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Assessing the post-quantitative easing surge in financial flows to developing and emerging market economies

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ABSTRACT

The aim of this paper is to assess the surge in financial flows to developing and emerging market economies induced by the Federal Reserve's experience of quantitative easing. Using both panel causality tests and dynamic panel regression models on a data set covering as much as 78 developing and EMEs between 2007Q1 and 2014Q4, it is found on the one hand that QE caused cross-border capital flows in the form of foreign direct investment. an equity portfolios, and bank loans. On the other hand, the study reveals that QE significantly fueled financial flows to developing and EMEs through the portfolio rebalancing, liquidity and confidence channels. In addition, the paper highlights the significant contribution of the fiscal channel and shows that when it comes to post-QE cross-border financial flows, the BRICS exhibit a pattern similar to that of other developing and EMEs.

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1. Introduction

In their policy response to the Great Recession, central banks in advanced economies (AEs) drove policy rates down to the zero lower bound and embarked on the journey of quantitative easing (QE). This unconventional monetary policy (UMP) has become the topic of a fierce debate among academicians, central bankers, and politicians for its theoretical foundations are disputed (Bernanke, 1999; Bernanke, Reinhart, & Sack, 2004; Buiter, 2010; Eggertsson & Woodford, 2003; Klyuev, Imus, & Srinivasan, 2009; Palley, 2011) and its domestic effects are dubious (Gambacorta, Hofmann, & Peersman, 2012; Herbst, Wu, & Ho, 2014; IMF, 2013; Kimura, Kobavashi, Muranaga, & Ugai, 2003; Menon & Ng, 2013). Furthermore, QE also raises controversy because it is associated with some complex spillover effects accentuating the cyclicality in global capital flows (Mohanty, 2013, 2014). Indeed, the combination of low policy rates, massive liquidity injections, and uncertain economic outlook prevailing in AEs triggered a search for yield that ultimately fueled capital flows to developing and EMEs.

In the pre-crisis period, capital flows to developing and EMEs were primarily driven by pull factors in the recipient countries such as the level of development of their financial

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market and their growth potential (Chen & Khan, 1997); meanwhile, the current pattern of capital flows to those economies is essentially driven by global push factors such as the financial and macroeconomic conditions in AEs, and especially in the U.S. (Banerjee, Devereux, & Lambardo, 2016). Lim and Mohapatra (2016) reveal that between the second quarter of 2009 and the first quarter of 2013, the cumulative gross capital inflow to developing countries rose 211%; from \$192 to \$598 billion. Moreover, they argue that the current pattern of financial inflows to developing countries is similar to the one observed during the pre-crisis bubble period.

The post-QE surge in capital flow to developing and EMEs stirs up worries in those economies. Indeed, those financial flows substantially alter financial and economic conditions in the developing world as they inflate financial asset and real estate prices, fuel the expansion of domestic credit and consumption, and lead to exchange rate appreciation. *In fine*, the impact of those financial inflows is so pervasive that it has raised concerns about economic overheating and financial stability in some of the recipient economies (Ahmed & Zlate, 2014; Lim & Mohapatra, 2016; Menon & Ng, 2013; Taguchi, Sahoo, & Nataraj, 2015). Those worries inspired this paper of which the aim is to assess the surge in cross-border financial flows induced by the Federal Reserve's QE programs. Attention is paid to the U.S. experience because the Great Recession originated in the jurisdiction of the Fed. Moreover, the U.S. economy and the U.S. dollar occupy a central position in the global economy. Finally, as compared to other central banks, it can fairly be said that the Fed went "the extra mile" in the implementation of UMPs and QE.

The contribution of this paper is multidimensional. Indeed, on a data set covering as much as 78 developing and EMEs between 2007Q1 and 2014Q4, QE-induced cross-border financial flows are assessed using both panel data causality tests and dynamic panel data regression models. Country-specific pull factors, different types of financial flows, different proxies for QE, as well as various transmission channels (portfolio rebalancing, liquidity, and confidence) are taken into consideration. Moreover, unlike previous studies on the subject matter, the fiscal channel of QE is taken into consideration. Indeed, it is argued after Bernanke et al. (2004) that the monetary injection done under QE could help relieve the budget constraint of the government and be conducive for fiscal stimulus. Such a fiscal stimulus mechanically increases the budget deficit of the government but has the potency to mitigate the fall in GDP induced by the Great Recession and ultimately lead to a reduction in crossborder financial flows.

Finally, a particular attention is paid to the BRICS so as to find more evidence using a reduced and relatively more homogenous sample. Brazil, Russia, India, China, and South Africa are singled out because they are the most advanced economies in the developing world. They are also major players when it comes to international financial flows as the combination of their cheap and young labor force, their big market, and their natural resources endowment constitutes a significant competitive advantage over other EMEs (Nistor, 2015).

The remainder of this paper is organized as follows: Section II reviews the literature related to the nexus between QE and cross-border financial flows; Section III describes the methodology of the study; Section IV presents and discusses the main findings; and Section V concludes with some policy recommendations.

2. Related literature

A growing literature is trying to assess the effects of the unorthodox accommodative policy stance in AEs on capital flows to developing and EMEs and the effects of those flows in the recipient economies. This literature uses a wide range econometric tools and takes into consideration various possible transmission channels of QE.

At the theoretical level, Banerjee et al. (2016) develop a core-periphery DSGE model to assess the cross-border effects of the policy stance in AEs. They assume that the core country's currency dominates cross-border flows of capital and that the model is driven by both the policy stance and financial shocks in the core economy. The study reveals that an accommodative policy stance in AEs leads to a fall in interest rates, reduces the funding cost for financial institutions, and fuels lending in EMEs. Moreover, inflows in EMEs lead to real exchange rate appreciation; they also inflate asset prices and compress spreads. The study finally reveals that following an accommodative policy stance in the core country, responses in the periphery are often larger than those in the core economy itself even if the periphery allows its exchange rate to adjust freely.

At the empirical level, Ahmed and Zlate (2014) assess the determinants of net private capital inflows in 12 EMEs assuming that the Fed's accommodative policy generates cross-border effects through its impact on Treasury yields. They take into consideration factors that could have a direct effect on the spread in expected returns between AEs and EMEs (growth and policy rate differentials), a proxy of global risk aversion (the implied volatility of the S&P 500 or VIX), and capital control measures in EMEs. Chen, Filardo, Dong, and Zhu (2016) study the international spillover effects of UMPs using a global vector error correction model covering 4 AEs and 13 EMEs. They assume that the Fed's QE programs affect financial flows to EMEs not only through their impact on the U.S. term spread but also through corporate bond spread¹ because those spreads reflect the health of the American financial sector.

Barroso, da Silva, and Sales (2016) study QE-related capital flows to Brazil based on the assumption that the effects of QE on the U.S. term spread leads to cross-border capital flows and Lim and Mohapatra (2016) analyze gross capital flows to 60 developing countries assuming that the cross-border effects of the QE measures implemented in AEs are transmitted to the developing world through the liquidity, the portfolio rebalancing, and the confidence channels. Even though it is argued that the monetary injection done under QE could help relieve the budget constraint of the government and be conducive for fiscal stimulus (Bernanke et al., 2004), such a transmission channel is still underexamined in the literature.

The EM-focused literature (Ahmed & Zlate, 2014; Barroso et al., 2016; Chen et al., 2016; Lim & Mohapatra, 2016) reveals that QE induces a surge in financial flows to the developing world. Ahmed and Zlate (2014) also find a structural change in the sensitivity of capital flows to policy rate differentials after the crisis. They reveal that in the post-crisis era, policy rate differentials lead to larger capital flows to EMEs. Chen et al. (2016) find that the Fed's accommodative policy stance generates larger cross-border effects through the compression of the corporate bond spread it induces rather than through that of the term spread.

¹The term spread is the difference between the 10-year and the 3-month Treasury yields while the corporate bond spread is the difference between the BofA Merrill Lynch U.S. corporate AAA bond yield and the Federal funds rate.

Lim and Mohapatra (2016) reveal that QE-induced financial inflows depend on the host country's characteristics as countries with outstanding growth and stable political and institutional frameworks tend to attract more inflows. Moreover, the authors find evidence supporting the liquidity, portfolio rebalancing, and confidence channels. As for Barroso et al. (2016), they reveal that the U.S. monetary easing did not only fuel financial inflows; but, it also inflated stock prices, induced exchange rate appreciation, boosted credit growth, and stimulated domestic activities related to consumption in Brazil.

It is argued that policymakers in EMEs allowed their currency to appreciate in the wake of the large capital inflows induced by the U.S. monetary accommodation. Thus, they needed less monetary stimulus to jump-start their respective economies (Ahmed & Zlate, 2014). Moreover, it is argued that QE-induced capital flows supported economic recovery in EMEs and even led to overheating in economies like Brazil and China (Chen et al., 2016). Finally, Lim and Mohapatra (2016) reveal that monetary easing in AEs fuels financial flows to developed countries beyond the liquidity, the portfolio rebalancing, and the confidence transmission channels.

3. Methodology

3.1. Data

On the one hand, quarterly data related to the Fed's QE programs and their possible transmission channels were obtained from the Federal Reserve Economic Data. The percent change (growth rate) in each variable was taken so as to cover the period from 2007Q1 to 2014Q4. On the other hand, annual data related to financial flows and economic conditions in developing and EMEs were obtained from the World Bank (WDI 2016). Those annual data were converted into quarterly ones using the formulas proposed by Goldstein and Khan (1976).²

From the list of 151 countries classified by the IMF (2012) as developing and EMEs and based on data availability, the study is carried out with a sample of 78 countries. Three different variables are chosen to account for financial flows to developing and EMEs: the first variable is the net inflows of foreign direct investment (FDI) expressed as a percentage of GDP. The second variable is the net inflows of portfolio equity (PFI) expressed as a percentage of GDP. The third variable – international bank loans – is proxied by domestic credit provided by financial institutions; also expressed as a percentage of GDP. Paying attention to pull factors in host economies, the study takes into consideration both the GDP growth rate and the real interest rate differentials between developing and EMEs and the U.S. economy. Indeed, it is assumed that sluggish financial and economic conditions – relatively low growth and interest rates – in the U.S. incite economic agents to increase their investment in the developing world.

In line with Lim and Mohapatra (2016), the study chooses three different transmission channels through which the Fed's accommodative stance could affect financial flows in developing and EMEs. The first transmission channel – the portfolio rebalancing channel – is built upon the intuition that money and financial assets are imperfect substitutes. Thus, by reducing the amount of financial asset relative to money in agents' portfolios,

²Goldstein and Khan (1976) state that from three consecutive yearly observations (x_{t-1}, x_t , and x_{t+1}) of a flow variable, the quarterly values of x_t can be computed using the following equations:.

the asset purchase program could incite those investors to purchase other financial assets in an attempt to rebalance their portfolio (Bernanke et al., 2004). The S&P 500 stock index accounts for this transmission channel as a bullish market is assumed to be the consequence of the rebalancing process. Similarly, the compression of the term spread also accounts for this transmission channel.

The second transmission channel – the liquidity channel – operates as follows: massive injection of liquidity in an economy characterized by sluggish economic conditions leaves investors with plenty of "free money" that could be used to fuel speculation and/ or capital flows to developing and EMEs. The 3-month Treasury yield accounts for this transmission channel because it is often used as a benchmark for short-term funding. Furthermore, following the argument made by Menon and Ng (2013) and Herbst et al. (2014), excess reserves at the Fed are also taken into consideration as an additional measure of the liquidity channel. Those researchers argue that the transmission mechanism of QE might be ineffective as the liquidity injected increases reserve balances instead of fueling credit to the economy. Thus, it is assumed that the surge in reserve balances reflects the scarcity of profitable investment opportunities in the U.S. and fuels a surge in cross-border financial flows.

As for the third transmission channel – the confidence channel – it stipulates that economic agents are more incline to invest when they perceive that the risk inherent to the market is relatively low or decreasing. Thus, the CBOE volatility index also known as the VIX or the fear index is used to account for this transmission channel because it captures the sentiment of agents investing in risky assets (Lim & Mohapatra, 2016). The CBOE gold ETF volatility index also accounts for this transmission channel as the safe haven characteristic of gold conveys information about the strains in financial markets.

Unlike previous studies on the subject matter, the fiscal channel of QE is taken into consideration. Indeed, it is argued after Bernanke et al. (2004) that the monetary injection done under QE could help relieve the budget constraint of the government and be conducive for fiscal stimulus. The budget deficit of the U.S. federal government accounts for this fiscal channel; but, given that the deficit itself is affected by the fall in GDP induced by the Great Recession, the data was cyclically adjusted using TRAMO-SEATS³ programs. The cyclically adjusted data is then used as a proxy for the structural budget deficit of the U.S. federal government.

Theoretically, the fiscal channel operates as follows: the large-scale asset purchase programs implemented by the Fed lower the cost of sovereign bonds, make it cheaper for the fiscal authority to borrow from financial markets, and allow the government to stimulate the economy through fiscal policy. Such a fiscal stimulus mechanically increases the budget deficit of the government; but, it has the potency to mitigate the fall in GDP induced by the Great Recession and ultimately lead to a reduction in crossborder financial flows.

Finally, three different proxies of QE were taken into consideration: UMP refers to the Fed's total assets and is a proxy for the central bank's unconventional monetary policy "full package" (QE, CE, and liquidity programs); QE refers to the securities held outright (Treasuries and MBS) and captures both the Fed's QE and CE programs; and Core_QE

³TRAMO stands for Time series Regression with ARIMA noise, Missing Observations and Outliers and SEATS stands for Signal Extraction in ARIMA Time Series.

refers to the Treasury securities held outright. This latter proxy is the narrowest conception of QE as it captures only the purchase of Treasuries.

3.2. Analytic framework

3.2.1. Granger causality test

Let us assume that X_t and Y_t are two stationary time series with zero means; X_t stands for the asset purchase program implemented by the Fed and Y_t represents financial flows to the developing world. According to Granger (1969), the causal relationship between X_t and Y_t is given by the following equation:

$$Y_{t} = \sum_{k=1}^{K} \alpha_{k} X_{t-k} + \sum_{k=1}^{K} \beta_{k} Y_{t-k} + \mu_{k}$$
(1)

where μ_i is a white noise; that is $\forall t \neq s, E[\mu_t \mu_s] = 0$; k is the number of lags included in the model (k < t); and α_k and β_k are parameters.

As for the decision rule, it is argued that X_t Granger causes Y_t if some α_k are different from zero. The causality approach proposed by Granger (1969) is built upon the unrealistic assumption that all α_k and β_k are the same for all countries. Thus, the panel data is treated as a stacked data set on which is performed the traditional Granger causality test; even though data related to one country are not included as lagged values of data related to another country.

3.2.2. Dumitrescu-Hurlin causality test

Dumitrescu and Hurlin (2012) propose a modified version of Granger's (1969) causality test for heterogeneous panel data models in which the parameters are fixed over time. This causality test takes into consideration the heterogeneity of both the causal relationship and that of the regression model used in Granger's (1969) approach. Thus, the causal relationship between the asset purchase program implemented by the Fed and financial flows to the developing world (x and y) is given by the following equation:

$$y_{t} = \delta_{i} + \sum_{k=1}^{K} \alpha_{i}^{(k)} x_{i, t-k} + \sum_{k=1}^{K} \beta_{i}^{(k)} y_{i,t-k} + \mu_{i,t} \quad \forall i = 1, 2, ..., N \text{ and } t$$

= 1, 2, ..., T (2)

where N is the number of countries and T the number of periods; $k \in \mathbb{N}^*$ is the number of lags included in the model; this lag order is assumed to be identical for all countries. The individual effects δ_i , the autoregressive coefficients $\beta_i = \left(\beta_i^{(1)}, \ldots, \beta_i^{(K)}\right)$ and the regression parameters $\alpha_i = (\alpha_i^{(1)}, \ldots, \alpha_i^{(K)})$ are all supposed to be fixed over time; But, β_i and α_i are allowed to vary across countries.

Under the homogenous non-causality (HNC) hypothesis (the null hypothesis of the test), Dumitrescu and Hurlin (2012) assume that there is no causal relation between x and y for all the cross-sections.

$$H_0: \ \alpha_i = 0 \qquad \forall i = 1, \ \dots, N \tag{3}$$

Under the alternative hypothesis, it is assumed that x does not Granger cause y for a subgroup of N_1 countries (where $N_1 < N$); while there is a causality relation between those variables for the other countries.

$$H_1: \ \alpha_i = 0 \qquad \forall i = 1, \ \dots, N_1 \tag{4}$$
$$\alpha_i \neq 0 \qquad \forall i = N_1 + 1, \ \dots, N$$

The unknown N_1 satisfies the following condition: $0 \le N_1/N \le 1$. If $N_1 = 0$, *x* Granger causes *y* for all the countries and if $N_1 = N$, the HNC hypothesis according to which there is no causality relation for all the countries is not rejected. Dumitrescu and Hurlin (2012) propose the following statistic associated with the HNC hypothesis:

$$W_{N,T}^{HNC} = \frac{1}{N} \sum_{i=1}^{N} W_{i,T}$$
(5)

where $W_{i,T}$ represents the individual Wald statistics for the ith country $(H_0 : \beta_i = 0)$. The authors demonstrate the limiting distribution of $W_{N,T}^{HNC}$ when $T \to \infty$ followed by $N \to \infty$ and proposed the following standardized test statistic:

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}} \left(W_{N,T}^{HNC} - K \right) \to N(0,1)$$
(6)

Finally, the authors demonstrate that when T is fixed and T > 5 + 2K, the standardized test statistics can be written as follows:

$$\tilde{Z}_{N}^{HNC} = \sqrt{\frac{N}{2 \times K} \times \frac{(T - 2K - 5)}{(T - K - 3)}} \times \left[\frac{(T - 2K - 3)}{(T - 2K - 1)}W_{N,T}^{HNC} - K\right] \to N(0, 1)$$
(7)

Both the causality approach proposed by Granger (1969) and that proposed by Dumitrescu and Hurlin (2012) are implemented and two different samples are taken into consideration in this causality analysis: the first sample includes all the 78 developing and EMEs while the second sample includes only the BRICS. Taking into consideration the trade-off between size and power characterizing the aforementioned causality tests, the lag order of the variables is chosen to minimize the average Akaike information criterion. Thus, eight lags are included in all the equations related to the full sample while the lag order varies from 5 to 8 in the equations related to the BRICS.

3.2.3. Regression model

The general specification of the model used is given by the following equation:

$$CF = \alpha_0 + \alpha_1 CF_{it-1} + \alpha_2 Growth_{it} + \alpha_3 IR_{it} + \alpha_4 Rebalancing_{it} + \alpha_5 Liquidity_{it} + \alpha_6 Confidence_{it} + \alpha_7 Deficit_{it} + \alpha_8 Reserves_{it} + Crisis_t$$
(8)
+ Post_crisis_t + Trend_t + $\delta_i + \epsilon_{it}$

where CF_{it} stands for the three types of capital flows for country i at time t; $Growth_{it}$ and IR_{it} represent the GDP growth rate and the real interest rate differentials, respectively; $Rebalancing_{it}$, $Liquidity_{it}$, and $Confidence_{it}$ are the conventional transmission channels of

QE; *Deficit_{it}* and *Reserves_{it}* stand for structural budget deficit (fiscal channel) and excess reserves (liquidity channel) respectively; *Crisis_t* and *Post_crisis_t* are the crisis and the post-crisis dummy variables, respectively; *Trend_t* stands for the time trend; δ_i represents country-specific fixed effects; ϵ_{it} is the residual; and $\alpha_a(a = 1, ..., 8)$ are the parameters to be estimated.

As demonstrated by Nickell (1981), the estimated parameters of a dynamic model with fixed individual effects are inconsistent when the number of countries tends to infinity while the number of quarters is kept fixed. Thus, the model is estimated using the bias-corrected Least Squares Dummy Variable method developed by Bruno (2005). The bias correction is initialized by the Anderson and Hsia (1981) consistent estimator and the accuracy of the approximation set up to order $O(\frac{1}{NT^2})$. Finally, bootstrapped standard errors are generated with 100 replicates.

4. Main findings

4.1. Evidence from causality tests

The results of the causality tests are presented in Tables 1 and 2 for the full sample and the BRICS, respectively. For the full sample, the results reveal that all three proxies of the Fed's unconventional policy stance Granger cause FDI and bank loan in developing and EMEs while none of them Granger causes PFI. Moreover, the Dumitrescu-Hurlin causality test confirms that Core_QE, QE and UMP Granger cause a surge in FDI and Loan in at least one developing country. Unfortunately, the latter test could not be performed in the case of PFI. It is therefore not possible to draw any conclusion in that case. Nevertheless, based on the evidence brought forth by those two causality tests, it can be argued that the accommodative monetary stance of the Fed fueled financial flows to developing and EMEs in the form of FDI and Loan. The surge in FDI is quite surprising because this type of financial flow is usually driven by the fundamentals of host countries

| | Granger Causality Test | | Dimitrescu-Hurlin Causality | y test | |
|-------------------------|--|-------------|--|--------|-----------|
| | Null hypothesis | F-statistic | Null hypothesis | W-stat | Zbar-stat |
| Foreign Direct | Core_QE does not Granger cause FDI | 11.776** | Core_QE does not homogeneously cause FDI | 26.908 | 11.900** |
| Investment | QE does not Granger cause FDI | 10.261** | QE does not homogeneously cause FDI | 21.516 | 7.815** |
| (k = 8) | UMP does not Granger cause FDI | 7.334** | UMP does not homogeneously cause FDI | 14.758 | 2.695** |
| Portfolio Investment | Core_QE does not Granger cause PFI | 1.063 | Core_QE does not homogeneously cause PFI | - | - |
| (k = 8) | QE does not Granger cause PFI | 1.072 | QE does not homogeneously cause PFI | - | - |
| | UMP does not Granger cause PFI | 1.528 | UMP does not homogeneously cause PFI | - | - |
| Loan (k = 8) | Core_QE does not Granger cause Loan | 5.517** | Core_QE does not homogeneously cause Loan | 18.927 | 5.854** |
| | QE does not Granger cause Loan | 13.115** | QE does not homogeneously cause Loan | 25.814 | 11.071** |
| | UMP does not Granger cause Loan | 11.642** | UMP does not homogeneously cause Loan | 20.983 | 7.411** |

Table 1. Panel causality tests for the full sample.

Source: Author estimates

**Denotes significance at the 5% level.

| | Granger Causality Test | | Dimitrescu-Hurlin Causality test | | |
|-------------------------|--|-------------|--|--------|-----------|
| | Null hypothesis | F-statistic | Null hypothesis | W-stat | Zbar-stat |
| Foreign Direct | Core_QE does not Granger cause FDI | 3.237** | Core_QE does not homogeneously cause FDI | 28.382 | 3.295** |
| Investment | QE does not Granger cau se FDI | 4.093** | QE does not homogeneously cause FDI | 11.999 | 0.153 |
| (k = 8/8/5) | UMP does not Granger cause FDI | 5.036** | UMP does not homogeneously cause FDI | 7.078 | 0.670 |
| Portfolio Investment | Core_QE does not Granger cause PFI | 6.601** | Core_QE does not homogeneously cause PFI | 19.214 | 1.537 |
| (k = 8) | QE does not Granger cause PFI | 8.626** | QE does not homogeneously cause PFI | 16.074 | 0.935 |
| | UMP does not Granger cause PFI | 6.235** | UMP does not homogeneously cause PFI | 20.229 | 1.732 |
| Loan (k = 8/8/7) | Core_QE does not Granger cause Loan | 4.442** | Core_QE does not homogeneously cause Loan | 46.147 | 6.703** |
| | QE does not Granger cause Loan | 5.262** | QE does not homogeneously cause Loan | 29.796 | 3.567** |
| | UMP does not Granger cause Loan | 4.448** | UMP does not homogeneously cause Loan | 26.458 | 5.354** |

Table 2. Panel causality tests for the BRICS.

Source: Author estimates

**Denotes significance at the 5% level.

rather than by push factors abroad. As for Loan, it is a type a financial flow that could well be influenced by push factors like speculation or the search for yield induced by QE.

As for the BRICS, the results reveal that all three monetary policy variables Granger cause FDI, PFI, and Loan in those countries. Nevertheless, those findings are not supported by the Dumitrescu-Hurlin causality test as it is found that Core_QE is the only monetary policy proxy Granger causing a surge in FDI in at least one of those five economies. It is also found that Core_QE, QE and UMP do not cause PFI in any of those countries while each of those proxies Granger causes Loan in at least one country. In sum, these findings reveal that the QE measures implemented by the Fed have induced financial flows in the BRICS; they also reveal that those financial flows were mainly in the form of bank loans. This might be explained by the fact that investors were primarily driven by the search for yield as they wanted to make some profit elsewhere while the U.S. economy is recovering from the crisis. In that vein, they chose bank loans because they offer the double advantage of short/medium-term profit and relatively low exit cost.

4.2. Evidence from regression models

4.2.1. FDI equations

Alternative model specifications (Equation (1) to Equation (5)) are run in the case of the full sample as well as in that of the BRICS. In the case of the full sample, paying attention to the transmission channels of QE, it is found that the QE measures implemented in the U.S. significantly affects FDI in the developing world through the liquidity and the rebalancing channels. Indeed, the liquidity channel is negatively and significantly correlated with FDI inflows; revealing that the Fed's QE programs could have flooded the economy with liquidity, induced a fall in the 3-month Treasury rate, and ultimately fueled a search for yield resulting in more FDI in developing and EMEs.

As for the portfolio rebalancing channel, it is positively and significantly correlated with FDI inflows. Thus, it can be argued that by reducing the amount of financial asset relative to money in agents' portfolios, QE incites investors to purchase foreign financial assets in an attempt to rebalance their portfolio (Bernanke et al., 2004). Paying attention to pull factors in the recipient economies, Tables 3 and 4 reveal that the GDP growth rate differential has a positive and significant impact on FDI in the developing world. Thus, in line with Lim and Mohapatra (2016), FDI is positively affected by host countries characteristics as countries with outstanding growth tend to attract more inflows.

Taking into consideration the budget deficit of the U.S. government as well as excess reserves at the Fed, it is found that the former variable has a negative and significant impact on FDI inflows in developing and EMEs. Thus, it can be argued that the largescale asset purchase programs implemented by the Fed make it cheaper for the fiscal authority to borrow from financial markets and allow the government to stimulate the economy through fiscal policy. The fiscal stimulus in turn increases the budget deficit of the government, mitigate the fall in GDP induced by the Great Recession, and ultimately lead to a reduction in cross-border financial flows.

The robustness of those findings is checked in Equation (5). In this specification, the U.S. term spread is used as a proxy for the rebalancing channel; excess reserves at the Fed account for the liquidity channel; and the CBOE gold ETF volatility index replaces the VIX as a proxy for the confidence channel. The results reveal that the fiscal channel is robust as well as economic growth in the recipient economies.

Paying attention to the BRICS, it is found that the liquidity channel is the only transmission channel through which the QE measures implemented by the Fed significantly affect FDI inflows in those emerging countries. In addition, it is found that country-specific pull factors have a positive and significant effect on FDI inflows. Thus, countries with outstanding economic and financial conditions tend to be the favorite destination for those financial flows. Moreover, evidence supporting the fiscal channel is not found in this case.

| | | Full sa | mple | | |
|--------------------------|------------------|------------------|-------------------|------------------|-----------------|
| Variables | Equation (1) | Equation (2) | Equation (3) | Equation (4) | Equation (5) |
| CF _{it-1} | 0.531(0.159)*** | 0.531(0.015)*** | 0 .536(0 .015)*** | 0.536(0.015)*** | 0.223(0.019)*** |
| Growth | - | 0.213(0.067)** | - | 0.207(0.067)*** | 0.278(0.053)*** |
| IR | - | 0.038(0.040) | - | 0.012(0.040) | 0.030(0.030) |
| Rebalancing | 0.154(0.118) | 0.015(0.011) | 0.031(0.013)** | 0.032(0.013)** | - |
| Liquidity | -1.875(0.287)*** | -1.709(0.297)*** | -2.529(0.346)*** | -2.323(0.351)*** | - |
| Confidence | -0.002(0.002) | -0.001(0.002) | -0.002(0.002) | -0.002(0.002) | - |
| Structural_Deficit | - | - | -0.003(0.001)*** | -0.002(0.001)*** | -0.001(0.001)* |
| Excess_Reserves | - | - | -0.001(0.001) | -0.001(0.001) | 0.001(0.001)*** |
| Rebalancing [#] | - | - | - | - | 0.001(0.004) |
| Confidence [#] | - | - | - | - | -0.001(0.002) |
| Crisis | -1.226(0.375)*** | -1.103(0.386)** | -2.069(0.445)*** | -1.913(0.453)*** | - |
| Post_crisis | -0.241(0.484) | -0.125(0.492) | -1.377(0.590)** | -1.241(0.600)** | 0.654(0.197)*** |
| Trend | -0.011(0.014) | -0.011(0.015) | 0.019(0.017) | 0.019(0.018) | -0.003(0.015) |
| Obs. | 2 418 | 2 418 | 2418 | 2418 | 2418 |
| Adj. R ² | 0.442 | 0.444 | 0.462 | 0.464 | 0.314 |

Table 3. Estimation of FDI equations for the full sample.

Source: Author estimates

*Denotes significance at the 10% level; ** denotes significance at the 5% level; and *** denotes significance at the 1% level.

Bootstrapped standard errors (with 100 replicates) are reported in parentheses.

| Table 4. Estimation of | Table 4. Estimation of FDI equations for the BRICS. | | | | |
|-----------------------------|---|-----------------------------------|----------------------------------|-----------------|-----------------|
| | | BRIC | BRICS only | | |
| Variables | Equation (1) | Equation (2) | Equation (3) | Equation (4) | Equation (5) |
| CF _{Ir-1} | 0.123(0.074)* | 0.198(0.064)** | 0.156(0.076)** | 0.208(0.066)*** | 0.155(0.078)** |
| Growth | | 0.201(0.037)*** | | 0.199(0.038)*** | 0.220(0.039)*** |
| R | | 0.042(0.014)** | | 0.040(0.014)*** | 0.056(0.019)*** |
| Rebalancing | -0.001(0.005) | -0.001(0.004) | 0.004(0.006) | 0.002(0.005) | |
| Liquidity | $-0.468(0.128)^{***}$ | -0.306(0.118)** | -0.585(0.150)*** | -0.330(0.138)** | |
| Confidence | -0.001(0.001) | -0.001(0.001) | -0.002(0.001)* | -0.001(0.001) | |
| Structural_Deficit | | | -0.001(0.001) | -0.001(0.001) | -0.001(0.001) |
| Excess_Reserves | | | 0.001(0.001) | 0.001(0.001) | 0.001(0.001) |
| Rebalancing [#] | | | | | 0.001(0.002) |
| Confidence [#] | | | | | 0.001(0.001) |
| Crisis | -0.162(0.167) | -0.037(0.147) | -0.308(0.199) | -0.071(0.181) | . ' |
| Post_crisis | 0.163(0.215) | 0.227(0.189) | -0.007(0.245) | 0.222(0.221) | 0.282(0.121)** |
| Trend | -0.008(0.006) | -0.001(0.005) | -0.003(0.007) | -0.001(0.006) | 0.002(0.009) |
| Obs. | 155 | 155 | 155 | 155 | 155 |
| Adj. R ² | 0.243 | 0.424 | 0.274 | 0.549 | 0.451 |
| | | | | | |
| Source: Author estimates | | | | | |
| *Denotes significance at th | Denotes significance at the 10% level; ** denotes significance at the 5% level; and *** denotes significance at the 1% level. | ce at the 5% level; and *** denot | es significance at the 1% level. | | |
| Bootstrapped standard erry | Bootstrapped standard errors (with 100 replicates) are reported in parentheses. | ed in parentheses. | | | |
| | | | | | |
| | | | | | |
| | | | | | |

4.2.2. PFI equations

The various model specifications are run with PFI inflows as the dependent variable and the results reported in Tables 5 and 6. Working with the full sample, it is found that the unconventional policy stance of the Fed does not significantly affect PFI in the developing world via any of the transmission channels previously used in the literature. However, the results show that QE significantly affects PFI through the fiscal channel. The results also reveal that economic and financial conditions in recipient economies do not significantly affect PFI inflows.

Working with the BRICS, it is found that QE significantly affects PFI in those countries via the rebalancing, liquidity and fiscal channels. Indeed, the increase in the S&P500 index, the fall in the 3-month Treasury rate, and the surge in the U.S. structural deficit induced by the large-scale purchases of the Fed significantly fuel cross-border financial flows to the developing world. It is also found that country-specific pull factors have a positive and significant effect on PFI inflows.

4.2.3. Loan equations

Focusing on the full sample, it is found that QE in the U.S. significantly affects bank loans in the developing world via the rebalancing, liquidity and confidence channels. Moreover, it is also found that QE significantly affects loans through the fiscal channel. These findings are in line with Bruno and Shin (2015) who argue that given the central position occupied by the dollar in the global banking system, low policy rate and massive liquidity injection in the U.S. lowers dollar funding costs and boosts cross-border financial flows. In turn, those capital flows alter financial conditions around the world as they lead to more lenient credit conditions in the recipient countries. In addition, it is found that economic and financial conditions in the developing world contribute to the post-QE surge in bank loans as those indicators are found to be positively and significantly correlated with the aforementioned financial flows. Paying attention to the BRICS, it is found that QE significantly affects loans in those economies through the liquidity, confidence, and fiscal channels. It is also found that host countries with outstanding growth tend to attract more inflows (Tables 7 and 8).

5. Concluding remarks

In the wake of Bowman, Londono, and Sapriza (2015), Barroso et al. (2016), Lim and Mohapatra (2016), and Ahmed and Zlate (2014), the evidence brought forth by both the causality and regression approaches show that the Fed's QE programs fueled financial flows to the developing world through the rebalancing, liquidity and confidence channels. It is also found that host countries with outstanding growth and high-interest rates tend to attract more inflows. In addition, it is found that the large-scale asset purchase programs implemented by the Fed lower the cost of sovereign bonds, make it cheaper for the fiscal authority to borrow from financial markets, and allow the government to stimulate the economy through fiscal policy. In turn, such a fiscal stimulus increases the budget deficit of the government, mitigates the fall in GDP induced by the Great Recession, and leads to a reduction in cross-border financial flows.

The results show that when it comes to post-QE cross-border financial flows, the BRICS exhibit a pattern similar to that of other developing and EMEs. Chen et al. (2016, p. 63) argue that the cyclical position of each economy shapes the perception of its policymakers regarding

| | and a semilation of the equations for the full sample. | ipic. | | | |
|--------------------------|--|-----------------|-----------------|-----------------|-----------------|
| | | Full s | Full sample | | |
| Variables | Equation (1) | Equation (2) | Equation (3) | Equation (4) | Equation (5) |
| CF _{It-1} | 0.763(0.016)*** | 0.763(0.016)*** | 0.762(0.016)*** | 0.763(0.016)*** | 0.729(0.018)*** |
| Growth | | 0.003(0.016) | | 0.003(0.016) | -0.001(0.021) |
| IR | | 0.006(0.009) | | 0.001(0.009) | 0.001(0.012) |
| Rebalancing | 0.001(0.002) | 0.001(0.002) | 0.004(0.003) | 0.004(0.003) | 1 |
| Liquidity | 0.036(0.071) | 0.031(0.073) | -0.071(0.083) | -0.069(0.083) | ı |
| Confidence | -0.001(0.001) | -0.001(0.001) | -0.001(0.001) | -0.001(0.001) | |
| Structural_Deficit | | 1 | -0.001(0.001)* | -0.001(0.001)* | 0.001(0.001) |
| Excess_Reserves | ı | ı | 0.001(0.001) | 0.001(0.001) | 0.001(0.001) |
| Rebalancing $^{\#}$ | ı | ı | ı | ı | 0.001(0.001) |
| Confidence [#] | ı | ı | | ı | -0.001(0.001) |
| Crisis | 0.003(0.090) | 0.001(0.093) | -0.127(0.106) | -0.125(0.108) | ı |
| Post_crisis | 0.053(0.116) | 0.059(0.119) | -0.108(0.144) | -0.100(0.144) | 0.043(0.082) |
| Trend | -0.004(0.003) | -0.005(0.003) | -0.001(0.004) | -0.001(0.004) | -0.010(0.006) |
| Obs. | 2418 | 2418 | 2418 | 2418 | 2418 |
| Adj. R ² | 0.566 | 0.565 | 0.581 | 0.580 | 0.590 |
| Source: Author estimates | | | | | |

Table 5. Estimation of PFI equations for the full sample.

*Denotes significance at the 10% level; ** denotes significance at the 5% level; and *** denotes significance at the 1% level. Bootstrapped standard errors (with 100 replicates) are reported in parentheses.

| | | BRIG | CS only | | |
|--------------------------|-----------------|-----------------|------------------|------------------|------------------|
| Variables | Equation (1) | Equation (2) | Equation (3) | Equation (4) | Equation (5) |
| CF _{it-1} | 0.524(0.076)*** | 0.549(0.076)*** | 0.569(0.077)*** | 0.586(0.081)*** | 0.524(0.072)*** |
| Growth | - | 0.075(0.029)** | - | 0.055(0.028)* | 0.045(0.023)* |
| IR | - | 0.022(0.011) | - | 0.010(0.011) | 0.016(0.011) |
| Rebalancing | 0.004(0.004) | 0.003(0.003) | 0.008(0.004)** | 0.007(0.004)* | - |
| Liquidity | 0.037(0.095) | 0.095(0.095) | -0.190(0.106)* | -0.118(0.105) | - |
| Confidence | -0.001(0.000) | -0.001(0.000) | -0.001(0.001) | -0.001(0.001) | - |
| Structural_Deficit | - | - | -0.001(0.001)*** | -0.001(0.001)*** | 0.001(0.001) |
| Excess_Reserves | - | - | 0.001(0.001) | 0.001(0.001) | 0.001(0.001) |
| Rebalancing [#] | - | - | - | - | -0.001(0.001) |
| Confidence [#] | - | - | - | - | -0.001(0.001)** |
| Crisis | -0.140(0.126) | -0.091(0.118) | -0.405(0.136)*** | -0.331(0.133)** | - |
| Post_crisis | -0.261(0.163) | -0.220(0.152) | -0.634(0.173)*** | -0.556(0.170)*** | -0.217(0.075)*** |
| Trend | 0.004(0.004) | 0.006(0.004) | 0.015(0.005)*** | 0.016(0.005)*** | 0.001(0.005) |
| Obs. | 155 | 155 | 155 | 155 | 155 |
| Adj. R ² | 0.443 | 0.480 | 0.536 | 0.549 | 0.649 |

| Table 6. | Estimation | of PFI | equations | for | the BRICS. |
|----------|-------------------|--------|-----------|-----|------------|
|----------|-------------------|--------|-----------|-----|------------|

Source: Author estimates

*Denotes significance at the 10% level; ** denotes significance at the 5% level; and *** denotes significance at the 1% level.

Bootstrapped standard errors (with 100 replicates) are reported in parentheses.

the spillover effects of QE. On the one hand, the cross-border effects of QE were perceived to be beneficial during the crisis as they helped stabilize financial markets and prevent a deeper fall in economic activity. On the other hand, after the crisis, those cross-border effects started to be perceived as harmful for some economies as they brought about capital flow pressures and currency appreciation that led to economic overheating and asset price inflation.

The massive capital flows induced by the QE measures implemented in AEs raise a lot of concerns among policymakers in developing and EMEs as they are associated with some side effects threatening financial stability in the recipient economies. Indeed, massive capital inflows and especially portfolio and loan inflows could create a lot of distortions in an environment with fewer investment opportunities and weak macroeconomic policy

| | | Full sa | ample | | |
|--------------------------|------------------|------------------|------------------|------------------|------------------|
| Variables | Equation (1) | Equation (2) | Equation (3) | Equation (4) | Equation (5) |
| CF _{it-1} | -0.268(0.020)*** | -0.256(0.020)*** | -0.242(0.020) | -0.233(0.020)*** | -0.262(0.021)*** |
| Growth | - | 0.885(0.145)*** | - | 0.871(0.137)*** | 0.857(0.183)*** |
| IR | - | 0.683(0.087)*** | - | 0.552(0.082)*** | 0.678(0.104)*** |
| Rebalancing | -0.017(0.025) | -0.024(0.024) | 0.086(0.028)*** | 0.074(0.028)*** | - |
| Liquidity | -4.769(0.619)*** | -4.603(0.633)*** | -8.550(0.729)*** | -7.837(0.724)*** | - |
| Confidence | -0.054(0.005)*** | -0.051(0.005)*** | -0.058(0.006)*** | -0.055(0.006)*** | - |
| Structural_Deficit | - | - | -0.016(0.001)*** | -0.015(0.001)*** | -0.007(0.003)** |
| Excess_Reserves | - | - | 0.001(0.001) | 0.001(0.001) | 0.001(0.001) |
| Rebalancing [#] | - | - | - | - | 0.043(0.014)*** |
| Confidence [#] | - | - | - | - | -0.020(0.008)*** |
| Crisis | -3.856(0.813)*** | -3.656(0.827)*** | -8.651(0.931)*** | -7.860(0.927)*** | - |
| Post_crisis | -1.128(1.049) | -0.163(1.053) | -7.391(1.234)*** | -5.777(1.226)*** | 1.804(0.677)*** |
| Trend | 0.049(0.031) | 0.020(0.032) | 0.217(0.037)*** | 0.173(0.037)*** | 0.067(0.055) |
| Obs. | 2418 | 2418 | 2418 | 2418 | 2418 |
| Adj. R ² | 0.650 | 0.670 | 0.683 | 0.697 | 0.678 |

Table 7. Estimation of Loan equations for the full sample.

Source: Author estimates

*Denotes significance at the 10% level; ** denotes significance at the 5% level; and *** denotes significance at the 1% level.

Bootstrapped standard errors (with 100 replicates) are reported in parentheses.

| | | BRIC | S only | | |
|--------------------------|------------------|------------------|-------------------|------------------|------------------|
| Variables | Equation (1) | Equation (2) | Equation (3) | Equation (4) | Equation (5) |
| CF _{it-1} | -0.332(0.077)*** | -0.243(0.070)*** | -0.297(0.077)*** | -0.227(0.070)*** | -0.239(0.079)*** |
| Growth | - | 5.603(1.288)*** | - | 5.142(1.275)*** | 6.132(1.365)*** |
| IR | - | 1.947(0.493)*** | - | 1.699(0.485)*** | 1.981(0.652)*** |
| Rebalancing | 0.001(0.211) | -0.006(0.175) | 0.184(0.212) | 0.116(0.179) | - |
| Liquidity | -9.487(4.733)** | -5.722(4.092) | -16.917(5.297)*** | -10.436(4.660)** | - |
| Confidence | -0.113(0.046)** | -0.073(0.036)** | -0.115(0.046)** | -0.082(0.037)** | - |
| Structural_Deficit | - | - | -0.033(0.012)*** | -0.020(0.010)* | -0.008(0.016) |
| Excess_Reserves | - | - | -0.001(0.003) | 0.001(0.003) | -0.001(0.003) |
| Rebalancing [#] | - | - | - | - | 0.031(0.076) |
| Confidence [#] | - | - | - | - | -0.043(0.043) |
| Crisis | -10.481(6.129)* | -6.908(5.050) | -19.678(6.891)*** | -12.764(5.940)** | - |
| Post_crisis | -4.558(7.864) | -1.275(6.503) | -17.073(8.475)** | -8.927(7.318) | 3.104(4.161) |
| Trend | 0.082(0.222) | 0.240(0.196) | 0.430(0.241)* | 0.428(0.213)** | 0.332(0.317) |
| Obs. | 155 | 155 | 155 | 155 | 155 |
| Adj. R ² | 0.552 | 0.659 | 0.598 | 0.677 | 0.653 |

Source: Author estimates

* Denotes significance at the 10% level; ** denotes significance at the 5% level; and *** denotes significance at the 1% level.

Bootstrapped standard errors (with 100 replicates) are reported in parentheses.

instruments. As mentioned in the literature (Ahmed & Zlate, 2014; Lim & Mohapatra, 2016; Menon & Ng, 2013; Taguchi et al., 2015), those financial flows usually lead to excessive credit creation, greater risk-taking behavior, boom-bust cycles, exchange rate appreciation, and financial instability. Consequently, as proposed by Rajan (2014), major central banks should internalize those spillover effects in their respective mandates.

Furthermore, international monetary organizations should be reformed so as to reinforce the "rules of the game" and prevent countries from embarking on a kind of competitive devaluation program coined as "quantitative easing". Finally, even though Lim and Mohapatra (2016) argue that the cross-border effects of QE occur along too many transmission channels to be mitigated effectively, policymakers in developing and EMEs should implement domestic prudential programs and introduce some capital control measures in order to mitigate the spillover effects of QE and protect their respective economies.

| Albania | Honduras | Nicaragua |
|--------------|-----------|---------------|
| Algeria | Hungary | Niger |
| Angola | India | Nigeria |
| Antigua | Indonesia | Oman |
| Argentina | Jamaica | Panama |
| Armenia | Jordan | Paraguay |
| Bahamas | Kenya | Peru |
| Bangladesh | Kuwait | Philippines |
| Benin | Kyrgyz | Poland |
| Bolivia | Latvia | Romania |
| Botswana | Lebanon | Russia |
| Brazil | Lesotho | Sao Tome |
| Bulgaria | Lithuania | Senegal |
| Burkina Faso | Macedonia | Sierra Leonne |
| Cameroon | Malawi | South Africa |
| Chile | Malaysia | Sri Lanka |
| China | Maldives | Swaziland |
| Colombia | Mali | Tanzania |
| | | (Continued |

Countries included in the panel.

(Continued).

| Albania | Honduras | Nicaragua |
|--------------------|------------|-----------|
| Comoros | Malta | Thailand |
| Costa Rica | Mauritius | Turkey |
| Croatia | Mexico | Uganda |
| Dominican Republic | Moldova | Ukraine |
| Egypt | Mongolia | Uruguay |
| Georgia | Montenegro | Venezuela |
| Guatemala | Morocco | Vietnam |
| Haiti | Namibia | Zambia |

Disclosure statement

No potential conflict of interest was reported by the authors.

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