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The role of the Fed's and ECB's balance sheet policies

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The views presented in this paper are those of the authors and do not necessarily reflect the views of Narodowy Bank Polski.

Contents

Abstract

This paper provides an empirical investigation of the impact of balance sheet policies undertaken by the Fed and the ECB since the Global Financial Crisis of 2009 on portfolio capital flows to emerging market economies (EMEs). The analysis is based upon a panel dataset covering 31 EMEs from different regions throughout the period of 2009-2019. Our results show that quantitative easing by the Fed has translated into capital inflows into EMEs throughout the world. The Fed's operations have affected both equity and debt flows. However, no such effect could be confirmed in the case of the balance sheet policies launched by ECB, even in the case of economies that remain closely integrated with the eurozone economy such as those from Central and Eastern Europe. These results have relevant policy implications, in particular in light of major central banks expanding their balance sheets in response to the Covid-19 pandemic. Most of all, in those EMEs that remain most vulnerable to capital flows volatility, changes in the Fed's balance sheet policies may warrant domestic macroeconomic policy adjustment in order to mitigate capital flow volatility to these economies.

Keywords: capital flows, emerging market economies, unconventional monetary policy spillovers, quantitative easing, balance sheet policies, longer-term refinancing operations

JEL codes: E52, F32

1. Introduction

The global financial crisis (henceforth referred to as GFC) and its aftermath prompted several central banks in advanced economies, including the Federal Reserve and the European Central Bank, to cut interest rates to effective lower bounds and embark on unconventional monetary policy (hereinafter referred to as UMP). The latter policies included most of all large-scale asset purchases and longer-term refinancing operations that provided financial sector with liquidity[1]. In this paper we will refer to these policies as "balance sheet policies".

Although balance sheet policies have been aimed at supporting domestic economic activity and inflation, they are believed to have affected other jurisdictions through spillovers, including financial ones, i.e. related to capital flows and asset prices movements.

Since the 1990s a number of studies have confirmed that external factors play a vital role in shaping capital flows to emerging market economies (henceforth referred to as EMEs; see for example Calvo et al., 1993; Fernandez-Arias, 1996). In particular, it is well established in the literature that standard monetary policy measures (i.e. changes in central banks' interest rates) undertaken by the major central banks may trigger capital inflows and outflows to EMEs (e.g. Canova 2005, Maćkowiak 2007). While capital flows may be conducive to economic growth in EMEs in the longer term, they also pose risks related to, most of all, potential excessive volatility of exchange rates (and resulting changes in external competitiveness), destabilization of local financial markets, forming up of asset bubbles and loss of autonomy of domestic monetary policy (Magud et al. 2011).

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[1] Both net asset purchases and liquidity providing refinancing operations conducted by a central bank lead to an increase in the bank's balance sheet. Liquidity providing refinancing operations can be in principle regarded as a traditional monetary policy instrument that provides the banking sector with sufficient liquidity to cover its short term liabilities (resulting e.g. from reserve requirement). However, such operations conducted by the ECB since the GFC can be perceived as non-standard due to 1) their longer term nature 2) their large scale 3) their aim as declared by the ECB, which was to preserve favourable borrowing conditions for banks and stimulate bank lending to the real economy.

It this context it is not surprising that the application of a new set of balance sheet policies by the major central banks has spurred discussions among policy makers and academics whether these policies create more volatility in capital flows to EMEs. Indeed, asset purchases by the Federal Reserve in the early 2010s seem to have been accompanied by a palpable inflow of portfolio capital to EMEs. Symmetrically, in the second half of decade, when the Fed's quantitative easing had been terminated and later partially unwound, the inflow eased off somewhat (see Graph A.1 in the appendix). Such an observation cannot be made in the case of the ECB's balance sheet policies (Graph A.2).

Probably the most widely discussed anecdotal evidence on the effects of financial spillovers to EMEs from balance sheet policies conducted by a major central bank was the so-called "taper tantrum" episode in 2013, when the Fed's officials signalled a possible tapering in asset purchases. The "taper talk" fuelled financial turmoil in a number of EMEs, prompting a sell-off of EMEs' financial assets, currency depreciations and an increase in yields on bonds (see for example Eichengreen and Gupta, 2013). Not surprisingly, the spillovers from balance sheet policies became a salient policy issue. Bernanke (2015) remarks that his announcement of expected tapering off of quantitative easing brought complaints from policy makers of emerging market countries, who were worried about the spectre of capital outflows. However, balance sheet policies by the major central banks pose challenges to policy makers in EMEs not only when they are being tightened. Symmetrically, balance sheet policies conducted by major central banks may contribute to excessive inflows of capital to EMEs, currency appreciation and an easing of financial conditions that may lead not only to imbalances building up in the financial sectors but also overheating of real economy in emerging countries.

Therefore capital flows may create intricate dilemmas for policy-makers in EMEs, who might be forced to choose whether fiscal and monetary policy should aim to address real economy considerations or to rein in developments in the financial account and asset prices movements that stem from capital flows. Such a dilemma can be resolved by capital flow management (CFM) control or macroprudential policy measures (IMF, 2012; IMF, 2017; Rey, 2018), however, these often pose challenges in effective implementation.

More than ten years after the Great Recession, balance sheet policies appear to remain a vital policy instrument for central banks in the years to come. In particular, due to calamitous economic consequences of the Covid-19 pandemic, major central banks have increased their balance sheets to an unprecedented scale. However, even before the pandemic economic literature pointed to declining natural interest rates in the world (Holston, Laubach, Williams, 2017; Krugman 2014), which increased the risk of central banks reaching the effective lower bound, underpinning the case for including balance sheet policies into monetary policy toolkit on a permanent basis.

Taking into consideration the likely continuation of balance sheet operations by major central banks and the pertinence of capital flows from the EMEs perspective, the interlinks between both constitute a promising research area. Our aim is to enrich the literature by providing robust empirical evidence on whether and to what extent balance sheet policies implemented by the Fed and the ECB translate into capital inflows to EMEs, based upon a large sample of countries from all over the world. Our sample covers 31 EMEs from different regions throughout the period of 2009-2019. Gross capital flows constitute our main variable of interest in this study. To be clear, we do not analyze if these flows translated into changes in asset prices, exchange rates or lending to non-financial private sector.

To our knowledge, our study is the first to consider the impact of measures undertaken by both central banks at a time. Although a host of literature on determinants of capital flows is available (see e.g. a comprehensive survey of the literature by Koepke, 2019), we seek to re-evaluate their relevance in the post-crisis environment, taking into the account the putative explanatory power of unconventional monetary policies.

Our paper is organized as follows. The first section contains a succinct review of empirical literature on capital flows and theoretical considerations about the spillovers of balance sheet operations. The second one is devoted to the discussion of our methodology and data used in the research. The results, along with robustness checks, are presented in the penultimate chapter. The fourth and last chapter concludes. The article is accompanied with an appendix that includes a detailed description of the dataset, descriptive statistics and figures.

2. Literature review

Before presenting the most relevant conclusions from the literature on the drivers of capital flows to EMEs it is worth clarifying some basic statistical aspects of capital flows analyses. The bulk of research on portfolio flows employs the Balance of Payments (BoP) statistics. The advantage of the BoP data is that they are available for a wide range of countries and share homogenous methodology. However, they are only available at quarterly frequency.[2]

The BoP data divide capital flows into portfolio flows (which can be further divided between equity and debt flows), foreign direct investment flows and other investment, which includes, most of all, banking flows. In this paper our main focus of interest – as already indicated – will be portfolio capital flows.

One can analyze capital flows either in gross or net terms. Gross capital inflows consist of flows by non-residents, whereas net capital inflows are adjusted by the transactions conducted by residents (i.e. their transactions abroad). Similarly to majority of the studies on the topic, in this paper we will analyze gross flows. First, flows by non-residents are more volatile and thus are more important from the financial stability perspective. Second, flows by emerging market residents are very often relatively small as compared with the flows by non-residents (Koepke, 2019).

The literature on the drivers of capital flows to EMEs is abundant. Its conclusions are comprehensively presented by R. Koepke in his literature review article from 2019 (Koepke, 2019). Overall, the literature divides determinants of portfolio capital flows into push and pull factors. Push factors encompass external conditions for EMEs that render capital flows, whereas pull factors are specific to a given emerging economy. The existing evidence on pull and push factors as regards portfolio capital flows is summarized in the table below.

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[2] Some researchers seek to analyze flows at higher frequency and employ alternative data sources (Cerdeiro and Komaroni, 2019; Ciarlone and Collabella, 2016; Sarno et al., 2012).

Table 1: Determinants of portfolio capital flows (debt and equity) to emerging market economies

Push factors	Pull factors
(−) advanced economies asset return	(+) domestic output growth
(+) advanced economies output growth	(+) asset return
(−) global risk aversion	(−) risk indicators (external debt, sovereign ratings, exchange rate volatility, public debt)
	(+) financial openness
	(+) institutional and regulatory framework

Source: Koepke (2019) and authors' survey of literature. (+ denotes positive impact on the capital inflows into emerging market economy, − signifies a negative impact).

As it can be observed in the table, domestic and foreign asset returns constitute a significant driver of capital inflows to EMEs. Accordingly, monetary policy decisions, to the extent they influence financial asset returns, also account for an important determinant of capital flows.

Consistently, in light of standard push-pull framework low policy rates in the developed world in the aftermath of the GFC should have – ceteris paribus – sparked capital inflows to EMEs, especially if the rate differentials have widened (Ahmed and Zlate, 2014). Another research question relates, however, to potential impact of the balance sheet policies applied by the central banks in advanced economies since 2009 on portfolio capital flows to EMEs.

Ciarlone and Collabella (2016) discern three channels through which such operations may impact cross-border capital flows: the portfolio rebalancing channel, the liquidity channel and the signalling channel. First, as regards the portfolio rebalancing channel, asset purchases reduce the amount of securities available to private investors and simultaneously boost their prices while tamping down yields, thus encouraging financial flows to more risky assets (including possibly those issued by EMEs). It deserves mentioning that similarly to outright asset purchases, longer-term

refinancing operations conducted by the ECB may also activate the portfolio rebalancing channel, however indirectly (Goodhart et al 2014)[3].

Second, an expansion of central bank balance sheet in an advanced economy leads to higher liquidity in the financial sector, which may be converted into (foreign or domestic) asset purchases or lending (liquidity channel). Third, balance sheet policies impact asset prices through the so called *signalling* channel. By increasing its balance sheet, the central bank signals that interest rates are likely to stay low for an extended period ahead, thus pushing down yields on longer term bonds in the economy and contributing to capital inflows to EMEs[4]. These three channels may work in both directions (fuelling capital inflows or outflows from EMEs) in line with expanding or shrinking a balance sheet of a central bank in an advanced economy.

While these three channels act in the same directions, i.e. growing balance sheet of a major central bank should be accompanied with higher capital inflows to an EME, in contrast to conventional measures, there might be a time lag between announcement and implementation of balance sheet policies. In theory, while asset prices can react swiftly following the announcement through the *signalling* channel, the *portfolio rebalancing* and *liquidity* channels should be set in motion by actual operations carried out by central banks. Hence, it is expedient to evaluate the impact of the implementation of balance sheet policies separately from their announcement.

Empirical literature about the impact of the balance sheet policies on capital flows to EMEs is relatively scarce. The existing studies corroborate that Fed's quantitative easing has ignited capital inflows into EMEs (Ahmed and Zlate, 2014; Fratzscher et al., 2012, Moore et al., 2013). They suggest that both the announcement and implementation of the balance sheet policies matter for capital flows, albeit the effects

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[3] While through the longer-term refinancing operations the ECB does not directly purchase securities, it contributes to higher market demand for them. There is abundant evidence that the longer-term refinancing operations of the ECB incentivized banks in the euro area to buy government securities and pledge them as collateral at the central bank to obtain refinancing. Due to return on bonds often exceeding the cost of refinancing at the ECB, the bank could gain on such a "carry trade" strategy (see e.g. Crosignani M. et al (2017), Acharya and Steffen (2015)).

[4] Obviously, the signalling channel it not specific to balance sheet policies, as other policy actions and statement by the central bank (in particular also forward guidance on policy rates) is likely to exert an impact on interest rates expectations and asset prices.

of the latter are more pronounced (Fratzscher at al., 2012). Evidence on the impact of the balance sheet policies of the European Central Bank on capital flows to EMEs is less conclusive. While Ciarlone and Collabella (2016) find a positive impact of ECB's asset purchase programmes on capital inflows to the European EMEs, the study by Angelovska-Bezhoska et al. (2018) does not support such a result[5]. The recent study by Bergant et al. (2020) confirms the presence of portfolio rebalancing effects from ECB's Public Sector Purchase Programme, albeit revealing that capital flows were primarily driven towards non-euro area advanced economies debt securities without significant inflow to emerging markets. That seems coherent with the earlier finding of the primordial importance of US monetary policy for global capital flows (Koepke, 2018).

Nonetheless, we believe that the research gap is substantive. First, empirical works concerning the impact of ECB's balance sheet policies rest upon the sample of European countries. Second, none of the existing studies takes into the account the policies by both central banks (i.e. the Fed and the ECB). Third, the existing literature usually employs a narrow set of control variables which makes them vulnerable to the omitted variable bias. The literature clearly lacks a comprehensive study encompassing the emerging markets from all regions with a broad set of controls, examining the impact of balance sheet policies undertaken by both the Federal Reserve and the European Central Bank. In this article we fill in this gap.

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[5] Ciarlone and Collabella (2016) take stock of the impact of securities purchases conducted by the ECB, whilst Angelovska-Bezhoska et al. (2018) employ the total assets held by ECB (which encompass also LTROs and traditional monetary policy operations) in their econometric specification.

3. Data and estimation strategy

As we aim to provide a comprehensive insight into the determinants of portfolio capital flows to EMEs, we have compiled a dataset comprising 31 countries from several regions (Table 2 below).

Table 2: Countries in the sample and regional classification

Central, Eastern and South Eastern Europe	Latin America	Asia	Africa
Armenia*	Argentina	China	South Africa
Bulgaria	Brazil	India	
Croatia	Chile	Indonesia	
Czechia	Colombia	Malaysia	
Estonia	Mexico	Philippines	
Georgia*	Peru	South Korea	
Hungary		Thailand	
Latvia			
Lithuania			
North Macedonia			
Poland			
Romania			
Russia*			
Serbia			
Slovakia			
Slovenia			
Turkey*			

Note: *- country included in the extended (CESEE+) definition of the CESEE region

Data on capital flows are derived from the IMF Balance of Payments database (at quarterly frequency). The choice of the countries included in the sample was primarily driven by data availability. We have disregarded countries where portfolio flows were negligible in size and incidental. Additionally, we have excluded major oil-exporters and low-income countries, where financial markets are less developed. Our country sample coverage corresponds to the earlier selective studies of the topic in question that were conducted for emerging market economies in Europe (Angelovska-Bezhoska et al., 2018) and Latin America and Asia (Ahmed and Zlate, 2014). As we focus on the impact of unconventional policies by major central banks, our sample is

restricted to the period of 2009Q1-2019Q1[6]. Consistently with the literature, we estimate fixed effects models, which seems to be a natural choice for a panel of countries.

The specification of our empirical model is as follows:

$$PI_{i,t} = \alpha_i + \Theta_1 FED_t + \Theta_2 ECB_t + \beta X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where $PI_{i,t}$ refers to gross inflow of portfolio investments to country i in quarter t as a percentage of quarterly GDP in country i. Similarly to other authors (Ahmed and Zlate, 2014) we choose to relate capital inflows to GDP. This approach is justified by the fact that nominal inflows may differ significantly between the countries in the panel set due to the size of the economies. Therefore, interpretation of panel specification with nominal inflows would be problematic due to parameter heterogeneity. We also choose gross inflows, i.e. capital flows by non-residents (rather than net inflows), due to several reasons enumerated earlier in this paper. Most of all, capital flows to EMEs are predominantly affected by non-resident flows, which are also less stable in general and thus of high importance from the financial stability perspective in EMEs. Furthermore, we assume that the monetary policy of the Fed (or the ECB) is likely to affect mostly capital flows of the investors in these jurisdictions, and to a lesser degree potential capital flows of the residents in EMEs.

α_i denotes country-specific fixed effects for country i capturing time-invariant characteristics of the given country. FED_t denotes quarterly net purchases of securities held outright by the US Federal Reserve (that includes, in particular, US Treasury securities and mortgage-backed securities purchased under the Fed's quantitative easing programs since 2009). In turn, the ECB_t denotes a quarterly change in the sum of the balance sheet positions "net acquisition of securities held for monetary policy purposes" and change in "longer-term refinancing operations". These balance sheet items reflect the ECB's operations under the asset purchase programmes (i.a. APP)

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[6] The US Federal Reserve launched its first quantitative easing programme in November 2008. The ECB began to apply its balance sheet policies on a larger scale in December 2011 (with the longer-term refinancing operations), and it fully embarked on its Asset Purchase Programme in March 2015 (beforehand the scale of outright purchases was relatively small).

and longer-term refinancing operations (LTROs). Both variables (FED_t and ECB_t) are calculated in relation to quarterly GDP of the respective economies.

Thus, the structural parameters θ_1 and θ_2 are of our key interest. Positive values of these parameters would indicate that unconventional monetary policy of the respective central bank translates into the inflow of portfolio investments to EMEs. While existing studies find that capital flows respond both to the implementation and to the announcement of unconventional measures (Fraetzcher et al., 2012; Ahmed and Zlate, 2014; Ciarlone and Collabella, 2016), our research falls into the strand of literature examining the impact of the implementation of non-standard monetary policy measures itself.

We assume that purchases of both government and corporate bonds or LTROs may affect capital flows twofold, through portfolio rebalancing channel and liquidity channel (the former channel in the case of LTROs operates indirectly; see: section 2: Literature review). Acquisition of other assets (e.g. Asset Backed Securities) can still induce capital inflows through the liquidity channel. Furthermore, all balance sheet policies may have an additional impact on the domestic longer term interest rates through the signalling channel, and thus may contribute to a change in interest rate spreads between emerging and advanced economies, thus influencing capital flows to EMEs.

$X_{i,t-1}$ is the vector of controls and β denotes the corresponding parameter vector. In our baseline specification the set of controls encapsulates S&P 500 implied volatility (VIX), short-term interest rate differential between a given country and the United States, GDP growth rate, log change of Brent oil price, public debt-to-GDP ratio and realized exchange rate volatility. The choice of control variables mostly rests upon the push-pull framework discussed in previous sections. VIX serves as a proxy of global risk aversion, while the short-term interest rate differential is used to control for conventional monetary policies and the resulting short term spread between the return on investing in the US (the euro area) and in an emerging market economy. While the longer term interest rate spread might also drive capital inflows to EMEs, such spread might be already positively correlated with the changes in balance sheets of the

respective central banks (due to the fact that the changes that reflect asset purchases or refinancing operations by the ECB and the Fed compress yields of longer term bonds in the US and the euro area). Therefore, incorporating both longer-term interest rate spread and net purchases of monetary-policy related assets by the ECB and the Fed might entail collinearity issues in our model and obscure identification of parameters of our interest.

Furthermore, GDP growth captures domestic cyclical conditions in a given emerging economy (trend GDP growth is already captured in the model by the country-specific fixed effects).

Idiosyncratic risk factors are addressed twofold. Realized exchange volatility accounts for exchange rate risk and the public debt-to-GDP ratio proxies for sovereign default risk. We extend our specification by oil price change, in order to tackle possible capital flows from oil exporters to emerging market economies.

In order to handle potential endogeneity bias, all controls in our baseline model are lagged by one quarter, except for the VIX variable and the public debt to GDP ratio (in the latter case we use a figure for the end of a preceding year). Alterations and extensions to our baseline model are discussed in the subsequent section. All estimation results are presented with robust standard errors as proposed by Driscoll and Kraay (1998).

4. Estimation results

4.1. Baseline estimates

Our baseline estimates are presented in Table 3. The main conclusion from these results is that portfolio capital inflows to EMEs are positively related to the quantitative easing conducted by the Fed, however, such positive relation could not be found in the case of the ECB's balance sheet policies. The point estimate suggests that a purchase of securities of 1% of quarterly US GDP by the Fed translates on average into inflow of portfolio capital to an EME amounting to 0.13% of country's quarterly GDP. This size of elasticity appears to be economically meaningful. To put this result in a perspective, throughout the period of 2009-2014, when the quantitative easing programmes were implemented, Federal Reserve's quarterly average net acquisition of securities amounted to 4% of (quarterly) US GDP. Hence, the estimation results imply that during that time, EMEs experienced additional portfolio capital inflows of around 0.5% of their respective GDP on the quarterly basis (while the average quarterly portfolio flows in our sample of the EMEs economies amounted to 2.7% of GDP over the period 2009Q1-2019Q1 in absolute terms).

As regards other estimation results in our model, they by and large support the push-pull framework presented in the earlier sections. First, the negative and statistically significant coefficient estimate on VIX points out that heightened global risk aversion discourages investors from investing their capital in emerging markets. Second global factor that impacts on capital flows to EMEs are oil prices in the global markets. Point estimate indicates that an increase of 10% in Brent oil prices triggers a portfolio inflow to an EME amounting to nearly 0.3% of its (quarterly) GDP. The spillovers from oil markets to capital flows are not well explained in the existing literature, albeit they might be explicated by the procyclical behaviour of oil prices in the global markets (i.e. economic booms are usually accompanied by higher oil prices). In line with the existing literature on capital flows, pull factors also appear to matter for portfolio flows. Capital inflows appear to be procyclical, as indicated by positive and statistically significant estimate the coefficient of the GDP growth variable. In turn, public debt seems to discourage portfolio investment, as an increase of debt-to-GDP

ratio by 1 p.p. sparks an average capital outflow from EMEs amounting to nearly 0.08% of GDP. We do not find any statistically significant relation between capital flows to EMEs and the short-term interest rate differentials (notwithstanding a positive sign of the coefficient on the latter variable) or the exchange rate volatility.

Table 3: Baseline regression

	Portfolio inflows
VIX	-1.237***
	(0.384)
short-term interest rate spread vs US	0.119
	(0.078)
GDP growth	0.087**
	(0.037)
public debt	-0.076***
	(0.023)
exchange rate volatility	5.461
	(7.192)
oil price change	0.029***
	(0.007)
FED	0.130***
	(0.041)
ECB	-0.019
	(0.021)
constant	7.046***
	(1.762)
Observations	1216
Countries	31

Note: Driscoll and Kraay (1998) robust standard errors in parentheses. Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively.

"ECB" represents the sum of net purchases of the monetary-policy related assets by the ECB and change in longer-term refinancing operations (LTROs). "FED" represents net purchases of securities held outright (US Treasury securities and mortgage-backed securities purchased, among others).

4.2. Robustness check and extensions

In order to provide a more in-depth insight into the implications of balance sheet policies implemented by the major central banks we extend our core specification

twofold. First, we divide the sample into regional subsamples. The rationale is that due to different strengths of economic linkages (through trade or the financial sectors), ECB's policies might possibly induce capital inflows only to European EMEs (henceforth the CESEE region), whereas the Fed's actions may matter more for Latin American and Asian countries. As mentioned in the previous section, we have delineated four regions (see Table 2). Nonetheless, for the purpose of econometric analysis we merge Asian and Latin American countries into a joint subsample (called henceforth LAA region) and drop Africa as it includes only one country. As a robustness check, in the case of the CESEE region we present a specification in which the differential of domestic short term interest rate versus the fed funds rate is replaced by differential versus 3-month interbank interest rate in the euro area.

The regional subdivision does not materially change our results (Table 4). Notably, there is no statistically significant relationship between the change in ECB's UMP-related assets (i.e. outright asset purchases and LTRO) and capital inflows to EMEs, even to the European ones. To the contrary, the Fed's assets purchases appear to translate into higher portfolio investments in that region. Such a conclusion holds irrespective of how we define the CESEE region. While these results may appear not fully intuitive due to the strong economic ties between the CESEE region and the euro area, the dominant role that the US dollar plays in the international financial system might constitute a possible explanation why quantitative easing conducted by the Fed appears to be more relevant for capital inflows to the EMEs in the CESEE region.[7] Notably, the Fed balance sheet policies appear to exert even stronger impact on portfolio flows in the CESEE region than on average across the our sample. This can be ascribed to the greater degree of financial openness in these countries.

Inflows into LAA region seem to be impacted by neither of the central banks' QE programmes, however these results need to be interpreted cautiously due to a smaller number of observations in the sample of these countries.

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[7] The US dollar accounts for around 60% of foreign exchange reserves, international debt and international loans, while the euro only for around 20% of these. At the same time, US dollar-denominated international debt issuance in EMEs is several times larger than euro-denominated international debt issuance in EMEs (ECB 2019).

Table 4: Regressions in regional subsamples

	All	CESEE	CESEE	CESEE+	LAA
VIX	-1.269***	-3.034***	-2.889***	-2.147***	-0.484
	(0.429)	(1.019)	(1.017)	(0.616)	(0.714)
short-term interest rate spread vs US	0.120	0.047		0.133	0.108***
	(0.077)	(0.230)		(0.120)	(0.037)
GDP growth	0.075**	0.079	0.056	0.103*	0.090
	(0.037)	(0.083)	(0.087)	(0.056)	(0.062)
public debt	-0.072***	-0.116**	-0.119**	-0.093**	-0.066***
	(0.025)	(0.046)	(0.045)	(0.037)	(0.021)
exchange rate volatility	7.315	60.506	65.413	9.668	4.912
	(7.166)	(41.520)	(40.889)	(15.075)	(4.248)
oil price change	0.028***	0.048***	0.048***	0.037***	0.018
	(0.007)	(0.011)	(0.011)	(0.009)	(0.013)
FED	0.099*	0.170*	0.181**	0.152**	0.058
	(0.051)	(0.088)	(0.088)	(0.067)	(0.076)
ECB	-0.063*	-0.075	-0.078	-0.060	-0.060
	(0.035)	(0.059)	(0.060)	(0.048)	(0.041)
short-term interest rate spread vs EA			-0.048		
			(0.253)		
constant	7.146***	14.493***	14.411***	10.379***	4.781**
	(1.853)	(4.250)	(4.573)	(2.969)	(2.133)
Observations	1216	523	523	677	425
Countries	31	13	13	17	11

Note: Driscoll and Kraay (1998) robust standard errors in parentheses. Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively.
"ECB" represents the sum of net purchases of the monetary-policy related assets by the ECB and change in (targeted) longer-term refinancing operations (LTROs). "FED" represents net purchases of securities held outright (US Treasury securities and mortgage-backed securities purchased, among others).

Additionally, we seek to evaluate whether unconventional monetary policy may alter the composition of portfolio flows, i.e. to what extent it affects debt and equity flows. The results show (Table 5) that the Fed's quantitative easing fuels both types of capital flows, whereas the ECB's has impact on neither. Furthermore, the coefficient of the

Fed's balance sheet variable is twice as large in the case of debt portfolio inflows as in the case of equity ones. This, however, does not necessarily indicate that debt flows are more responsive to the Fed's quantitative easing, but might be also explained by the larger share of debt capital flows in total flows.

As for other variables, debt flows are on balance responsive to all our explanatory variables save exchange rate volatility, whereas equity flows react only to domestic GDP growth, apart from net asset acquisition by the Federal Reserve.

Table 5: Regressions of portfolio inflows by asset type

	Portfolio inflows (equity)	Portfolio inflows (debt)
VIX	-0.030	-1.206***
	(0.146)	(0.340)
short-term interest rate spread vs US	0.005	0.113*
	(0.014)	(0.065)
GDP growth	0.022**	0.065*
	(0.011)	(0.035)
public debt	-0.002	-0.074***
	(0.004)	(0.025)
exchange rate volatility	0.630	4.831
	(1.156)	(6.860)
oil price change	0.003	0.026***
	(0.003)	(0.006)
FED	0.042**	0.089**
	(0.018)	(0.033)
ECB	0.004	-0.023
	(0.006)	(0.016)
constant	0.161	6.885***
	(0.481)	(1.887)
Observations	1215	1216
Countries	31	31

Note: Driscoll and Kraay (1998) robust standard errors in parentheses. Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively.
"ECB" represents the sum of net purchases of the monetary-policy related assets by the ECB and change in (targeted) longer-term refinancing operations (LTROs). "FED" represents net purchases of securities held outright (US Treasury securities and mortgage-backed securities purchased, among others).

Moreover, in order to further probe the robustness of our estimates and provide a more in-depth insight, we have carried out a number of further exercises (Table 6). First, we have re-estimated our model with net change in UMP-related assets of only one central bank at a time. Second, we have included additional explanatory variables (one at a time): the average of World Governance Indicators[8], lagged term of portfolio inflows[9], net asset purchases by Bank of Japan; used US Corporate BBB Option-adjusted spread as an alternative financial stress indicator (instead of VIX); replaced GDP growth by growth differential versus the United States or the weighted average for the G7 countries.

None of these alterations has materially challenged our results. There is no shred of evidence that balance sheet policies by the ECB affect capital inflows to EMEs, while the conclusion about the Fed's influence holds irrespective of the specification, notwithstanding some differences in the quantitative estimate of its impact.[10]

Moreover, while the institutional quality indicators appear not to have any direct effect on capital flows, higher quality of institutions seems to amplify capital inflows to EMEs in response to the Fed's asset purchases (as suggested by the statistically significant parameter estimate by the interaction of the Fed securities purchases and the average of institutional quality indicators). While, like the ECB and the Fed, the Bank of Japan has engaged in a large scale asset purchases over the recent years, the results of our estimations suggest that those measures have not translated into capital inflow to the EMEs in our sample.

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[8] The World Bank Governance Indicators provides measures related to six dimensions of governance: control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law and voice and accountability.

[9] The fixed effects estimator is biased in dynamic panel specifications (Nickell, 1981), albeit the bias diminishes as time dimension increases, thus it is less a concern in our case since our panel is long (T=41 for most countries).

[10] As a robustness check we have also investigated whether only changes in net purchases of the monetary-policy related assets by the ECB or only changes in LTROs conducted by the ECB affect capital flows to EMEs. In order to mitigate the risk that our results were corrupted by "traditional" 1-month and 3-month LTROs stemming from the pre-GFC era, we considered a specification where only changes in ECB's LTROs since 2012 were taken into account. However, we did not obtain any results suggesting that balance sheet policies conducted by the ECB might have exerted positive impact on portfolio capital flows to the analyzed group of EMEs.

In addition, we have thoroughly examined the robustness of our estimates to a potential presence of atypical observations. First, we have re-estimated the baseline specification excluding one country at a time from our sample. The key estimates (coefficients by quarterly changes in UMP-related assets of the Fed and the ECB) are not vulnerable to such an alteration (results available upon request). Hence we may rule out the possibility that our results are driven by any outstanding circumstances in a single country. Further, we have performed the outlier detection procedure for fixed effects models, designed by Veradi and Wagner (2010), but no troublesome observations have been found.

Table 6: Robustness check – regressions with additional explanatory variables

	(1) Baseline	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VIX	-1.237*** (0.384)	-1.252*** (0.417)	-1.050** (0.396)	-1.216*** (0.400)	-1.109** (0.409)	-1.227*** (0.383)	-1.577*** (0.519)		-1.376*** (0.396)	-1.383*** (0.394)
short-term interest rate spread vs US	0.119 (0.078)	0.115 (0.076)	0.134 (0.084)	0.099 (0.077)	0.091 (0.075)	0.117 (0.078)	0.123 (0.079)	0.117 (0.076)	0.113 (0.079)	0.112 (0.079)
GDP growth	0.087** (0.037)	0.091** (0.037)	0.052 (0.043)	0.084** (0.038)	0.093** (0.036)	0.086** (0.037)	0.084** (0.034)	0.080** (0.038)		
public debt	-0.076*** (0.023)	-0.078*** (0.024)	-0.086*** (0.023)	-0.081*** (0.026)	-0.074*** (0.026)	-0.076*** (0.023)	-0.071*** (0.025)	-0.071*** (0.024)	-0.075*** (0.023)	-0.075*** (0.023)
exchange rate volatility	5.461 (7.192)	5.020 (7.140)	6.853 (8.413)	9.288 (6.111)	5.948 (6.601)	5.805 (7.055)	4.656 (7.749)	7.057 (7.990)	4.641 (7.180)	4.526 (7.195)
oil price change	0.029*** (0.007)	0.028*** (0.007)	0.030*** (0.007)	0.031*** (0.007)	0.030*** (0.007)	0.028*** (0.007)	0.025*** (0.009)	0.021** (0.008)	0.029*** (0.007)	0.028*** (0.007)
FED	0.130*** (0.041)	0.145*** (0.035)		0.098** (0.041)	0.075 (0.047)	0.130*** (0.041)	0.128*** (0.041)	0.171*** (0.055)	0.099** (0.042)	0.102** (0.041)
ECB	-0.019 (0.021)		-0.042* (0.021)	-0.027 (0.020)	-0.027 (0.018)	-0.018 (0.021)	-0.020 (0.019)	-0.010 (0.021)	-0.025 (0.022)	-0.024 (0.021)
insitutional quality (WGI)				0.160 (0.199)	0.034 (0.193)					
WGI x FED					0.030** (0.011)					
WGI x ECB					0.001 (0.006)					
portfolio inflows (t-1)						0.009 (0.030)				
BoJ							-0.143 (0.141)			
BBBS								-0.454** (0.176)		
GDP growth differential vs G7									0.078* (0.046)	
GDP growth differential vs US										0.076 (0.046)
constant	7.046*** (1.762)	7.088*** (1.756)	7.316*** (1.551)	7.220*** (1.580)	6.778*** (1.542)	6.992*** (1.766)	8.126*** (1.934)	4.242*** (1.266)	7.646*** (1.776)	7.694*** (1.765)
Observations	1216	1216	1216	1107	1107	1216	1216	1216	1216	1216
Countries	31	31	31	31	31	31	31	31	31	31

Note: Driscoll and Kraay (1998) robust standard errors in parentheses. Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively.

"ECB" represents net purchases of monetary-policy related assets by the ECB plus change in (targeted) longer-term refinancing operations (LTROs). "FED" represents net purchases of securities held outright (US Treasury securities and mortgage-backed securities purchased, among others). "BoJ" represents net purchases of securities by Bank of Japan.

5. Concluding remarks

In this article we analyse a panel dataset of 31 EMEs in the period of 2009-2019 and we show robust evidence that gross capital flows to EMEs are positively related to the quantitative easing conducted by the Federal Reserve, whilst no such effect could be observed in the case of the balance sheet policies applied by the European Central Bank. The Fed's balance sheet policies boost both portfolio and debt inflows to EMEs. Strikingly, inflows to EMEs in Central, Eastern and South Eastern Europe are driven by the Fed's balance sheet policies, with no statistically significant impact from similar operations of the ECB.

These results have relevant policy implications, in particular in light of major central banks expanding their balance sheets in response to the Covid-19 pandemic. Most of all, in those EMEs that remain most vulnerable to capital flows volatility, changes in the Fed's balance sheet policies may warrant domestic macroeconomic policy adjustment in order to mitigate capital flow volatility (and resulting potential macroeconomic instability) to these economies.

Nonetheless, the Fed's policy is not the only factor influencing portfolio capital flows, although the traditional push and pull factors exert their influence mainly on debt flows. In line with previous studies, we corroborate that portfolio debt inflows to EMEs appear to be restrained by global risk aversion. Additionally, we find oil prices to be a significant push factor, driving up debt flows. Both debt and equity flows appear to be fuelled by domestic economic growth, while the level of public indebtedness serves as a restraining factor for debt inflows. The importance of short-term interest rate differentials is limited as we find only tenuous sings of effect on debt flows. Capital flows to EMEs sparked by US quantitative easing seem to be directed to countries with more robust institutional frameworks.

Appendix – graphs and tables

Table A.1: Descriptive statistics (global explanatory variables)

| Variable	Description	Source	Observations	Mean	Std. Dev.	Min	Max
VIX	Log of quarterly average of VIX	St. Louis Fed (FRED)	41	2.86	0.32	2.33	3.81
BBBS	ICE BofAML US Corporate BBB Option-Adjusted Spread (Average spread between BBB-rated corporate bonds and US Treasury notes)	St. Louis Fed (FRED)	41	2.25	1.07	1.28	7.03
FED	Net outright securities purchases by Federal Reserve (% of GDP)	St. Louis Fed (FRED)	41	2.12	3.65	-2.24	12.70
ECB	Net change in value of securities held for monetary policy purposes and longer term refinancing operations, Eurosystem (% of GDP)	ECB (ECB Data Warehouse)	41	2.45	6.47	-10.80	16.18
BoJ	Net outright securities purchases by the Bank of Japan (% of GDP)	Bank of Japan	41	2.04	1.53	-0.58	5.25
OIL	Quarterly log change in price of Brent oil (per Barrel), multiplied by 100	St. Louis Fed (FRED)	41	-1.28	18.11	-73.85	30.08

Table A.2: Descriptive statistics (country-specific variables)

Variable	Description	Source	Observations	Mean	Std. Dev.	Min	Max
gross portfolio inflows (total)	Gross inflow of portfolio investment (% of GDP)	IMF (BOP)	1216	1.39	4.52	-24.53	35.53
gross portfolio inflows (debt securities)	Gross inflow of portfolio investment in form of debt securities (% of GDP)	IMF (BOP)	1216	1.20	4.35	-22.72	35.42
gross portfolio inflows (equity)	Gross inflow of portfolio investment in form of equity (% of GDP)	IMF (BOP)	1216	0.18	0.87	-3.73	7.52
interest rate differential vs US	Short-term interbank interest rate differential versus fed funds rate	Eurostat, OECD, IMF (IFS), BIS, St. Louis Fed (FRED)	1216	4.19	4.18	-2.72	33.91
interest rate differential vs EA	Short-term interbank interest rate differential versus 3-month interbank interest rate in the Euro Area	Eurostat, OECD, IMF (IFS), BIS, ECB (ECB Data Warehouse)	1216	4.07	3.97	-0.89	34.54
GDP growth	Year-on-year real GDP growth rate (seasonally adjusted)	IMF (IFS), St.Louis Fed (FRED)	1216	2.83	4.12	-17.53	18.19
public debt	Gross debt of General Government at the end of preceding year (% of GDP)	IMF (WEO)	1216	40.82	18.23	4.49	85.71
institutional quality (WGI)	Average of World Governance Indicators	World Bank	1107	1.19	3.18	-4.55	7.32
GDP growth differential vs G7	Year-on-year real GDP growth rate differential versus G7	IMF (IFS), St.Louis Fed (FRED), OECD	1216	1.18	3.63	-16.06	16.73
GDP growth differential vs US	Year-on-year real GDP growth rate differential versus the United States	IMF (IFS), St.Louis Fed (FRED), OECD	1216	1.61	3.53	-15.58	17.46
exchange rate volatility	Realized volatility of exchange rate (quarterly mean of squared log-returns on daily exchange rate versus USD multiplied by 100)	Own calculations (based on BIS, Bloomberg and ECB data)	1216	0.01	0.01	0.00	0.16

Table A.3: Gross portfolio inflows to emerging markets (averages by country)

| Country	Observations	Gross portfolio inflows (total;mln USD)	Gross portfolio inflows (debt; mln USD)	Gross portfolio inflows (equity;mln USD)	Gross portoflio inflows (total;% of GDP)	Gross portoflio inflows (debt;% of GDP)	Gross portfolio inflows (equity;% of GDP)
Argentina	34	1676.83	1616.22	60.60	0.33	0.32	0.01
Armenia	35	27.15	26.68	0.47	1.05	1.03	0.02
Brazil	40	5997.65	2722.47	3275.18	1.15	0.52	0.63
Bulgaria	41	73.21	70.53	2.68	0.53	0.51	0.02
Chile	41	2012.63	1488.25	524.38	3.26	2.41	0.85
China	41	16042.44	7851.53	8190.92	0.73	0.36	0.37
Colombia	40	1985.96	1712.14	273.82	2.54	2.19	0.35
Croatia	40	131.48	129.39	2.09	0.92	0.91	0.01
Czechia	40	1261.75	1239.77	21.98	2.41	2.36	0.04
Estonia	40	-13.87	-9.87	-3.99	-0.23	-0.17	-0.07
Georgia	40	48.16	41.39	6.77	1.36	1.17	0.19
Hungary	40	-156.50	-195.48	38.99	-0.47	-0.58	0.12
India	40	3960.75	1161.02	2799.73	0.80	0.23	0.57
Indonesia	39	3687.85	3707.48	-19.63	1.75	1.76	-0.01
Latvia	40	174.93	168.30	6.48	2.46	2.37	0.09
Lithuania	40	216.73	216.90	-0.17	1.99	1.99	0.00
Malaysia	40	1628.02	1262.28	365.74	2.23	1.73	0.50
Mexico	38	9339.89	8494.78	845.11	0.82	0.75	0.07
North Macedonia	41	42.09	44.63	-2.54	1.60	1.69	-0.10
Peru	33	773.98	764.81	9.17	1.79	1.77	0.02
Philippines	40	411.35	312.68	98.67	0.65	0.50	0.16
Poland	40	2388.78	1756.55	632.23	1.90	1.39	0.50
Romania	41	750.79	718.46	32.28	1.59	1.52	0.07
Russia	39	-155.58	1092.78	-1248.37	-0.04	0.27	-0.31
Serbia	40	112.31	113.51	-1.20	1.01	1.02	-0.01
Slovakia	40	752.95	738.73	14.57	3.19	3.13	0.06
Slovenia	40	441.55	400.90	40.65	3.66	3.33	0.34
South Africa	33	3468.02	2014.89	1453.13	1.01	0.59	0.42
South Korea	40	4951.08	2874.81	2076.27	1.48	0.86	0.62
Thailand	40	512.72	845.43	-332.71	0.53	0.87	-0.34
Turkey	40	3636.48	3249.58	386.90	1.77	1.58	0.19

Source: IMF data.

Graph A.1: Gross portfolio inflows to emerging market economies and net asset purchases by the Fed
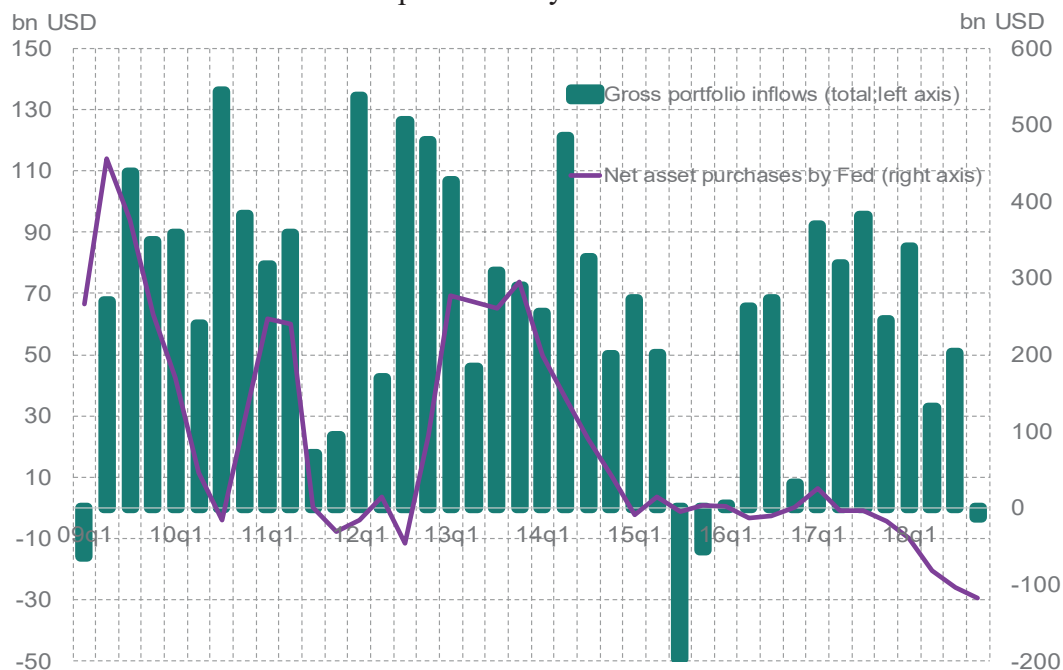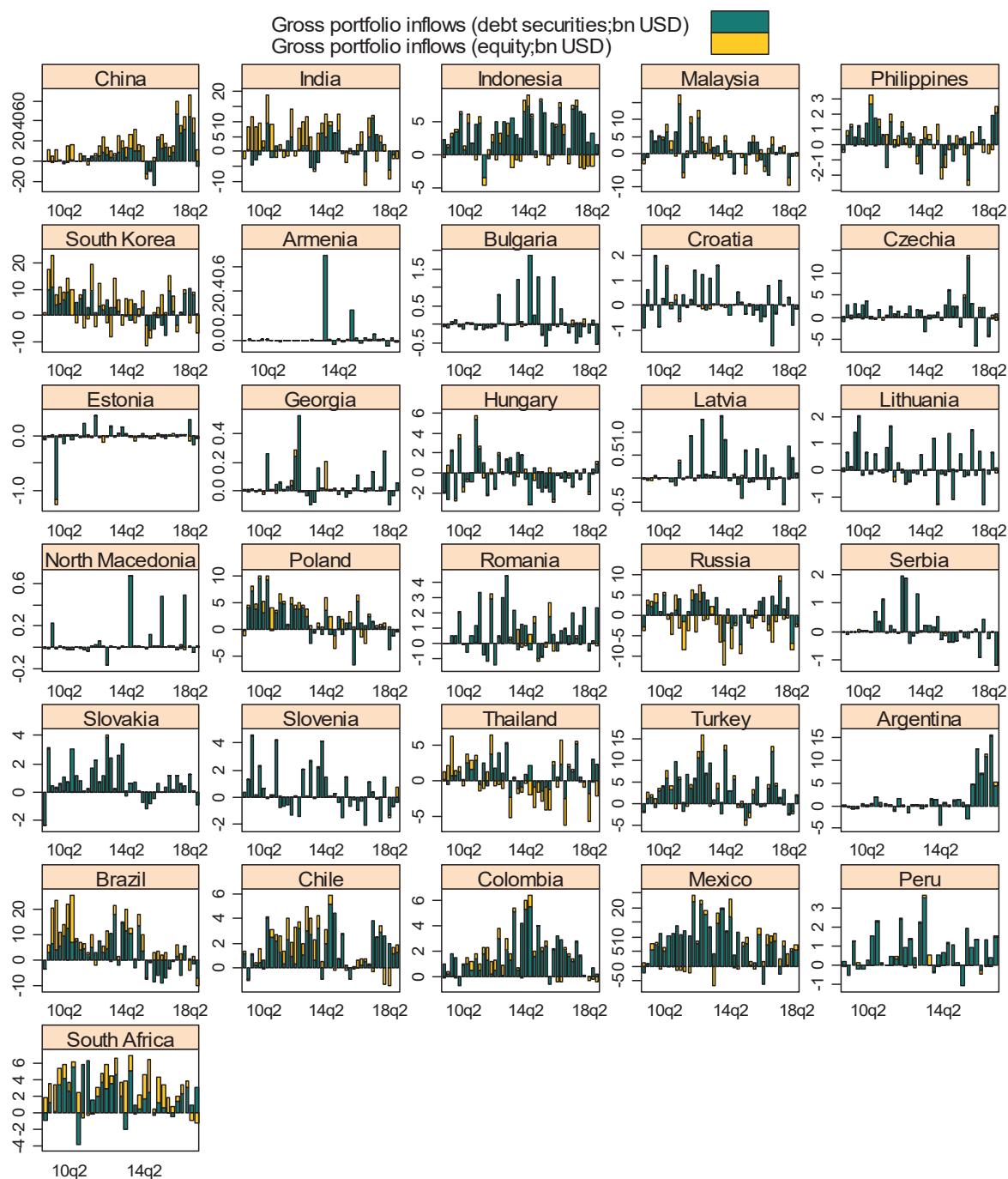

Source: The Fed and IMF data.

Graph A.2: Gross portfolio inflows to emerging market economies and net asset purchases together with change in LTROs by Eurosystem (ECB)
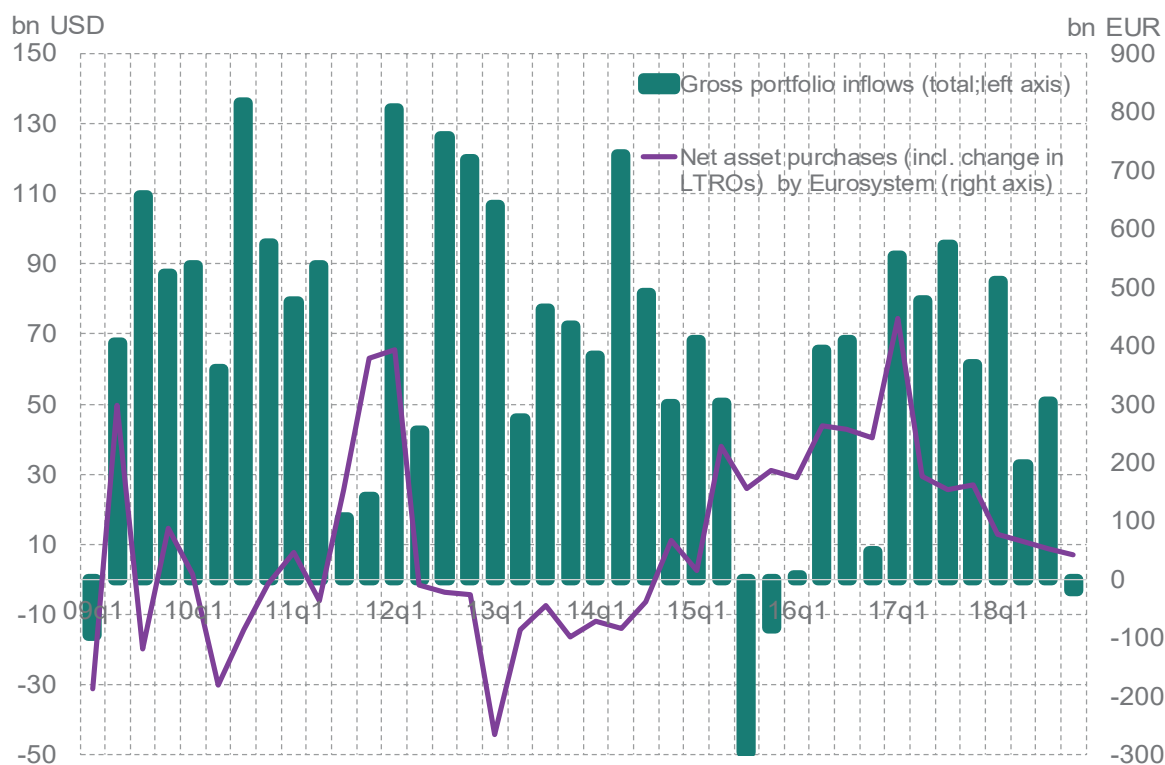
Source: The ECB and IMF data.

Graph A.3: Gross portfolio inflows into emerging markets (by country)

Source: IMF data.

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