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Gross Capital Flows and their long-term Determinants for Developing Economies: A Panel Co-integration Approach

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Abstract

The purpose of this paper is to estimate a model for gross capital flows for a sample of developing economies and assess their long-term determinants by using a panel co-integration approach. Results indicate that there is a co-integration relationship between key push and pull factors and gross capital inflows. Particularly, FDI inflows have a positive, long-term association with GDP growth, and a negative one with public debt and the interest rate differential (the latter being a puzzling finding), while portfolio inflows are connected negatively to foreign asset prices and positively to international financial market volatility. Unexpectedly, interest rate differentials do not exhibit a long-term relationship with the latter, which challenges the standard portfolio assumption -that uncovered interest parity is satisfied, at least, in the long term-. As for disaggregate outflows, no long-term association between them and their drivers could be obtained.

Classification JEL: F21, F32, F36, C5

Key words: gross capital flows, long-term determinants, developing economies, panel co-integration approach

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I. Introduction

Interest in the behavior and macroeconomic effects of capital flows by analysts, specialized researchers and particularly by economic authorities resurged after the 2007-2009 international financial crisis. Moreover, only very recently did the literature start considering the differences between net and gross flows, analyzing their behavior, drivers and impact on a country´s macroeconomic and financial stability (see Lane and Milesi-Ferretti, 2007; Borio and Disyatat, 2011; Forbes and Warnock, 2012; Obstfeld, 2012; Lane, 2013). As stated by Borio and Disyatat (2011), net capital flows and current accounts reveal little about financing, since "they capture changes in net claims on a country arising from trade in real goods and services and hence net resource flows. But they exclude the underlying changes in gross flows and their contributions to existing stocks… As such, [they] tell us little… about the degree to which [a country´s] real investments are financed from abroad, about the impact of cross-border capital flows on domestic financial conditions." In fact, according to these authors, since the early 90s, the increase in net claims in the United States was about three times smaller than the change in gross claims. "This reflected substantial outward financial investments by US residents as well as inward financial flows from foreigners." (Ibid, page 13).

Likewise, if the purpose is to analyze issues related to financial stability (which, as the recent crisis showed, is critical for advanced and developing economies), one should concentrate on gross flows because they can also be a source of risk and international financial contagion (De Gregorio, 2012). For instance, Calderón and Kubota (2012) evaluated whether an increase in gross capital inflows led to credit booms in a sample of 71 countries (23 industrial economies and 48 Emerging Markets) and quarterly data for the 1975-2010 period. Two of their main results are that surges in gross capital inflows are good predictors of credit booms, and that their likelihood is higher if inflows are driven by other inflows and, to a lesser extent, portfolio inflows.

Furthermore, net flows may hide what is really is happening with a country's foreign financing at the time of a sudden stop, since it may reflect either a retreat of international

investors or a sudden flight of local investors (Rothenberg and Warnock, 2011). Indeed, these authors show that many of the sudden stop episodes identified by the literature were driven by capital flights of local investors instead of contractions of foreign inflows. In turn, Broner et al. (2013) illustrate that during crises "there is a retrenchment in both inflows by foreigners and outflows by domestic agents." Following this approach, Alberola et al. (2015) study the impact of the accumulation of international reserves on the behavior of gross capital flows in periods of global stress. They find that the higher the stock of reserves, the larger the drop in gross domestic outflows, since residents repatriate capitals in order to mitigate the lack of foreign financing. Conversely, capital inflows fall during periods of stress.

On the other hand, Janus and Riera-Crichton (2013), who use a "four-way decomposition" of capital flows,[1] obtain that the crises of the nineties in Indonesia, Mexico, and South Korea were mainly due to foreign disinvestment, instead of reflecting declining gross capital inflows, as the literature had suggested. These authors also identified a large amount of capital repatriation to South Korea during that crisis, and to the US and UK during the global crisis of 2008–2009. Thus, by studying the reaction of gross flows when domestic and external conditions change is important not only to predict their behavior in the international capital markets at normal or stressful times, but also to increase the competence of policy-makers to respond and manage capital flows.

As is well known, capital flows respond to foreign, domestic or both types of drivers (Calvo et al.; 1993; Fernández-Arias, 1996). The first one relates to push factors such as interest rates, economic growth, stock prices, and risk aversion in the international markets (Calvo et al.; 1993; Dixit and Pindyck, 1994; Izquierdo et al., 2008; Reinhart and Reinhart, 2008; Egly et al., 2010; Forbes and Warnock, 2012). The second one is associated with pull factors such as productivity growth, macroeconomic conditions, and institutional framework of the countries receiving the resources (Chuhan et al., 1996; Papaioannou, 2009; Milesi-Ferretti and Tille, 2010; Bluedorn et al., 2011). However, they can respond to

[1] That is, outflows from liabilities, inflows from liabilities, outflows from assets, and inflows from assets, taken from the financial accounts of the statistics on the balance of payments.

both push and pull factors (Felices and Orskaug, 2008; Fratzscher, 2011; Arias et al., 2013; Alberola et al., 2015). Moreover, they can also be determined by commercial flows (Valdes-Prieto and Soto, 1998; Milesi-Ferretti and Tille, 2010) and information asymmetry, which affects the behavior of capital flows, among others, because foreign investors usually alter their decisions on account of "herd behavior" and "home bias" (Cont and Bouchaud, 2000; Bikhchandani and Sharma, 2001; Dvořák, 2003). Therefore, from the behavioral analysis of capital flows, and particularly of gross flows, the authorities might be able to predict what would happen if international and local conditions change and, similarly, to anticipate and prevent adverse effects through policy decision making as well.

Accordingly, the purpose of this paper is to estimate a reduced-form model for gross capital inflows and outflows for a representative sample of 38 developing economies and assess the role of their long-term fundamental drivers. In order to meet this objective, quarterly information is used for the 2000:I - 2013:I period, as well as a panel co-integration approach that follows Chudik, Mohaddes, Pessaran and Raissi (2015).

Thus, this study seeks to answer questions such as Is there a long-term relationship between gross capital flows and their main drivers in developing economies? If there is, what is the relevance of each of the drivers? Moreover, do gross FDI, portfolio and other flows respond to the same fundamentals and to the same degree? Although empirical literature has traditionally studied aggregate flows, the different types are not necessarily deemed to respond to the same fundamentals. Also, their macroeconomic and microeconomic effects may differ significantly, as has been recently argued and shown by the literature on net flows (Kose et al., 2009; Contessi et al., 2010; Fratzscher, 2011; Byrne and Fiess, 2011; Arias et al., 2013) or gross flows (CIEPR, 2012; Forbes and Warnock, 2012; Obstfeld, 2012; Broner et al., 2013).[2] Besides, as stated before, they do not respond in the same way over the cycle or at the time of financial stress (Rothenberg and Warnock, 2011; Milesi-Ferretti and Tille, 2011; Broner et al., 2013; Calderon and Kubota, 2013; Alberola et al.,

[2] In fact, even some of them may respond to factors other than the market itself, like in the case of capital flows directed to public sector financing. For this reason, they are excluded from the capital flows series. Alfaro et al. (2011) address this issue by separating private from public flows.

2015). As for the econometric approach, the authors are not aware of any paper in the international literature that implements a panel co-integration approach to study long-term determinants of capital flows.[3]

Traditionally, short panel methods (in which the cross-section dimension (*N*) is large and the time dimension (*T*) is short) have been used as an extension of their nature applied to micro-panels when working with macroeconomic panels. However, when the time dimension tends to grow above the cross-section dimension (as is the case in most of the empirical literature referenced here) time-series aspects become critical. Specifically, in macro-panels with a relatively large number of individuals and temporal observations (as in this paper and in many other papers referenced) the non-stationary nature of the time series deserves more attention (Baltagi, 2005; Breitung and Pesaran, 2008). For example, testing for panel unit roots and panel co-integration is required to prevent spurious regressions, since OLS estimations entail the problem of having asymptotically biased estimators when non-stationary series are present. Additionally, their probabilistic distributions depend on the parameters of the error term and regressors and not on those belonging to the real data generator process (Pedroni, 2000). Furthermore, special tests are needed in order to elude severe size distortions of the panel tests (Larsson et al., 2001¸ Breitung and Pesaran, 2008).

As a result, the literature has dealt with the estimation of non-stationary panel data through models such as the generalization of Engel and Granger's (1987) representation theorem for single equation approaches, or those by Johansen (1991, 1995) and Pesaran et al. (1999) for system approaches. In the first case, a co-integration relationship is estimated for each individual and then the coefficients found are grouped as one, which represents the whole panel ("residual based approaches"). Also, only one co-integration vector is assumed to exist and that there is cross-section independence. Among the several different estimators that can be found in this branch of research are those by Phillips and Moon (1999), Pesaran et al. (1999), Pedroni (2000), Kao and Chiang (2000). Choi (2002) takes an alternative path, estimating through instrumental variables that can be used in panel data models with

[3] Applications on macroeconomics are, for example, on growth and convergence (Lee et al., 1997), Purchasing Power Parity hypothesis (Groen and Kleiberger, 2003; Smith et al., 2004) and on the current account balance (Wu, 2000).

non-stationary and endogenous variables. In the second case, VARs are utilized to test and estimate co-integration panels, with tests allowing for the presence of more than one co-integration vector, but assuming cross-section independence (Larsson et al., 2001; Groen and Kleibergen, 2003; Breitung, 2005).

However, this literature is still challenged by the possible presence of heterogeneous regression parameters in the pooled regression model (i.e. one regression for each individual), cross section dependence among individuals, cross-unit co-integrating relationships among individuals, and the *N* and *T* asymptotic (Banerjee et al., 2004; Baltagi, 2005; Breitung and Pesaran, 2008). Accordingly, this paper uses econometric approaches that deal with these problems, for instance, by controlling heterogeneity (Pesaran and Smith, 1995; Pesaran, 2006)[4] and cross-section correlation (see Moon and Perron, 2004; Mark, Ogaki and Sul, 2005).[5]

This study contributes in the following ways to the literature that analyzes capital flows: firstly, it studies gross flows, offering new evidence to the new "gross approach" to capital flows; secondly, it uses a sample that covers the period before and after the 2007-2009 international crisis. This allows us to evaluate their consequences on gross inflows to developing economies. Thirdly, it analyzes the different types of gross flows separately, as recommended by the literature. Fourthly, this study analyzes the long-term drivers of capital flows instead of short-term ones, which is common in the literature. Fifthly, rather than using standard OLS or panel data techniques (static, dynamic or based on IV and GMM), which capture, in general, the short-term behavior of capital flows suffering some of the problems mentioned, in this paper we implement a panel co-integration approach which allows us to evaluate their long-term drivers.

However, econometrically speaking, why is a panel co-integration approach useful? Because it is robust to endogeneity, to many forms of omitted variables, and to simultaneity

[4] He proposed the Common Correlated Effects (CCE) estimator.

[5] They introduced a Dynamic Seemingly Unrelated Regression (DSUR) estimator.

and measurement errors (Pedroni, 2000; Pesaran, 2006). Moreover, it can isolate long-term, steady-state relationships from short-term dynamics and it can be implemented with much shorter data length. Furthermore, it allows for flexible modeling of heterogeneity, a problem that generates inconsistent estimation, which is a very common, unacknowledged problem in traditional dynamic panel data procedures (Pesaran and Smith, 1995; Pedroni, 2004; Pesaran, 2006).[6] And —last but not least— because panel co-integration and panel unit root tests generally have standard distributions such as normal distribution (Pedroni, 2004).

The main findings indicated the presence of a co-integration relationship among key push and pull factors and gross capital inflows. Particularly, FDI inflows have a positive long-term association with GDP growth and a negative one with public debt and the interest rate differential, while portfolio inflows are connected negatively to foreign asset prices and positively to international financial market volatility. As for other inflows and disaggregate outflows, no long-term association between them and their drivers could be obtained.

This document consists of four sections aside from the introduction. The second section describes the data, introduces the econometric approach, and shows the preliminary statistics. The third one presents and analyzes the results. The last section summarizes the conclusions.

II. Data, regression model and testing

As with co-integration in a time series, panel co-integration analysis imposes the need to perform similar steps, such as unit root tests, co-integration tests and estimation and inference. Thus, this section firstly describes the data and comments the unit root tests. As for the co-integration, it will be assumed, as in Chudik et al. (2015).

[6] Traditional dynamic models require dynamics to be homogeneous across individuals.

Data

This paper builds a quarterly database for a representative sample of 38 developing economies for the 2000:I - 2013:I period. The countries were selected according to their representativeness in terms of income (high-income, middle-income and low-income countries) and to data availability.[7] The data sources are the International Financial Statistics (IFS) and Balance of Payments Statistics (BPS) published by the International Monetary Fund, the World Development Indicators (WDI) issued by The World Bank, Bloomberg, DataStream, and home pages of the countries' central banks. The list of countries in the sample and a detailed explanation of the time series, sources, and methodological issues are in Appendixes 1 and 2, respectively.

The quarterly data on capital flows were compiled from the database of the IFS and BPS, and from the home pages of the countries' central banks when needed. Gross capital inflows are defined as the net purchases of domestic assets by foreign agents ("nonresidents"); that is, liability inflows minus liability outflows with nonresidents, according to financial accounting of the statistics on the balance of payments (IMF, 2009, Chapter 8). On the other hand, gross capital outflows are the net purchases of foreign assets by domestic agents ("residents"); that is, they are assets inflows minus assets outflows with residents. Total gross inflows (outflows) are the sum of direct foreign investment, portfolio (equity) and other inflows (outflows), such as external debt bonds and other investments. Within the latter, the other National Central Government and Monetary Authorities' net investment flows are excluded. The stock of international reserves as a percentage of GDP is included in our panel as a scaling factor, given the impossibility to build a more meaningful indicator for all countries in our sample, such as international reserves relative to a monetary aggregate. Total gross inflows (outflows), as well as their components, have been considered in nominal dollars of the United States of America (USA), and were normalized by the USA's GDP in nominal dollars. Finally, a quarter-by-quarter cumulative series was built for each of the flows.

[7] We started with a sample of 85 developing economies but we ended up with only 38, given the difficulties obtaining consistent data for all countries and period of interest.

Regression model

The econometric strategy consists in constructing estimable panel co-integration equations for the whole and each one of the types of capital inflows and outflows. The explanatory variables are constituted by pull and push factors and by the short-term interest rate differential, in order to capture a carry trade strategy by international and local investors. The importance of each factor is expected to vary according to the type of flow explained and to the time term analyzed. For instance, portfolio (equity) or other flows should be more associated with short-term interest rate differentials and risk aversion variables, while FDI flows should be more related to domestic output growth or institutional factors. Thus, the pull factors are the domestic GDP growth and indicators of institutional stability, public debt, trade openness, reserve adequacy, and financial openness. Similarly, the push factors are the VIX variations, foreign stock price returns, and foreign GDP growth. Finally, as stated above, the short-term interest rate differential is the last regressor.

In order to estimate the determinants of each capital flow (IED, Portfolio and Other flows), this paper uses the estimator developed by Chudik et al. (2015). These authors investigate estimation and inference of long-term effects by using panel data models where the time dimension (T) and the cross-section dimension (N) are both relatively large.

It is worth nothing that the pooled mean group approach by Pesaran et al. (1999), the panel dynamic OLS approach by Mark and Sul (2003), and the panel fully modified OLS approach by Pedroni (2001) allowed for heterogeneity of short-run dynamics and lagged dependent variables, but not for error cross-section dependence. To solve this weakness, Chudik et al. (2015) propose a cross-sectional augmented distributed lag (CS-DL) approach to estimate the long-run effects in dynamic heterogeneous panel data models with cross-sectionally dependent errors, which improves those Autoregressive-Distributed Lag (ARDL) types of estimators. The main advantage of the proposed CS-DL approach is its robustness to dynamic misspecification and small sample performance (Chudik et al., 2015).

The CS-DL approach assumes that there is only one long term relation between what is explained and the explanatory variables, which can be estimated regardless of whether the variables are I(0), I(1) or whether the regressors are exogenous or endogenous. Hence, two different estimators of the long-term relationship are proposed, starting from the regression model for the dependent variable y in individual *i*,

$$(1) \qquad y_{i,t} = \boldsymbol{\theta}_i x_{it} + \boldsymbol{\alpha}_i'(L)\Delta \boldsymbol{x}_{it} + \bar{u}_{it}$$

where $\boldsymbol{x}_i$ is the $kx1$ vector of individual-specific regressors, $\bar{u}_{it} = \varphi(L)^{-1}u_{it}$, $\varphi_i(L) = 1 - \sum_{l=1}^{p_{yi}} \varphi_{il}L^l$, $\boldsymbol{\theta}_i = \boldsymbol{\delta}_i(1)$, $\boldsymbol{\delta}_i(L) = \varphi_i^{-1}(L)\boldsymbol{\beta}_i(L) = \sum_{l=0}^{\infty} \boldsymbol{\delta}_{il}L^l$, $\boldsymbol{\beta}_i(L) = \sum_{l=0}^{p_{yi}} \beta_{il}L^l$, and $\boldsymbol{\alpha}_i(L) = \sum_{l=0}^{\infty}\sum_{s=l+1}^{\infty} \boldsymbol{\delta}_s L^l$. Besides, p is the lag order, which is an increasing function of the sample size, so that u_{it} is a serially uncorrelated process across all *I* and L is the lag operator. Notice that parameters $\boldsymbol{\theta}_i$ are the coefficients of interest, since, once they have been determined, they can be averaged across *i* to obtain consistent estimates of the average long-term coefficients ($\bar{\widehat{\boldsymbol{\theta}}}_i$). The way to average them is the standard $N^{-1}\sum_i^N \widehat{\boldsymbol{\theta}}_i$.

Equation (1) is further developed to include a set of cross section averages $\bar{\boldsymbol{z}}_{wt} = (\bar{y}_{wt}, \bar{\boldsymbol{x}}_{wt})$ to control for unobserved individual components. From this, Chudik et al. (Ibid.) build two distinct estimators. The CS-DL mean group estimator is

$$(2) \qquad \widehat{\boldsymbol{\theta}}_{MG} = N^{-1}\sum_{i=1}^{N} \widehat{\boldsymbol{\theta}}_i,$$

Where

$$(3) \qquad \widehat{\boldsymbol{\theta}}_i = (\boldsymbol{X}_i'\boldsymbol{M}_{qi}\boldsymbol{X}_i')^{-1}\boldsymbol{X}_i'\boldsymbol{M}_{qi}\boldsymbol{y}_i,$$

with $\boldsymbol{X}_i = (\boldsymbol{x}_{i,p+1}, \boldsymbol{x}_{i,p+2}, \dots, \boldsymbol{x}_{i,T})'$, $\boldsymbol{M}_q$ being the projection matrix for individual *i* defined as $\boldsymbol{M}_{qi} = \boldsymbol{I}_{T-p} - \boldsymbol{Q}_{wi}(\boldsymbol{Q}_{wi}'\boldsymbol{Q}_{wi})^{+}\boldsymbol{Q}_{wi}'$, where $\boldsymbol{Q}_{wi} = (\overline{\boldsymbol{Z}}_w, \Delta\overline{\boldsymbol{X}}_{wp}, \Delta\boldsymbol{X}_{ip})$, $\overline{\boldsymbol{Z}}_w = (\bar{\boldsymbol{z}}_{w,p+1}, \bar{\boldsymbol{z}}_{w,p+2}, \dots, \bar{\boldsymbol{z}}_{w,T})'$, $\Delta\overline{\boldsymbol{X}}_{wp} = \sum_{i=1}^{N} w_i\, \Delta\boldsymbol{X}_{ip}$, and $\boldsymbol{y}_i = (y_{i,p+1}, y_{i,p+2}, \dots, y_{i,T})'$.

And the CS-DL pooled estimator of the mean long-term coefficients is

$$(4) \qquad \widehat{\boldsymbol{\theta}}_P = (\sum_{i=1}^{N} w_i \boldsymbol{X}_i' \boldsymbol{M}_{qi} \boldsymbol{X}_i')^{-1} \sum_{i=1}^{N} \boldsymbol{X}_i' \boldsymbol{M}_{qi} \boldsymbol{y}_i.$$

The CS-DL mean group and the CS-DL pooled estimator are distributed as Normal with different variance matrix definition.

The advantages of using this approach, besides those mentioned, are that the insertion of cross-section averages increases robustness to the presence of unit roots and heterogeneity or homogeneity in short-and long-term coefficients; besides, it reduces the cross-sectional dependence in the error term.

Testing for panel unit roots

We implement two panel unit root tests for the capital flows and pull and interest rate differential series, which correspond to what the literature has called "first" and "second" generation tests. The "first" one is the Fisher-type test proposed by Maddala and Wu (1999) and Choi (2001), which assumes cross-sectional independence. The advantages of these tests are that they do not require a balanced panel, because they can use different lag lengths in the individual ADF regressions and they can be employed for any unit root test. The "second" test is the one developed by Pesaran (2007), which allows for cross-sectional dependence. As for the push factors, which are common factors in the panel, we carry out the time-series unit root test with structural changes introduced by Zivot and Andrews (1992).[8] In this way, possible breaks in the series occurring at the time of the international financial crisis are controlled.

Results show that the capital flow series and the pull factors represented by the GDP, debt as a percentage of GDP, commodities and openness indexes, and international reserves as a percentage of GDP series all behave as unit root processes (Appendix 3). On the contrary,

[8] Notice that this test rather than fixing the breakpoint, as in Perron's (1989), it estimates it.

the series of the annual variation of the real GDP and the alternative measurements of the interest rate differential are stationary. With respect to the push factors, the Standard & Poor's 500 and the foreign GDP growth series appear to be unit root processes, while the annual variation of VIX is a stationary process.[9]

III. Panel co-integration estimations

This section presents the findings on the estimations. Particularly, there are results for FDI and portfolio inflows for all the regions proposed. As for other inflows and disaggregate outflows, no long-term association between them and their drivers could be obtained. The estimations only show the regressors that resulted statistically significant at least for one of the regions.[10]

Table 1 shows that the GDP and public debt were statistically significant and with the correct sign. This means that there is a positive long-term relationship between FDI and GDP and a negative one between FDI and public debt. At the same time, there is a long-term effect of the interest rate differential, although its sign does not follow what the economic theory would suggest, particularly with the uncovered interest rate parity condition, which is puzzling. The variable crisis, which captures the effect of the international financial crisis 2007-2009, was statistically significant for the case of developing countries in Latin America (positive sign) and the "Other" countries (negative sign). One possible explanation for this result could be that during the crisis, Latin American countries offered a better environment to international investors than did the rest of the developing world. This caused a shift of resources from the emergent Europe, Asia, and Africa into Latin America.

[9] Strictly speaking, the test for the first difference of the foreign GDP growth series indicates that it behaves as a times series process with a degree on integration higher than 1. Since this is a non-standard result and we did not find a reasonable explanation for this behavior, we assume it is a *I*(1) series.

[10] Neither trade openness, VIX, S&P500, a world leading indicator for economic activity nor a local vulnerability indicator (international reserves as a percentage of GDP) resulted statistically significant.

FDI INFLOWS AND THEIR DETERMINANTS BY REGION			
Variable\Region	**America**	**Europe**	**Other**
Real GDP	0.599 (1.75)*	0.276 (1.74)*	-0.361 (1.20)
Public Debt	-0.449 (1.88)*	0.050 (0.52)	-0.284 (1.25)
Interest Rate Spread	-0.242 (2.59)***	-0.048 (0.93)	-0.020 (0.32)
Crisis	1.854 (2.03)**	0.501 (1.12)	-1.314 (2.15)**
Constant	-26.590 (1.42)	25.762 (0.45)	-13.283 (0.37)
*** p<0.1; ** p<0.05; *** p<0.01**			

Table 1. CS-DL Results for FDI Inflows

As for portfolio inflows, Table 2 shows that asset prices (S&P500) and the volatility indicator (VIX) were statistically significant and presented the signs expected. This implies that there is a positive long-term relationship between portfolio and international risk and a negative one between portfolio and the international asset prices. These results suggest that a volatility increase in the United States pushes investors to seek returns in other markets, particularly in developing economies. On the other hand, an increase in asset prices in the US causes a reduction in capital inflows to developing economies. At the same time, there is a positive long-term effect on portfolio inflows to Latin America from having relatively more international reserves. Indeed, an economy with higher international reserves could respond better to external shocks, as has been shown by the literature discussed previously. The interest rate differential was not significant for any region. One can say that the unconventional policies taken by developed economies during and after the financial crisis of 2007-2009 distorted the traditional transmission mechanism of interest rate differentials worldwide.

PORTFOLIO INFLOWS AND THEIR DETERMINANTS BY REGION			
Variable\Region	America	Europe	Other
Reserves / GDP	0.062 (2.56)**	0.019 (0.90)	-8.739 (0.99)
Asset Prices (S&P500)	-2.431 (2.37)**	-8.620 (1.66)*	-20.666 (2.43)**
Interest Rate Spread	-0.042 (1.42)	-0.006 (1.03)	0.117 (0.97)
VIX	52.115 (2.34)**	50.438 (2.48)**	108.792 (3.90)***
Crisis	-0.725 (1.70)*	0.021 (0.17)	-0.121 (0.32)
Constant	-1.289 (0.53)	1.673 (0.98)	3.163 (1.12)
* p<0.1; ** p<0.05; *** p<0.01			

Table No 2: CS-DL Results for Portfolio Inflows

IV. Conclusions

Attention on the behavior and the macroeconomic effects of capital flows resurged after the 2007-2009 international financial crisis, and this paper is part of this new sweep. We studied the dynamics of capital flows to emerging markets and their determinants for a representative sample of 38 developing economies for the 2000:I - 2013:I period, estimating panel co-integration equations in order to explain the long-term determinants of gross capital flows, following a pull and push factors approach. The paper examined gross flows because their behavior not only provides information to agents and authorities on the macroeconomic impact they have, but also on the benefits or risks for a country's financial stability. Moreover, the paper analyzed disaggregated flows because they respond differently to drivers, absorb shocks in dissimilar way, and impact the economy distinctly.

Firstly, our findings showed that the countries' data generating process for capital inflows, GDP, debt, commodities, economic openness, international reserves, foreign equity prices

and growth behaved as panel unit root processes. On the contrary, real GDP growth, interest rate differential and annual variation of VIX acted as stationary.

Secondly, results indicated evidence of a co-integration relationship among some push and pull factors and gross capital inflows. In particular, FDI flows have a positive long-term association with GDP growth and a negative one with public debt and the interest rate differential —the latter being a puzzling finding—, while portfolio inflows are connected negatively to foreign asset prices and positively to international financial market volatility (measured by VIX). Unexpectedly, the interest rate differential does not have a long-term association with gross capital inflows, which challenges the standard portfolio assumption of uncovered interest parity being satisfied, at least, in the long term.

Thirdly, no long-term association between other inflows or gross outflows and drivers could be obtained. Data problems could explain this unexpected result.

Finally, it is worth nothing that our estimations controlled for the financial crisis of 2007-2009, which is important due to the diverse behavior of capital flows from/to developing economies during times of crisis. For instance, Latin American countries experienced a surge of capital inflows because they seemed to offer better business conditions to international investors. On the other hand, developing countries in Eastern Europe, Asia, and Africa faced a decline in capital inflows.

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Appendix 1. Developing economies in the sample

Africa	Asia	Europe	Latin America
Morocco	Azerbaijan	Bulgaria	Argentina
South Africa	Hong Kong	Croatia	Brazil
	India	Cyprus	Chile
	Indonesia	Czech Republic	Colombia
	Israel	Estonia	Costa Rica
	Jordan	Hungary	Mexico
	Kazakhstan	Latvia	Peru
	Malaysia	Lithuania	Uruguay
	Philippines	Malta	Venezuela
	Republic of Korea	Poland	
	Russia	Romania	
	Thailand	Slovak Republic	
	Turkey	Slovenia	
		Ukraine	

Source: authors' own selection.

Appendix 2. Variables and sources

Variable	Construction	Sources
Trade openness	Sum of goods and services imports and exports as a percentaje of GDP.	Balance of Payments Statistics (IMF), home pages of some central banks, national statistics offices, DataStream, Eurostat and Comtrade
Domestic GDP growth	Annual variation of Real GDP. GDP series (nominal and real) were seasonally adjusted using the TramoSeats methodology.	International Financial Statistics (IMF) and The World Bank's World Development Indicators (WDI)
Crisis **Crisis1** **Crisis2** **Crisis3**	Dummies 1, since 2008 until 2010. 0, otherwise 1, for year 2008. 0, otherwise 1, for year 2009. 0, otherwise	Authors' own calculations
Public debt	Foreign and domestic debt as a percentage of DDP. This index was constructed using frequency conversion from annual data to quarterly data with the "quadratic match sum" procedure (Eviews).	Source: Carmen M. Reinhart Database (http://www.carmenreinhart.com/data/) and home pages of some central banks
Appreciation expectations	There were estimated three alternative measures of depreciation expectations: the first one was constructed using Holt-Winters smoothing, the second one using Holt-Winters with double filter and the third one using a MA(3) process. All measures were used but only the second one is reported in the results of the estimations.	International Financial Statistics (IMF) and authors' own calculations
Total gross capital flows and their components: foreign direct investments, portfolio and other gross flows	These series were built by merging two datasets, because the methodological changes of the balance of payments statistcs of the IMF. Thus, from 2000 to 2005 data were collected under Manual 5, and from 2006 to 2013 under Manual 6. Total gross flows series was constructed by adding up FDI, Portfolio and Other Flows for each country and each quarter.	Balance of Payments Statistics (IMF) and home pages of some central banks
Foreign GDP growth	Leading indicator of the economic activity in Developed Economies: Weighted average of the economic activity indexes of the Eurozone (OECD Euro Area Index) and the United States (CB US leading Index). They were weighted by their respective share in the aggregated GDP.	Bloomberg

Source: Authors' compilation and own calculations.

Appendix 2. Variables and sources (continued)

Variable	Construction	Sources
Financial openness	Financial globalization indicator (*de jure* measurement of capital controls): An increase in the index means wider openness of a country's capital account.	Chinn & Ito (2008)
Institutional stability indicator	Index that rates the type of countries' democracy (it has a range between 10 and -10): 10, consolidated democracy; -10, strongly autocratic; 10 to -6, autocracies; -5 to 5, anocracies and 6 to 10, democracies.	Center for systemic peace, Polity IV. http://systemicpeace.org/polity/polity4.htm
Foreign stock price returns	Annual Standard & Poor's 500 percent variation.	Bloomberg
Foreign short-term interest rate	3-month Treasury Bills interest rate.	Bloomberg
VIX	Annual Chicago Board Options Exchange Market volatility index.	Bloomberg
Reserve adequacy indicator	International reserves as a percentage of GDP. This data was transformed from monthly to quarterly frequency, using an quarterly average	IFS, IMF databases, and the World Bank's World Development Indicators (WDI) databases
Commodities Index	It measures the importance of commodities in total exports and is calculated as the ratio of commodity exports to total exports of goods. Formally: $$CI_{it} = \frac{\sum_{j=1}^{J} com_{jit}}{Total\ Exports_{it}}$$ where i represent countries and j the commodities selected. This index was constructed using frequency conversion from annual data to quarterly data with the "quadratic match sum" procedure (Eviews).	International Financial Statistics (IMF), the World Bank's World Development Indicators (WDI), DataStream and Trading Map
Domestic and foreign interest rate differenctial adjusted by depreciation expectations	$$DI_{it} = \frac{1 + i_{it}}{(1 + r_t)\left[\left(1 + \frac{e_{it}}{e_{i,t-4}}\right) - 1\right] - 1}$$ where i represents the domestic short-run interest rate, r is the 3-month FED yields and e is the estimate of the depreciation expectations.	DataStream and home pages of central banks

Source: Authors' compilation and own calculations.

Appendix 3. Panel unit root test

A.3.1 *Capital inflows series*

Series of capital inflows	**Ho: No stationary**			
Lag order = 1	**Fisher**		**Pesaran**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	0,15	0,47	0,22	0,63
Portfolio/GDP	1,00	0,00	0,74	1,00
Other Flows/GDP	0,91	1,00	0,98	1,00
Total capital inflows/GDP	1,00	0,87	1,00	0,98
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	1,00	1,00
Portfolio/GDP	1,00	-	1,00	1,00
Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital inflows/GDP	1,00	1,00	1,00	1,00

Lag order = 2	**Fisher**		**Pesaran**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	0,10	0,57	0,17	0,43
Portfolio/GDP	1,00	0,01	0,67	1,00
Other Flows/GDP	0,95	1,00	0,89	1,00
Total capital inflows/GDP	1,00	0,86	0,99	0,98
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	1,00	1,00
Portfolio/GDP	1,00	-	1,00	1,00
Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital inflows/GDP	1,00	1,00	1,00	1,00

Lag order = 3	**Fisher**		**Pesaran**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	0,03	0,56	0,22	0,33
Portfolio/GDP	1,00	0,01	0,95	1,00
Other Flows/GDP	0,97	1,00	0,67	0,99
Total capital inflows/GDP	1,00	0,73	0,99	0,95
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	-	1,00	1,00	1,00
Portfolio/GDP	1,00	-	1,00	1,00

Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital inflows/GDP	1,00	1,00	1,00	1,00

Lag order = 4	**Fisher**		**Pesaran**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	0,02	0,50	0,21	0,26
Portfolio/GDP	1,00	0,00	0,96	1,00
Other Flows/GDP	0,98	1,00	0,12	0,87
Total capital inflows/GDP	1,00	0,51	0,91	0,85
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	-	1,00	1,00	1,00
Portfolio/GDP	1,00	-	1,00	1,00
Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital inflows/GDP	1,00	1,00	1,00	1,00

Source: Authors' own calculations.

A.3.2 *Capital outflows series*

Series of capital outflows	**Ho: No stationary**			
Lag order = 1	**Fisher**		**Pesaran**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	0,94	1,00
Portfolio/GDP	0,00	0,00	0,93	0,51
Other Flows/GDP	0,99	1,00	0,28	0,92
Total capital outflows/GDP	0,02	1,00	0,11	0,99
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	1,00	1,00
Portfolio/GDP	1,00	1,00	1,00	1,00
Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital outflows/GDP	1,00	1,00	1,00	1,00

Lag order = 2	**Fisher**		**Pesaran**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	0,62	0,99
Portfolio/GDP	0,00	0,00	0,87	0,30
Other Flows/GDP	0,99	1,00	0,29	0,93
Total capital outflows/GDP	0,05	1,00	0,09	0,97
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	1,00	1,00
Portfolio/GDP	1,00	1,00	1,00	1,00
Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital outflows/GDP	1,00	1,00	1,00	1,00

Lag order = 3	**Fisher**		**Pesaran**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	0,07	0,69
Portfolio/GDP	0,00	0,01	0,80	0,07
Other Flows/GDP	0,98	1,00	0,10	0,94
Total capital outflows/GDP	0,14	1,00	0,00	0,56
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	1,00	1,00
Portfolio/GDP	1,00	1,00	1,00	1,00
Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital outflows/GDP	1,00	1,00	1,00	1,00

Lag order = 4	Fisher		Pesaran	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	0,01	0,17
Portfolio/GDP	0,00	0,01	0,97	0,28
Other Flows/GDP	0,98	1,00	0,00	0,21
Total capital outflows/GDP	0,26	1,00	0,00	0,02
		I(1)		
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
FDI/GDP	1,00	1,00	1,00	1,00
Portfolio/GDP	1,00	1,00	1,00	1,00
Other Flows/GDP	1,00	1,00	1,00	1,00
Total capital outflows/GDP	1,00	1,00	1,00	1,00

Source: Authors' own calculations.

A.3.3 *Pull variables and interest-rate differential series*

Lag Order = 1	**Fisher**		**Pesaran**	
	Ho: No Stationary		**Ho: No Stationary**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	0,985	0,947	0,824
Annual variation Real GDP	0,000	0,000	0,000	0,000
Differential Interest Rates HW	0,000	0,000	0,000	0,000
Differential Interest Rates HW Double	0,000	0,000	0,000	0,000
Differential Interest Rates MA(3)	0,000	0,011	0,000	0,000
Debt as % of GDP	0,001	0,998	0,997	0,433
Commodities Index	0,952	1,000	0,000	0,654
ln(Openning Index)	0,006	0,000	0,531	0,423
International Reserves as % of GDP	0,997	0,992	0,864	0,651
	I(1)		**I(1)**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	1,000	1,000	1,000
Annual variation Real GDP	-	-	-	-
Differential Interest Rates HW	-	-	-	-
Differential Interest Rates HW Double	-	-	-	-
Differential Interest Rates MA(3)	-	-	-	-
Debt as % of GDP	-	1,000	1,000	1,000
Commodities Index	1,000	1,000	-	1,000
ln(Openning Index)	-	-	1,000	1,000
International Reserves as % of GDP	1,000	1,000	1,000	1,000

Lag Order = 2	**Fisher**		**Pesaran**	
	Ho: No Stationary		**Ho: No Stationary**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	0,973	0,950	0,640
Annual variation Real GDP	0,000	0,000	0,000	0,000
Differential Interest Rates HW	0,000	0,000	0,000	0,000
Differential Interest Rates HW Double	0,000	0,000	0,000	0,000
Differential Interest Rates MA(3)	0,000	0,000	0,000	0,000
Debt as % of GDP	0,020	0,999	0,946	0,002
Commodities Index	0,724	0,998	0,000	0,009
ln(Openning Index)	0,004	0,000	0,824	0,831
International Reserves as % of GDP	0,996	0,988	0,817	0,717
	I(1)		**I(1)**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	1,000	1,000	1,000
Annual variation Real GDP	-	-	-	-
Differential Interest Rates HW	-	-	-	-
Differential Interest Rates HW Double	-	-	-	-
Differential Interest Rates MA(3)	-	-	-	-
Debt as % of GDP	-	1,000	1,000	-
Commodities Index	1,000	1,000	-	-
ln(Openning Index)	-	-	1,000	1,000
International Reserves as % of GDP	1,000	1,000	1,000	1,000

Lag Order = 3	**Fisher**		**Pesaran**	
	Ho: No Stationary		**Ho: No Stationary**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	0,968	0,911	0,421
Annual variation Real GDP	0,000	0,000	0,000	0,000
Differential Interest Rates HW	0,000	0,000	0,000	0,000
Differential Interest Rates HW Double	0,000	0,000	0,000	0,000
Differential Interest Rates MA(3)	0,000	0,000	0,008	0,653
Debt as % of GDP	0,071	0,998	0,995	0,005
Commodities Index	0,524	0,972	0,000	0,140
ln(Openning Index)	0,006	0,000	0,823	0,656
International Reserves as % of GDP	0,996	0,988	0,922	0,732
	I(1)		**I(1)**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	1,000	1,000	1,000
Annual variation Real GDP	-	-	-	-
Differential Interest Rates HW	-	-	-	-
Differential Interest Rates HW Double	-	-	-	-
Differential Interest Rates MA(3)	-	-	-	1,000
Debt as % of GDP	1,000	1,000	1,000	-
Commodities Index	1,000	1,000	-	1,000
ln(Openning Index)	-	-	1,000	1,000
International Reserves as % of GDP	1,000	1,000	1,000	1,000

Lag Order = 4	**Fisher**		**Pesaran**	
	Ho: No Stationary		**Ho: No Stationary**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	0,970	0,803	0,456
Annual variation Real GDP	0,000	0,001	0,111	0,998
Differential Interest Rates HW	0,000	0,000	0,013	0,514
Differential Interest Rates HW Double	0,000	0,000	0,034	0,656
Differential Interest Rates MA(3)	0,000	0,009	0,111	0,982
Debt as % of GDP	0,144	0,999	1,000	0,908
Commodities Index	0,594	0,986	0,995	1,000
ln(Openning Index)	0,011	0,000	0,899	0,754
International Reserves as % of GDP	0,996	0,983	0,954	0,718
	I(1)		**I(1)**	
Variable	**No trend**	**Trend**	**No Trend**	**Trend**
Ln(Real GDP)	1,000	1,000	1,000	1,000
Annual variation Real GDP	-	-	1,000	1,000
Differential Interest Rates HW	-	-	-	1,000
Differential Interest Rates HW Double	-	-	-	1,000
Differential Interest Rates MA(3)	-	-	1,000	1,000
Debt as % of GDP	1,000	1,000	1,000	0,000
Commodities Index	1,000	1,000	1,000	0,000
ln(Openning Index)	-	-	1,000	1,000
International Reserves as % of GDP	1,000	1,000	1,000	1,000

Source: Authors' own calculations.

A.3.4 *Push series* (*common factors*)

Zivot - Andrews Unit Root Test				
Ho: The series have unit root				
Critical value at 5%	-4,80	-4,42	-5,08	
Variable	**Intercept**	**Trend**	**Both**	**Result**
Standard & Poors 500	-2,39	-2,30	-3,28	No stationary
Annual variation of VIX	-5,44	-4,83	-5,36	Stationary
World Lider	-4,14	-2,27	-3,83	No stationary
First Differences				
Variable	**Intercept**	**Trend**	**Both**	**Result**
D(Standard & Poors 500)	-7,54	-6,72	-7,59	Stationary
D(World Lider)	-3,3	-2,8	-3,16	No stationary [I(2)?]

Source: Authors' own calculations.


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