze the effects of mild capital flow fluctuations onto the macroeconomic performance of EME. We started off by carefully analyzing an approximate, dynamic factor model that we estimated using net portfolio inflows of debt and equity data. We ended up with a set of statistically relevant factors that we later on compared with traditional drivers already suggested by previous literature, all of this in order to check the intuitive appealing of our estimated latent variables.

Even though both our empirical approach and the data we used have been employed extensively in this prolific strand of literature, we took a step forward by trying to extract information regarding shocks to these factors and their effects on activity and financial variables of EME countries. We obtained rather consistent results with previous literature along several dimensions in addition to robustness checks to our initial estimates. In sum, we found that portfolio inflows factors behave like a sounding board, where liquidity and risk aversion in the U.S.—and commodity price fluctuations also—reflect themselves, and generate impulse-response functions consistent with relevant papers in the literature.

A Data

We obtained portfolio investment (net acquisition of financial assets) debt securities, and equity and investment fund shares from the IMF. Gross domestic product per capita, constant prices, is also from IMF. Most of the U.S series (Federal Funds rate, VIX, real exchange rate, financial conditions indexes) were downloaded from St. Louis Fed's FRED, the Brokers-Dealers leverage data is from the website of Board of Governors of the Federal Reserve System. Commodity price indexes are from the IMF, except for DJ commodity index and GSCI which come from Bloomberg. Macroeconomic uncertainty and economic policy uncertainty indexes come from their respective authors' websites.

GDP data for emerging countries come from the IMF, except for Mexico, which comes from Banxico. All of the nominal exchange rate and CPI data is from the IMF International Financial Statistics database. Monetary aggregates come from IMF, OECD and Bloomberg. Ten-year interest rates and EMBI data come also from OECD and Bloomberg. The short-term interest rate series follows Uribe and Yue (2006) procedure.

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