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An enduring truth: the Mundell-Fleming trilemma in emerging economies
A study of policy levers to cope with global financial shocks

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Abstract

Is the Mundell-Fleming trilemma still alive in our highly financially integrated world? We investigate with a new prism. First, we consider that monetary policy independence is not only control over interest rates but also over real economy's variables – such as credit. Second, we look at interactions between the three corners of the triangle: what is the best policy mix? What combination of regimes and barriers should countries choose? We find that, in emerging economies, the trilemma still holds to a certain extent. Flexible exchange rate regimes protect economies against foreign influences more than fixed regimes, even when economies with fixed regimes implement capital controls. This appears to be true even for non-pure floats: all intermediate regimes better absorb shocks than pegs. Yet, the trilemma is a trilemma *to a certain extent:* flexible regimes seem to not be fully insulated. Choosing capital controls and a flexible regime appear to be the favorite choice.

Acknowledgments

I am grateful to Sciences Po for the many opportunities it has provided me with to open my mind to adversity. I am particularly thankful for my third year in Lebanon, where I discovered that emerging economies bear more afflictions than developed economies. This has prompted my desire to better understand what levers could be activated to improve the real economy in these countries – and thus to write this master's thesis.

I am grateful towards my supervisor, Philippe Martin, for his pedagogy, availability and constant support throughout the writing of this thesis. I would like to thank him for our discussions and his advices that have provided an invaluable source of guidance in developing my ideas.

Why should I read this research?

The empiric validity of the trilemma is a hot topic in international macroeconomics. This debate seeks policy options for emerging economies as they are increasingly confronted to booms and busts in capital flows.

The flooding of emerging economies by financial flows derives, partly, from monetary policies in advanced economies since 2008-2009. Yet, expansionary policies will continue. The Covid-19 crisis has already led economies with monetary leeway to largely engage in such policies. Moreover, the public debt overhang in developed economies might lead economic authorities to grant room for manoeuver to the fiscal lever. The debate over the right policy mix to handle financial flows in emerging economies stemming from these policies will thus keep the trilemma debate cogent.

Capital flows dynamics, including credit flows, are highly correlated with global factors, among which the U.S. monetary policy stance is a key component. Simply put, it means that some economies absorb monetary policies from other economies. This is thus a sovereign issue: investigating how countries can protect themselves against foreign influences will lead us to better understand how they can determine their financial conditions according to what *they* believe is necessary.

This topic has been investigated by different papers. The trilemma has sometimes morphed into a dilemma, into a 2.5-lemma, or remained a trilemma. We build on this literature to propose a new approach. We seek to test the three corners of the trilemma to find what is the best combination to implement: capital controls or not capital controls? With flexible or fixed exchange rate regimes? Although such an approach has been used before, ours is innovative as it takes the financial recipient of monetary policy – the real economy – as an indicator of policy autonomy. Indeed, as shown by Rey (2014, 2015), important monetary policy channels directly transmit global shocks to domestic economies - through other means than interest rates. Our approach enables us to find concrete policy recommendations for emerging economies.

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Introduction

"The real economy appears to dance to the tune of global financial developments rather than the other way around. If you will excuse a rather extravagant metaphor, the financial tail appears to be wagging the real economy dog. This is not how it is supposed to work". This statement, made by Hyun Song Shin in <u>The State of Economics, the State of the world</u>, recaps the main question of this paper: how can we make things work the way they are supposed to work. In other words, how can we ensure that central banks across the world keep monetary policy independence from international financial dynamics? How can we ensure that central banks have the power to autonomously determine what they believe are the appropriate domestic conditions?

Developed economies, since the Great Financial crisis, have engaged in expansionary monetary policies that have led emerging economies to face higher and more volatile capital inflows. At the same time, the level of financial integration we have reached globally has made economies across the world increasingly open to these flows. Yet, although beneficial to these economies, financial flows can also bring many challenges for macroeconomic and financial governance in emerging economies. Advantageous for an economy when in appropriate volumes, credit flows can lead to a credit boom – an important indicator of financial crises. Equally challenging is the withdrawal of liquidity induced by capital outflows. In addition to these vulnerabilities, the central bank does not control this supply of credit: there is also a question of timing. Credit growth might come in inappropriate times, while this is identically true for liquidity withdrawals.

According to Hélène Rey (2014, 2015), capital flows obey global factors and most importantly the United States' monetary policy. These global factors form what she calls the "Global Financial Cycle (GFC)". According to her studies, the GFC reflects different channels of monetary policy from the base country (the U.S.) to peripheral economies – which are not only the interest rate channel. In emerging economies, these channels, the risk-taking and credit channels, have been enhanced by important credit flows denominated in US dollars.

All in all, what this tells us is that financial integration leads some countries to import monetary conditions from other countries, and this is specifically true with the U.S.' one. Yet, these monetary conditions impact some important aspects of domestic real economies, such as real credit growth, and should thus retain our attention.

How do we protect our economies against this increasing influence of foreign factors on monetary policy? The Mundell-trilemma is providing us clear recommendations to solve the issue: to reach monetary policy independence, countries must adopt either a flexible exchange rate or a fixed exchange rate regime but not without capital controls. Many researchers have focused on the empirical validity of this trilemma, but most of the time by focusing on the interest rate channel. As we saw above, Rey casts light on different channels of monetary policy transmission that affect the real economy directly. She also investigates the Mundell trilemma

by looking at the direct impact of a global financial shock on the real economy. She finds that flexible exchange rate regimes do not protect economies anymore and thus, according to her, countries must implement capital controls. As Rey only looks at advanced economies, Obstfeld, Ostry and Qureshi (2017) investigate the same question but in emerging economies. Their results are different: according to them, the trilemma still hold.

Yet, the role of capital controls to protect the real economy has not been investigated yet: what is the best combination of exchange rate regimes and capital controls a country should implement? This is the central question of this analysis. We also focus on emerging economies as we believe that these countries, as the most affected by credit booms and busts, should be provided with a central place in our analysis. By estimating regressions with interaction terms, our results provide clear policy recommendations.

In our financially integrated world, emerging economies opting for a fixed exchange rate regime must protect themselves through the implementation of capital controls. In addition, economies will always be more protected by a flexible or intermediate regime than by a fixed regime, even with capital controls. Our results also indicate that all other types of regimes than pegs are to be preferred. It seems that the trilemma remains a trade-off. We also respond to our main question, when are economies the most protected? We find that emerging countries under flexible regimes are still vulnerable to foreign shocks: when seeking the higher protection, they must choose a combination of capital controls and flexible exchange rates.

The study is organized as follows: the first section provides the facts and figures necessary to understand the evolutions undergone by the global financial landscape since the Great Financial crisis and their implications for emerging economies. In the second section, we recap the latest developments on the empirical validity of the Mundell-Fleming trilemma. In the third section, we present our data, sources and methodology, prior to explaining our results in the fourth section.

I.   The global financial landscape and its implications for emerging economies

1. *A snapshot of what has changed in capital flows dynamics in emerging economies since the Great Financial crisis*

Since the Great Financial crisis, the debate around whether emerging economies can insulate themselves from global financial shocks has popped up again. Among other factors, the major monetary easing policies taking place in developed economies have led to increasing volumes and volatility in capital fleeing to emerging economies. To gain some perspective on what exactly happened, we will first have a look at what has changed since the Great Financial crisis in terms of volume and volatility of capital flows.

According to Hannan (2018), flows of foreign capital to frontier and emerging economies date back to early twentieth century when England invested in railways and infrastructure in Argentina. In the early 1970s, flows to developing economies rose sharply due to the oil price shock, just before plunging drastically after emerging economies experienced major crises (Latin American debt crisis in 1982, Mexican crisis in 1994, Asian and Russian crisis in 1997-1998). After the Asian crisis, net private capital flows to emerging markets dropped to one third compared to pre-crisis levels. In 2002, a renewed upswing in capital flows appeared in a more robust form. Emerging markets' assets became more attractive as domestic financial systems turned more solid (development of local currency debt markets and stronger domestic financial firms) as well as improved macroeconomic performances. In parallel, capital outflows started to rise as investors from emerging markets started investing in industrial countries' assets. During the following major shock, in 2008, emerging economies appeared to be more resilient than advanced economies (Bussière, Valla, Schimdt, 2016). Capital inflows towards emerging economies recovered quickly after the crisis and increased compared to pre-crisis levels, while capital outflows remained steady. Indeed, this Great Financial crisis has led developed economies to engage in long-lasting expansionary monetary policies and quantitative-easing programmes. This situation encouraged investors to engage in a "search for yields" leading to massive capital inflows in emerging economies. As an illustration, the graph below shows that financial accounts in Turkey and Brazil decreased drastically in the aftermath of the crisis. In other words, foreign ownership of domestic assets increased. However, the proportion decreased again after the crisis, with the notable exception of flows directed to China.
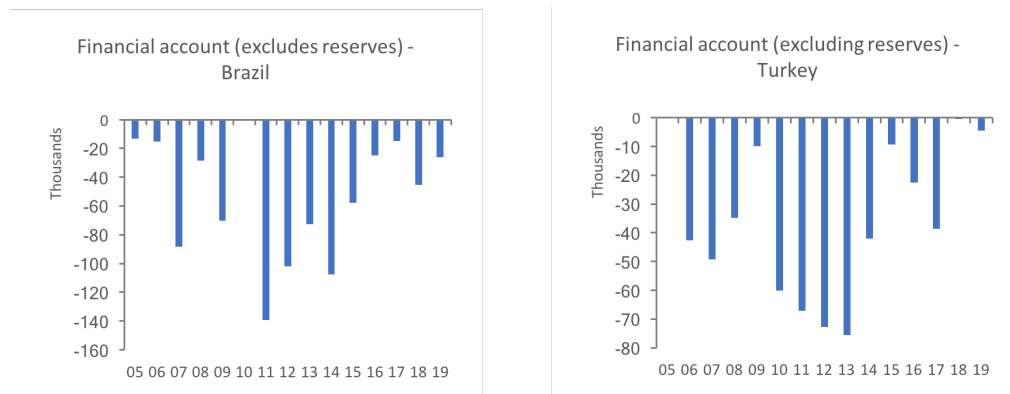
Sources: *International Monetary Fund*

During the post-crisis years, gross capital flows to both emerging economies and advanced economies have shown greater volatility. Significant episodes such as the "taper tantrum" episode in 2013, when the Federal Reserve announced that it would start tapering off bond purchases, particularly affected emerging economies. Indeed, this has led to what is called a "sudden stop": investors drew back their investments from emerging economies to the U.S., where higher yields would be granted with a lower risk compared to the one in emerging economies.

The Covid-19 crisis the world is currently experiencing has also led to unprecedented capital outflows from emerging economies. Indeed, similarly to previous crisis episodes, investors have sought for safe assets, leading to massive capital outflows from emerging economies. According to Haver and Lanau (2020), capital outflows from EMs week on week since the beginning of the Covid-19 crisis have been larger than during the Great Financial crisis and accumulated to double the peak seen during the taper tantrum episode. Indeed, according to the IMF, approximately $83 billion have left these economies during the month of March. Yet, capital outflows were less significant during the first half of April. Within emerging economies, some countries were hit harder than others. In Latin America, Mexico and Colombia suffered from a stronger and sudden stop, due to the collapse of oil prices. More generally, financial markets have discriminated between resilient and more vulnerable emerging economies. This is reflected by the performance of currencies: most currencies stabilized in April, except Brazil (-7%), Turkey (-6%), Mexico (-4%) and South Africa (-6%) (Allianz Research, 2020).

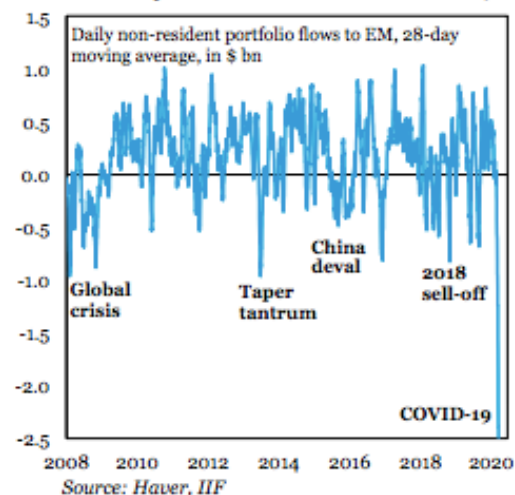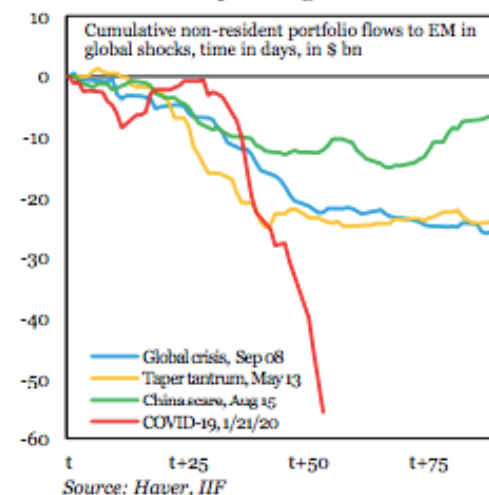**Exhibit 1. Daily trackers show massive outflows, ...**

Daily non-resident portfolio flows to EM, 28-day moving average, in $ bn

Global crisis

Taper tantrum

China deval

2018 sell-off

COVID-19

Source: Haver, IIF

Exhibit 2. ... that surpass the global crisis.

Cumulative non-resident portfolio flows to EM in global shocks, time in days, in $ bn

Global crisis, Sep 08
Taper tantrum, May 13
China scare, Aug 15
COVID-19, 1/21/20

Source: Haver, IIF

2. Opportunities and challenges arising from international capital inflows towards emerging economies

The question of welfare benefits brought by financial integration is an enduring issue in international finance. Why do countries seek capital flows? What are the benefits and potential drawbacks of such flows?

Financial integration: a double-edged sword

Based on the neoclassical growth model, capital flows are determined by capital productivity, with capital leaving richer countries for countries with lower capital stock, thus more profitable investments. According to Gourinchas and Rey (2014), the economies with less capital are characterised by a high autarky rate of interest compared to the world average interest rate: capital-scarce economies would consume and invest at faster pace thanks to foreign capital than if they had remained in autarky. Therefore, this leads to an efficient allocation of savings and investments from surplus to deficit countries. However, Coeurdacier et al (2014) and Gourinchas and Jeanne (2006) find very limited welfare gains. The reasoning behind their findings is that the lack of capital is transitory: the country would have reached its steady-state level of capital regardless of financial openness anyway. According to Coeurdacier et al (2014), an additional negative effect must not be put aside: when the domestic economy financially integrates itself, world interest rates increase, in turn leading to an increased cost for the emerging economy as the economy is now a net debtor.

The theory also explains that capital flows lead to efficiency gains as they are associated with governance structures, management know-how and intensified competition (Kose et al. (2009), Henry (2007)). Besides contribution to growth, additional positive effects include a greater global integration, and thus better absorption capacity when it comes to local shocks. Gourinchas and Jeanne (2013) and Kose et al. (2009) also underscore a signaling effect of

stability-oriented policies and enhanced self-discipline, as the cost of outflows can discourage governments to undertake unsound policies.

However, capital flows can also represent a challenge for economic management. First, inflows can lead to an appreciation of the real exchange rate. When expectations of real appreciation are temporary, it will stimulate the desire to benefit from low prices off foreign capital to foster investments. When domestic capital goods and foreign capital goods are complementary, domestic demand will also increase. Therefore, a capital boom is associated with a domestic boom in investment and consumption (for the same reasons: complementarity between imported and domestic goods in consumption). However, in the case where the exchange rate appreciation is not recognized as temporary, economists consider two possible outcomes. First, it leads to enhanced wealth, and thus to increased consumption and investment, which is a positive outcome. However, it is also agreed that, since the prospects of having competitive tradable goods has been hampered by the exchange rate appreciation, investment in tradable goods' industries will decrease. Thus, as these industries are key, prospects of economic growth will be destabilized.

Another key challenge is related to financial stability and macroeconomic activity. Capital flows will lead to credit growth. The normal characteristic of credit is that it transfers purchasing power from savers to users, facilitating the exchange of goods as well as production processes and enhancing financial services. Therefore, in normal times, credit is beneficial to economic development. However, the development of cross-border transfers can lead to concrete fragilities. It can lead to credit crunch, such as the one observed during the East Asian financial crisis. In many countries of the region, the level of credit to governments and private sector borrowers increased rapidly due to lax controls on banking institutions. At the same time, interest rates were low and banks heavily relied on foreign borrowings for the continuing expansion of credit. Yet, in 1997, when Thailand decided to unpeg the baht from the U.S. dollar, foreign investors withdrew deposits from banks and foreign portfolio investments from capital markets. By withdrawing foreign credit, foreign investors decreased the amount of liquidity available within banking institutions and thus economic agents, often over-borrowed due to the preceding credit boom. The following depreciation of exchange rates and rise in interest rates implemented to defend the currency will lead to increased banking problems. If borrowers or banks have debts denominated in foreign currency, currency depreciation increases the real value of liabilities, leading insolvencies and overall reduction of bank assets. This depreciation leads to what is called the "twin banking and currency crises" (Kaminsky and Reinhart (1999)). In some examples, when governments intervene to acquire bank assets or guarantee bank liabilities, it leads to "the third sibling", the sovereign default crisis. In emerging economies, the question of whether the government will be strong enough to generate resources for debt repayments can generate additional capital outflows.

This example aims at providing the simple mechanism linking cross-border capital flows and credit. When capital flows come to emerging economies, they can fuel credit booms that destabilize inflation, increase imports and possibly create asset bubbles, over-indebtedness and risks of financial crises. Indeed, empiric studies realized by Obstfeld and Gourinchas (2011)

have shown that domestic credit expansion and real currency appreciation are significant predictors of financial crises. Moreover, they find that this is even more true when it comes to emerging economies, our area of interest. Yet, capital outflows are equally challenging: they have both financial and real effects. Financial effects include exchange rate depreciation, decline of reserves and lower equity prices. Then come the real economy effects: GDP growth decelerates, the current account strengthens and investment slows.

Therefore, one of central banks' prerogatives is to monitor credit expansion. "Central banks have the unenviable task of judging at all times what amount of additional bank credit will be in prevailing circumstances be reconcilable with the objective of maintaining overall financial stability", for instance by relying on the observation of early signs of credit expansion - rising inflation or increase in imports (Chris Stalas, seventh governor of the South African Reserve, 1998).

Stability: a key feature to seek in capital flows

As seen with the example of the East-Asian crisis in 1997, when investors feared the consequences of the end of the currency peg in Thailand, they rapidly withdrew their investments: deposits from banks and portfolio investments from capital markets. The intuition is that the composition of capital flows is of great importance: the fastest they can be withdrawn, the more fragility it will bring to the country suffering from the sudden stop.

Capital flows are generally classified into three categories with different characteristics: foreign direct investments (acquisition of new firms for instance); portfolio flows (acquisition of financial assets); and other flows (which can include private transfers, bank loans or loans granted by multilateral institutions).

In the economic literature, foreign direct investments are often associated with low volatility and resilience in times of crises. It is also associated with the notion of economic development as they often imply more than a "pure transfer", meaning that a technology transfer or knowledge is implied. Indeed, FDIs allow the technology transfer that might not have been allowed through trade or financial investments. In addition, when businesses open, recipients of FDIs often benefit from employee training, which contributes to human capital development. Investments in specific sectors have been recognized as particularly beneficial. For instance, this is the case for the manufacturing sector, as it enables a transfer of skills to low-skilled labour force. On the opposite, bank lending and portfolio flows are most often described as "hot money" (Bluedorn *et al.*, 2013). Within portfolio flows, equity is seen as having a more positive influence on growth than short-term debt flows that have proved very volatile.

Empiric studies have confirmed this intuition. Wong and Wei (2011) have studied whether the composition of capital flows between these categories affect the degree of credit crunch during crises. By studying the 2007-2008 crisis, they find that, while the volume of capital flows had no effect, the composition mattered a lot. According to the authors, greater dependence on non-

FDI capital inflows (bank lending and portfolio flows) before the crisis worsened the credit crunch. They conclude that exposure to FDIs alleviate the liquidity constraint.

Besides the importance of the composition of flows, their volatility also impacts economic development. According to the Bank of England (2019), an emerging economy receiving capital inflows will grow 0.3% faster while, ceteris paribus, an emerging economy facing higher volatility will grow 0.7% slower.

Empirics confirm the theory

According to Bussière, Valla, Schmidt (2016), the different categories appeared to be in tune with their reputation since the Great Financial crisis. Globally, foreign direct investments have been resilient (from 25% prior to the crisis to 45% in 2016) whereas other flows have decreased (from 44% prior to the crisis to 12% in 2016). In between, portfolio flows show some heterogeneity: portfolio equity flows have been resisting, while debt flows halved since the crisis. This category represents now 50% of flows compared to 33% prior to 2008.

In emerging economies, net direct investment inflows remained stable after the crisis: in 2008, FDIs represented 40.5% of emerging economies total liabilities while in 2017, they represented 43.6%. Regarding more volatile categories, portfolio flows' share increased, while bank lending decreased. Market-based finance has increased from 23,1% in 2008 to 32,4% in 2018 (Bank of England, 2019). In terms of volatility, these types of flows appear to be flightier than bank loans. In addition, the most volatile subcategory within the market-based finance category, investment funds, is also growing: from 4.6% in 2008 to 9.4% in 2018. This sub-category now accounts for one third of all portfolio flows. As shown in the graph below, this sub-category is the most sensitive to negative shocks within portfolio flows, especially in extreme scenario (indicated by the 5th percentile bar). Therefore, we can see that emerging economies are confronted to capital flows increasingly volatile by nature.

Figure: The sensitivity of Capital Flow-at-risk to push factors, by source of capital flows
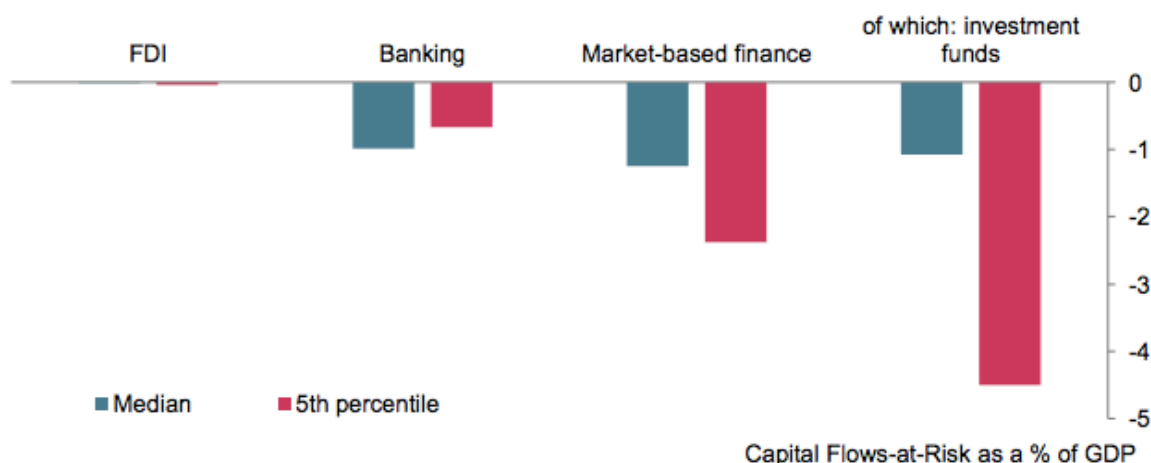
Sources: IMF, EPFR, Bank calculations.
Notes: Chart shows the sensitivity of different capital flows to a negative "push" shock. Coefficients are standardised by each component's share of total flows e.g. the red MBF bar shows how total Capital Flows-at-Risk would respond to a one standard deviation tightening in global financial conditions if all capital flows were accounted for by MBF.

Source: Bank of England (2019)

According to the IMF (2015), bank lending represents about half of all external liabilities of emerging economies. Other sources indicate that it accounts for only 24% of external liabilities in 2017 – against 36.4% in 2008 (Bank of England, 2019). This slowdown in bank lending might be partly due to banks' equity requirements and buffers that have increased compared to pre-crisis. However, although bank lending decreased, it still represents a large share of total domestic bank credit. According to Brauning and Ivashina (2019), with the exception of Asia-Pacific, cross border credit represents 10% to 20% of domestic credit, showing the importance of such flows in domestic economies.

The presentation of the evolution of cross-border financial interconnections shows us several interesting conclusions: (1) emerging economies have been exposed to higher and more volatile capital flows in the last decades; (2) the characteristics of these flows can threaten the autonomy of central banks over important financial variables to the benefit of global factors, (3) a lack of autonomy can lead to significant risks of financial and economic instability.

Therefore, a key question emerges: what tools countries can resort to in order to protect their autonomy on domestic financial conditions? What should countries do in order to remain independent?

II. State of knowledge

The Mundell-Fleming trilemma states a cruel truth: "policy makers cannot have it all". According to this classical concept, countries should choose between capital openness and the associated benefits we saw in the above section; a fixed exchange rate and security against risk of currency fluctuations; and monetary policy autonomy. Although this theory has been recognized in international macro-economics, the recent evolutions of capital flows dynamics in the last decades has revived the debate. Among others, Rey (2014) has stated that the trilemma has morphed into a dilemma. In this section, we will expose latest developments to understand what does the economic literature recommend.

1. The cornerstone of international macroeconomics: the Mundell-Fleming trilemma

The Mundell-Fleming trilemma is a useful concept to address these issues. The basic reasoning behind it is that having at the same time capital openness, fixed exchange rate and central bank autonomy is not compatible.

According to the trilemma, if capital flows are free and the exchange rate is fixed, then the central bank cannot meet its objectives regarding internal stabilization. For instance, if a country has a fixed exchange rate and open financial markets, its interest rate must follow the one of the base country, and thus give up its monetary policy. Conversely, if it does not follow the base country and leaves its capital account open, it breaks the peg. Indeed, an increase of policy rates in the base country not followed by the domestic economy would lead investors to shift their assets to the higher interest rate currency, in turn generating a depreciation of the domestic currency and threatening the peg.

Another interpretation to have in mind is that when capital markets are closed or the exchange rate is not fixed, countries should be able to accomplish their internal policy objectives. Thus, according to the trilemma, if a country needs capital inflow, flexible exchange rate gives the economy some additional flexibility compared to fixed exchange rates.

Perfect capital mobility
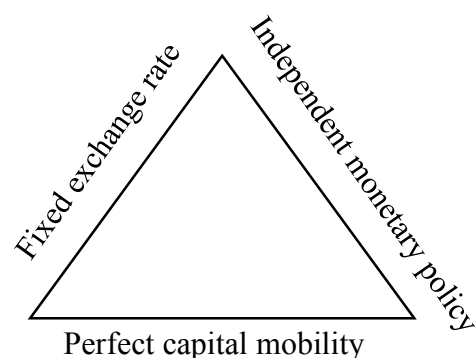
This trilemma seems to provide interesting recommendations to policy makers. Yet, does it empirically exist?

2. Monetary policy transmission mechanisms in a world a globalized finance

Conventional monetary policy transmission mechanisms: interest rates

Since interest rates are the most conventional monetary policy tool, a consequent part of the literature examining the empirical validity of the Mundell-Fleming trilemma has focused on the interest rate channel (or price of credit channel).

More precisely, research has often focused on short-term interest rates. In 2004, Shambaugh, using a sample of developing and industrial countries, used the short-term interest rate as a measure of monetary policy. He assumes that autonomy can be measured by movements in these short-term rates and compares how the latter follow base country interest rates in pegged economies compared to non-pegged economies. Shambaugh finds evidence that pegged countries follow changes in the base country's interest rates, with a significant difference between pegged and non-pegged countries. In another paper, Obstfeld, Shambaugh and Taylor (2005), also use the short-term nominal market interest rates. They justify their choice by stating that monetary policy "has almost always taken the form of interest-rate targeting (…). Even if the interest rate is not the primary instrument of monetary policy, it should be directly affected by monetary policy changes and thus would still serve as a measure of stance of policy".

Long-term interest rates are also part of the interest rate channel. Long-term interest rates are set by market forces, representing investors' anticipation of future policy rates: it represents not only short-term rates but also expected future rates and risk factors. Through forward guidance, monetary policy usually affects longer-term interest rates (mortgage rates or corporate borrowing rates). These long-term interest rates act on key economic sectors and, through asset valuation effects, drive real wealth. Obstfeld (2015) seeks to assess whether international linkages between these rates could hamper monetary autonomy. He concludes that long-term rates are correlated with those of base countries even in countries with fixed exchange rates.

Risk-taking and credit channels

Yet, Rey (2014) has revived the debate by stressing that channels of monetary policy are not limited to interest rates. Two other channels have gained some visibility since the Great Financial Crisis and need to be considered: the "credit channel" and the "risk-taking channel".

The credit channel derives from an asymmetry of information mechanism between creditors and debtors (Bernanke and Gertler (1995)). The mechanism of this agency problem is the

following. Since it is costly for banks to verify the individual quality of investment projects, they often apply to all debtors a supplement to the interest rate to compensate for the average risk of default. This agency cost dissuades companies that have qualitative projects with a low probability of default (and thus that are likely to repay interests on their borrowings). Conversely, risky projects are not discouraged and less reluctant to pay high premiums. Thus, the more banks raise their interest rates, the more they dissuade safe and sound projects. In consequence, this adverse selection issue leads banks to adjust the level of loans more than the level of interest rates when policy rates increase or when access to liquidity is restrained. On the contrary, when interest rates decrease, the volume of loans increases. In an international context, the idea remains the same but the opportunity cost for the borrower is between internal finance and external finance and can be called "the external finance premium". This premium depends on the stance of monetary policy. To understand it, one must take into account the asset price channel, taking place simultaneously. In a context of expansionary monetary policy, a decrease in policy rates leads savers to buy assets already present on the market (as they present a higher rate than the one proposed on new assets). Thus, this leads to an increase in asset prices, particularly equity prices, which in turn increases net worth of borrowers and thus the value of the collateral (Kiyotaki and Moore (1997)). This mitigates the adverse selection phenomenon mentioned above, as lending increases. In the international context, the increase in lending will enable borrowers to switch to external financing. Therefore, we can see the impact of such a channel on the independence of the domestic economy. If the central bank tries to decrease interest rates, borrowers will increase their access to external finance. Empirical evidence of this channel has been found by Miranda-Agrippino and Rey (2012).

The risk-taking channel is also a powerful channel of monetary transmission. Interest rates impact the level of risk of banks' portfolios (Altunbas et al. (2014)). Manddaloni and Peydrò-Alcade (2011) have also shown that a decrease in short-term interest rates leads to a softening of non-financial conditions of credit (margins, collaterals, volumes, etc..), especially for private sector loans. We can explain this phenomenon thanks to the asset price channel. A decrease of policy rates will increase the value of collaterals (the same mechanism than we described above is at stake here). Banks take their lending decisions in order to maintain the overall level of risk in terms of potential losses (value-at-risk) steady: higher asset prices increase banks' debt capacity. Thus, by decreasing banks' risk level for a given debt, a decrease of interest rates drives banks to lend more, which in turn leads to a higher level of credit in the economy.

How do these channels lead domestic economies to import the base country monetary policy? In economies with significant levels of foreign debt denominated in the base country currency, the mechanisms mentioned above take place. Decreasing the base country's rate decreases interest payments due from borrowers, which improves their cash flows. At the same time, a lower discount rate increases the value of assets denominated in the base country's currency and their collateral value. In turn, as we saw above, this leads banks to increase lending. Thus, in place of domestic interest rates, the most crucial interest rate is the base country's one, regardless of what domestic monetary policy is seeking. In addition, a decrease of the base country's interest rates, through the credit channel, leads the domestic economy to choose between output stabilization and balance sheet effect. Indeed, when the base country decreases

its interest rates, the domestic exchange rate depreciates, leading to a stimulation of domestic exports. At the same time, the value of foreign debt rises, putting corporates at risk of default and leading to tightened financial conditions.

Therefore, Rey points out that, in a context where monetary policy of the center country can have implications on balance sheet and financial stability in the rest of the world, looking at countries' autonomy with regards to their interest rates is not enough.

What is important to keep in mind is that while these channels are important for domestic central banks' channeling of their monetary policies, in the international context, they represent a rival that may undermine central banks' objectives. Due to these channels, local monetary policy would not be able to transmit to local financial conditions in economies.

Measuring the credit and risk-taking channels

According to Rey (2014), there is a high degree of co-movement in credit growth, risky asset prices, leverage and financial aggregates – what she calls the Global Financial Cycle. Her results confirm that there is an international credit channel or risk-taking channel, as we mentioned above. In addition, they show that this cycle is highly influenced by U.S. monetary policies. Therefore, the loss of autonomy over financing conditions in the domestic economy would be triggered by this Global Financial Cycle, in turn determined by the U.S. monetary policy.

It is noteworthy that Miranda Agrippino and Rey (2012) and Bruno and Shin (2015b) show that these variables are highly negatively correlated to the Chicago Board Options Exchange's equity option volatility index (VIX), an index of market fear. Lower values of the VIX indicate greater risk-taking and leverage.

The geography of finance for emerging economies

As Rey shows, the credit and risk-taking channels are important in the context where foreign debt, denominated in the base country's currency, is significant in the domestic economy's balance sheet.

In our current global economy, the U.S. dollar remains dominant, although in the last decades both the renminbi and the euro have shown greater influence. Indeed, it is noteworthy that in 2016 approximately 87,6% of change transactions are in U.S. dollars, against only 31,3% in euros and 21,6% in yens.[1] The same year, 43% of international payments were made in dollars,

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[1] Change transactions implying two currencies. Total of percentages is 200%.

for 29,4% in euros. Reserves were at 64% denominated in dollars, with only 19,7% in euros and 4,2% in yen.[2]

According to Obstfeld (2015), credit, which we saw is a critical financial variable to look at, from U.S. banks to non-banks outside the United States has risen from 23% of total U.S. domestic bank credit in 2000 to 35% in 2015. This means that more than a third of US dollars loans made by banks to non-banks at that period took place outside of the United States.

In 2018, the Bank for International settlements estimated that the total stock of U.S. dollar-denominated debt of non-banks outside the United States stood at $11.4 trillion.
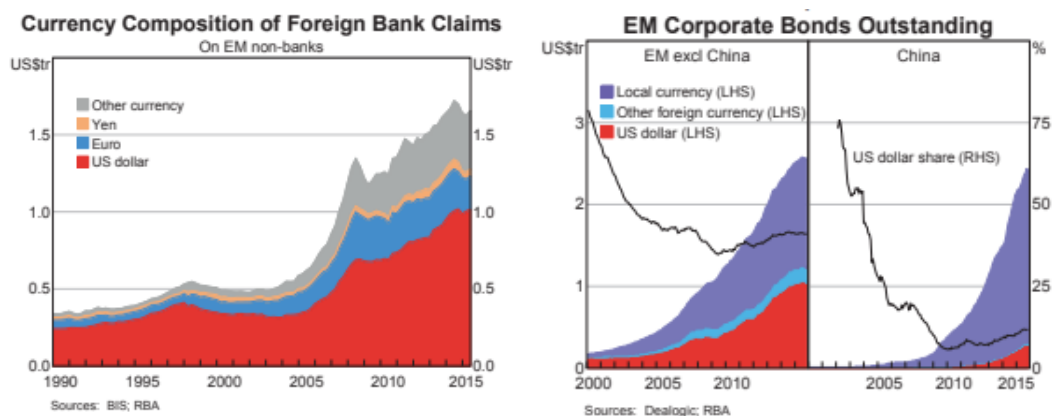
Out of this total, in emerging economies, Kofanova, Walker and Hatzvi (2015) estimate that EM corporations' U.S. dollar denominated external debt was $0.8 trillion in 2014 and that it reached $3.1 trillion in mid 2015 (see graph below).
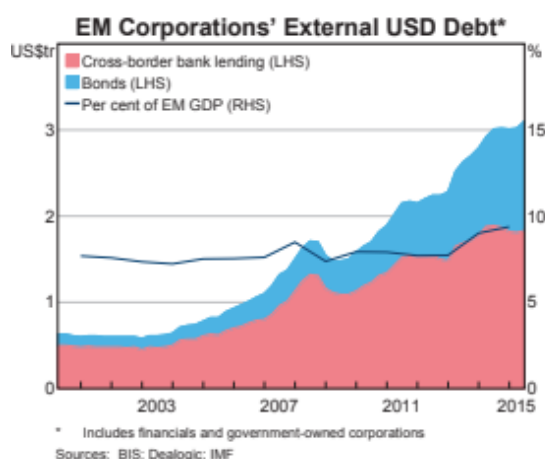
To see the importance of dollar-denominated debt in emerging economies, the following graphs are also insightful. We can see that U.S. dollars denominated foreign banks' claims represent $1 trillion in 2010, against $200 billion for euro-denominated claims in 2015 (concentrated in emerging Europe). According to Brauning and Ivashina (2017), 80% of loans in emerging economies are denominated in dollars. The same authors show that this bank lending has been mainly done by foreign global banks: a third of all external liabilities of emerging economies of emerging markets are held by Japanese, U.S. and European banks.

With regards to corporate bonds: U.S. dollar-denominated corporate bonds comprise one-quarter of all EM bonds outstanding and 90% of EM corporations' foreign currency-denominated bonds.

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[2] Sources for all date mentioned in the paragraph: Bank for International Settlements 2016; BCE 2017 ; FMI, 2016 ; Bénassy-Quéré A., Coeuré B., Jacquet P., Pisany-Ferry J. (2017). *Politique Économique.* (4th edition). Louvain-La-Neuve : De Boeck Supérieur

Currency Composition of Foreign Bank Claims
On EM non-banks

Sources: BIS; RBA

EM Corporate Bonds Outstanding

Sources: Dealogic; RBA

Therefore, it seems that, in emerging economies, the Global Financial Cycle has been intermediated mainly through bank lending denominated in U.S dollars. Brauning and Ivashina (2017) estimate that over a typical U.S. monetary easing cycle, we see a 32% loan volume increase for emerging markets, with a similar effect for a monetary tightening cycle. While Brauning and Ivashina look at the direct correlation between the U.S. policy and emerging economies financial conditions, we have seen that the VIX allows us to look at the global co-movement of financial variables induced by these monetary policies and thus to take into account all channels, and not only the interest rate channel. Interestingly, Baskaya et al (2017) demonstrate that an increase of the VIX enabled important domestic banks in Turkey to lower credit rates: it explained 43% of the observed credit growth in Turkey.

Fear of floating: interacting with the risk-taking and credit channels of monetary policy

According to the literature, the international credit and risk-taking channels can interact with another well-known channel: the "fear of floating". This phenomenon has been described by Calvo and Reinhart (2000). Their study relies on the analysis of financial crises endured by many countries in the last decades. As seen above, one view, relying on the recommendations provided by the trilemma, states that fixed regimes can be blamed for not protecting economies from such shocks and that they should rely on floating regimes. However, they show that although some countries state that they let their currencies float, they in fact do not, even in developed economies. This means that, for instance, when the Fed which, as shown above, has a consequential impact on financial spillovers across economies, loosens its policy rates, domestic central banks might fear that their exchange rate will appreciate due to large capital inflows – wooed by the perspective of higher interest rates. Therefore, instead of letting their currencies float, they will loosen their policy rates. In turn, this will lead to reinforce the international credit and risk-taking channels already operating on the domestic economy and increase risks of credit booms. In this case, as Rey explains, this can once again lead the base country to determine credit conditions in the base economy.

3. What should countries do to protect themselves from these financial spillovers?

By underpinning the room of manoeuver countries have over their own domestic conditions, the Global Financial Cycle, influenced mainly by the U.S. and channeled towards major financial variables, need to be taken care of. Since the Mundell-Fleming trilemma provides us with clear and widely-used policy recommendations, investigating whether it is still empirically observed when taking into account the GFC appears particularly relevant.

Do flexible exchange rates insulate economies from the Global Financial Cycle?

This is what Rey (2014) investigates when looking at the effect of U.S. monetary policy shocks (the one-year U.S. rate and the Federal Funds rate) on asset prices in a range of advanced open economies with flexible exchange rates (Sweden, Canada, New Zealand, UK). She finds out that credit conditions – measured by mortgage spreads – respond to US monetary policy shocks rapidly and by the same magnitude than the U.S. own mortgage spread response. This means that flexible exchange rates do not insulate countries from the Global Financial Cycle more than fixed exchange rates. Therefore, the trilemma would have morphed into a dilemma. Rey adds that these results show that measuring monetary policy's autonomy only through interest rates is tantamount to missing an important channel of transmission. Another implication is that relying on these interest rates to achieve output stabilization and financial stability is not enough: full insulation could only be ensured thanks to macro-prudential tools and capital controls.

Obstfeld, Ostry and Qureshi (2017) further investigate the claim that a flexible exchange rate does not insulate economies more than fixed exchange rate regimes. Yet, since the issue of insulation from external financial shocks is particularly relevant in emerging economies (not analyzed by Rey), the authors run their analysis on 43 emerging economies. They analyze the response of a range of domestic financial variables (credit, price of risky assets - real house prices and real stock returns - and banking system leverage) to global financial conditions, proxied by the VXO (sensibly similar to the VIX). Since financial conditions in emerging economies are associated to cross-border capital flows, they also examine the sensitivity of private capital flows to global financial shocks. Their findings show that fixed exchange rate countries experience higher vulnerability (a rapid domestic credit and house price growth, increase in bank leverage) to global financial shocks. They also find that private capital flows react more to the VXO in fixed than flexible regimes.

However, in their analysis, the authors examine the interaction of the VXO with fixed and flexible exchange rate regimes but do not consider the capital controls' role in the trilemma. Yet, the trilemma has three angles: exchange-rate regime, capital openness and monetary policy autonomy. By looking only at the interaction of regimes and monetary policy autonomy, the authors do not entirely test the trilemma. It is possible that countries with flexible exchange rate

regimes also hold capital controls – which often happen in countries with such exchange rate regimes - thus leading to a bias in the analysis.

Capital controls: state of the art

The prevailing view, prior to the Great Financial crisis, was skeptic towards the use of capital controls. However, since the crisis, part of the literature has started to suggest that they may be implemented under certain conditions and that they could be beneficial under some circumstances (Ostry et al. 2011).

One aspect of the research supports that targeted capital controls, used in a flexible manner, could reduce financial fragility and increase welfare. Although the question of whether capital controls are beneficial has been addressed in the past, Korinek (2011) has recently carried out some research on the welfare economics of prudential capital controls by transposing the closed-economy analysis of macro-prudential policies to international capital flows. His results advocate for a countercyclical Pigouvian tax on debt inflows during the boom to reduce risks of bust. Precise research on what should be the optimal tax has also been done by Bianchi (2011). Jeane (2011, 2012) also advocates for a more debate on whether and in what circumstances the regulation of capital flows might be appropriate. His view is that a good use of capital controls would be to implement them in order to address booms and busts, to prevent the country from running large current account deficits that could jeopardize macroeconomic stability and from overvaluation of the domestic currency. In addition, empirics have confirmed that free capital mobility has little impact on economic development (with the exception of foreign direct investments, as we saw earlier). On the contrary, permissiveness about capital account restrictions also comprise risks. These restrictions might be used to distort real exchange rates to the benefit of trade in the domestic economy and distort trade flows as tariffs and subsidies would have. Jeane is thus in favor of an international agreement that would recognize the benefits and misusages of capital flows.

Another segment of the literature has focused on the relation between capital controls and monetary policy autonomy. Part of the literature has tested whether the trilemma works for the two corners often less studied: capital controls and fixed exchange rates. Farhi and Werning (2012) have tried to answer the following question: "to what degree should countries give up on free capital mobility to regain monetary policy?". Therefore, they study the optimal use of capital controls in an open economy with a fixed exchange rate and thanks to a New Keynesian model. They find that it heavily depends on the nature of the shock, on the stickiness of prices and the openness of the economy (exports/GDP). Their results indicate that optimal capital controls are used for transitory shocks in economies that have a small level of openness. They find that controls, in response to risk premium variations, can mitigate the variations in the domestic nominal interest rate as well as stabilize the real exchange rate. They also explore whether controls can be useful in a flexible exchange rate regime, which are not always perfect. They find that capital controls can also be beneficial as they can lower the risk premium and thus moderate capital inflows and nominal exchange rate appreciation. Even in flexible

exchange rate regimes, capital controls raise welfare. Yet, here again we look at interest rates but not at financial variables important to the real economy and financial stability such as credit.

Capital controls can take different forms. Klein (2012) talk about "walls" and "gates". Indeed, some countries have long-standing capital controls while other use they on an episodic basis. Klein and Shambaugh (2013) have studied what they call the middle-ground policies: partial and temporary capital controls rather than walls and exchange rate policies that allow limited currency fluctuations as opposed to pure free floats. They explore whether such temporary measures can provide countries with monetary policy autonomy in terms of policy rates. They find that, while non-pure floats can provide such autonomy, partial capital controls do not. Only thoroughgoing and long-standing controls seem to be effective according to them.

This literature on capital controls provides us with the knowledge that controls can increase welfare and represent buffers against financial instability. Yet, some argue that capital controls should be temporary and used for temporary shocks, such as credit booms. The use of such controls would provide an interesting buffer against macroeconomic and financial instability. Conversely, the second view argues that only long-standing controls can provide monetary policy independence. Although most beneficial in fixed exchange rate regimes, the literature tends to show that controls can increase welfare in flexible exchange rate regimes too.

However, the trilemma is not fully tested here as we do not learn how combinations of capital controls and nominal exchange rates affect a country's monetary policy independence. What combinations of controls and exchange rate regimes provide the most insolation from external shocks? Thanks to the trilemma and the literature we presented, we know that fixed regimes combined with capital controls provide some autonomy, but to what extent compared to flexible exchange rate regimes alone? In addition, one may ask whether flexible exchange rate regimes provide enough autonomy or whether countries should prefer a combination of a flexible exchange rate regime and capital controls? Indeed, the objective is to understand when a country is independent to be able to determine the best tools for this country to protect itself.

Interaction terms: finding the best combination of capital controls and exchange rate regimes

Han and Wei (2016) examined these combinations of capital controls and exchange rate regimes.

The authors assume that a change of the periphery's monetary policy is determined by four factors: the value of the policy rate a period ago, a change in desired policy rate driven by domestic factors, a change in the interest rate driven by the center country and the global financial cycle factor (approximated by the VIX).

They estimate the country's domestic need thanks to an estimated surprise component of the inflation forecast and of the growth forecast with the Taylor rule specification (stability of the

exchange rate, output and price stabilization). Thanks to their estimations, the authors can control for coincidental co-movements between a U.S. monetary policy and the country's one.

Since they are seeking to find which combination of capital control regimes and exchange rate regimes provides the most monetary policy independence, they look at the following four interaction terms: (a) fixed exchange rate regime without capital controls, (b) fixed exchange rate regime with capital controls, (c) flexible exchange rate regime without capital controls and (d) flexible exchange rate regime with capital controls.

According to the trilemma, the coefficient of (a) = 1 and of (d) and (c) = 0. Indeed, a fixed exchange rate regime without capital controls should provide no monetary policy independence, while a flexible exchange rate regime would. If capital controls are effective, (b) should be equal to 0. If capital controls are only partially effective (but a flexible exchange rate system is not effective on its own), we may observe that (a) > (b) > 0, and (c) > (d) > 0.

Their results are the following: (a) is positive and statistically significant. (b) and (c) are not statistically different from zero, meaning that capital controls allow immunity. (d) is positive and significant, showing that flexible exchange rates do not provide full insulation. Therefore, capital controls appear to provide more protection. The best combination appears to be capital controls with a flexible exchange rate. They conclude that the trilemma is not anymore relevant: they talk about a "2.5-lemma".

Interestingly, they also allow economies with flexible exchange rates to react differently to an increase or a decrease in the U.S. rate. They show that a flexible exchange rate provides policy independence when the center country raises its policy rate but not when it lowers the rate. They explain this phenomenon with the concept of the "fear of appreciation": countries would be willing to follow expansionary policy but not tightening.

However, although the approach seems to provide additional knowledge on the best combination of capital controls and exchange-rate regimes that countries can deploy to protect themselves from a change of monetary policy in the center country, Han and Wei consider independence of monetary policy as independence of short-term and long-term policy rates as well as exchange rate stability under the Taylor rule. Yet, according to Rey (2014), the risk-taking and credit channels of the center country's monetary policy transmission affect the domestic economy through other channels than the interest rate. As mentioned above, credit growth, asset pricing and leverage of intermediaries are important to look at. For instance, Obstfeld, Ostry and Qureshi (2017) look at real domestic credit growth, real house price growth, real stock returns or leverage (change in loan-to-deposit ratio).

Our analysis aims at completing this literature by bringing in a completing approach.

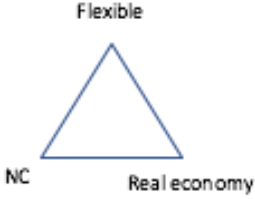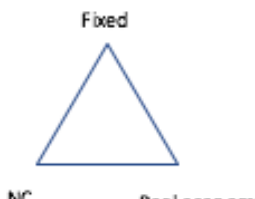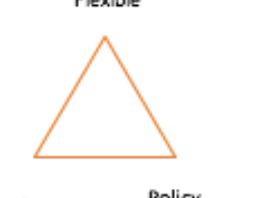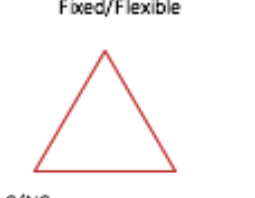## III. Is the Mundell-Fleming trilemma still alive in emerging economies?

This paper contributes to the existing literature in various aspects.

First, while most of the literature on the Mundell-Fleming trilemma focuses on the interest rate channel of the base country's monetary policy to the one of the domestic economy, we build up on the recent findings that other channels can undermine the domestic economy's own objectives. To assess the impact of the risk-taking and credit channels, and more broadly of global financial shocks, we use the VXO instead of an analysis of interest rates.

Second, we also distance ourselves from the interest rates as the unique definition of monetary policy autonomy. Financial spillovers do not only affect monetary policy by preventing domestic central banks from setting the appropriate level of interest rates: the risk-taking and credit channels can directly impact financial conditions such as the level of domestic credit. Moreover, our analysis is even more cogent when considering the fact that the impact of interest rates on such variables is undermined by these channels. Lastly, as shown by Obstfeld in 2014, long-term rates tend to be highly influenced by global factors – while they exert a significant influence on domestic variables. Reunited, these conditions appeal for an evaluation of domestic real financial variables instead of an analysis of control of short-term rates. While Obstfeld, Ostry and Qureshi (2017), who follow the same approach, estimate the impact of the VXO on many financial variables, we only focus on real domestic credit growth. Indeed, as shown earlier, it seems that credit growth is a key variable in terms of prediction of crises and remains a fundamental variable in order to consider the real economy.

Although innovative with regard to the bulk of the literature on the topic, the two preceding points are still close to Obstfeld, Han and Wei, and Rey's approaches. The main innovation of this paper is to look for the best combination of capital controls and exchange rate regimes in the context of the two preceding points. Our key question here is: what should we recommend to policy makers? What is the best combination that would isolate economies from losing control over credit growth? To put it differently, we will look at what combination of capital controls and exchange rate regimes provide economies the most monetary autonomy – proxied by credit growth - against exterior global financial shocks fueled by monetary policy in the U.S. Obstfeld has provided us with an analysis of the impact of the Global Financial Cycle on financial variables, but only tested the empiric existence of the trilemma – and not of the trilemma morphed into a dilemma - and looked at whether a flexible regime still provides more isolation than the fixed regime. Our contribution is that we will include capital controls in the analysis and rebuild the triangle. On the contrary, Han and Wei (2016) tested interaction terms with capital controls and exchange rate regimes but did not include real financial domestic variables such as credit growth, while we believe it is a key objective of monetary policy.

The following table situates our contribution in comparison with the contributions we presented in the literature review section. This table aims at providing a clearer picture of what our analysis aims at.

Author	Mundell Triangle (1)	Protection against GFC*(inferior, superior, equal)	Mundell triangle (2)
Obstfeld, Ostry and Qureshi (2017)	Flexible — NC — Real economy	>	Fixed — NC — Real economy
Rey (2014, 2015)	Flexible — NC — Real economy	=	Fixed — NC — Real economy
Han and Wei (2016)	Flexible — C — Policy rates	>	Fixed — C/NC — Policy rates; Flexible — NC — Policy rates
This analysis	Fixed/Flexible — C/NC — Real economy	?	Fixed/Flexible — C/NC — Real economy

NB: C refers to capital controls, NC refers to no capital controls, GFC refers to the Great Financial Cycle.

1. Data and sources

Following the work of Obstfeld, Ostry and Qureshi (2017) as well as of Han and Wei (2016), we believe that emerging economies are more often confronted to risks of booms and busts than advanced economies. The example of the Covid-19 crisis, which has led to massive capital outflows from emerging economies, reminds us that such a subject is topical in emerging economies. Conversely to Rey (2014), who only looked at advanced economies, we thus explore the situation for emerging economies.

We look at 35 emerging economies in all continents.[3] We look at quarterly data between 1991 and 2013 for all these economies.

For the economic variables, the data on GDP (current prices in local currencies) comes from IHS Data Insight. The real GDP growth is a quarter on quarter percentage change in real GDP, with the variable smoothed by taking three-quarter moving average. The data on private sector credit comes from the IMF's International Financial Statistics database. For the data on the VXO/VIX (Chicago Board Options Exchange market volatility index), we use data from Bloomberg.

For the capital account openness, we use the Quinn and Toyoda index (2008). The index goes from 1 to 100: the higher the more liberalized, the lower the more closed. We rely on the assumption that countries below the median in our sample are considered as closed economies while countries above the median will be considered as open economies. For exchange rate regimes, we use Ghosh et al. (2015) de facto classification (based on the IMF classification). This classification makes the distinction between six different regimes (hard currency pegs, single currency exchange rate, currency basket exchange rate, exchange rate bands, crawling pegs, managed exchange rates and independent exchange rates). In our analysis, we will consider that hard currency pegs and single currency exchange rates will be fixed regimes; exchange rate bands, crawling pegs and managed exchange rates will be intermediate regimes; and independent will be floating regimes. As our objective is to find what type of regime provides the most insolation, we need an important cross-country variation in regimes. This sample provides us with countries with regimes in all categories and thus such variation. Yet, the analysis could be taken further by integrating even more variation thanks to additional countries in the African continent. In this analysis, our initial attempt was to be able to compare our results with the ones of Obstfeld, Ostry and Qureshi (2017) and we have thus opted to reproduce the same sample as much as possible.

2. Methodology

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[3] The sample comprises: South Africa, Morocco, Egypt, Tunisia, Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Mexico, Peru, Uruguay, Venezuela, Sri Lanka, India, Indonesia, Malaysia, Philippines, Thailand, Kazakhstan, Bulgaria, Russian Federation, China, Czech Republic, Slovak Republic, Estonia, Latvia, Hungary, Lithuania, Croatia, Poland, Romania, Turkey.

For this analysis, we draw on the existing literature, particularly Obstfeld, Ostry and Qureshi (2017), Han and Wei (2016) as well as Rey (2015). Since the objective is to obtain results that are comparable to this literature, our first step has been to recreate Obstfeld, Ostry and Qureshi (2017) results. The estimation can be found in Table A. We found results that are consistent with theirs. Therefore, this enables us to have estimations based on the same ground that are appropriate for comparison.

As a reminder, the aim of our analysis is to understand what combination of capital controls and exchange rate regimes would protect emerging economies from foreign influences the most. We present here the most relevant estimations based on two different methodologies.

I.   First methodology.

The rationale of this methodology is to compare the impact of the exchange rate regimes on credit growth, in two settings: with capital controls and no capital controls. We will have four regressions testing the different combinations. Here, the main objective is to be able to directly compare *fixed* and *flexible* regimes.

The results of the following four regressions are reported in Table 1.

(1) Without capital controls:

$$f_{i,t} = \beta_0 + \beta_1\,Fixed_{it} + \beta_2\,Fixed_{it} * VXO + \sum \lambda_k\,z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

(2) With capital controls

$$f_{i,t} = \beta_0 + \beta_1\,Fixed_{it} + \beta_2\,Fixed_{it} * VXO + \sum \lambda_k\,z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

(3) Without capital controls

$$f_{i,t} = \beta_0 + \beta_1\,Flexible_{it} + \beta_2\,Flexible_{it} * VXO + \sum \lambda_k\,z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

(4) With capital controls

$$f_{i,t} = \beta_0 + \beta_1\,Flexible_{it} + \beta_2\,Flexible_{it} * VXO + \sum \lambda_k\,z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

where $f_{i,t}$ is domestic credit growth in country i at time t. *Flexible* and *Fixed* are dummy variables for fixed and flexible exchange rate regimes. The *VXO* is the VXO index (in logs) – which is the index used prior to the VIX and thus reflects the same information - enables us to proxy the Global Financial Cycle and influence from the U.S. (Miranda-Agrippino and Rey, 2015); z refers to a set of control variables. To mitigate endogeneity concerns, control variables are lagged two periods. We use real GDP growth, credit to GDP ratio (a proxy for financial

development), a time trend and a dummy for the global financial crisis as control variables. μ_i captures country fixed effects; η_t captures quarter-year effects to control – for this reason, we are not able to capture an estimation of the effect of the VXO. We opt for quarter-year effects as the opposite decision would have imply the risk of capturing global factors very correlated to the VXO. Yet, we verify by estimating a regression with credit growth as the dependent variable and we find a negative and statistically significant coefficient. ε_{it} captures the random error term.

All samples include non-financial crisis years, following Obstfeld's observation that countries may have switched their exchange rate regimes in response to a domestic financial crisis. We thus use the same identification as Obstfeld, Ostry and Qureshi (2017) which relies on Laeven and Valencia (2013). The sample used for (1) and (3) comprises countries and years with no capital controls – with a level on the Quinn and Toyoda index above the sample's median. The sample for (2) and (3) comprises countries and years with capital controls – thus, with a level on the index below the sample's median. We talk about countries/years because some countries have implemented capital controls for some periods and not for other. As a reminder, the higher the score, the more the capital account is liberalized.

II.   Second methodology

For this section, we rely on the same samples than in the first methodology. Variables are also defined in the first methodology.

In this second methodology, we aim at obtaining information not only on fixed and flexible regimes but also intermediate regimes.

a. Fixed & Intermediate regimes

In this sub-section, we are interested in comparing the effect of intermediate and fixed regimes compared to the reference category, the flexible regime (in our analysis, the flexible regime is a floating exchange rate regime). This will enable us to compare exchange rate regimes. *Intermediate* and *Fixed* are dummy variables for fixed and intermediate exchange rate regimes.

The results of the following specifications can be found in Table 2.

(5) Without capital controls:

$$f_{i,t} = \beta_0 + \beta_1 \, Fixed_{it} + \beta_2 \, Intermediate + \beta_3 \, Fixed_{it} * VXO + \beta_4 \, Intermediate * VXO + \sum \lambda_k \, z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

(6) With capital controls:

$$f_{i,t} = \beta_0 + \beta_1\,Fixed_{it} + \beta_2\,Intermediate + \beta_3\,Fixed_{it}*VXO + \beta_4\,Intermediate$$
$$*VXO + \sum \lambda_k\,z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

b. Intermediate and flexible

In (5) and (6), we test for the effect of intermediate and fixed regimes on credit growth, compared to the effect of a flexible exchange rate regime. In (7) and (8), we flip the analysis: we aspire to test for the effect of intermediate and flexible exchange rates compared to a fixed exchange rate. The use of different approaches will enable to verify the continuity of our results.

The results of the following specifications can be found in Table 3.

(7) Without capital controls:

$$f_{i,t} = \beta_0 + \beta_1\,Intermediate_{it} + \beta_2\,Flexible + \beta_3\,Intermediate_{it}*VXO$$
$$+ \beta_4\,Flexible*VXO + \sum \lambda_k\,z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

(8) With capital controls:

$$f_{i,t} = \beta_0 + \beta_1\,Intermediate_{it} + \beta_2\,Flexible + \beta_3\,Intermediate_{it}*VXO$$
$$+ \beta_4 Flexible*VXO + \sum \lambda_k\,z_{it,k} + \mu_i + \eta_t + \varepsilon_{it}$$

IV. Analysis

1. First methodology

Our first observation is that the coefficients, in both open (9.608***) and closed economies (although not statistically significant, 1.195) are higher for $\beta_1\,Fixed_{it}$ than for $\beta_1\,Flexible_{it}$ (in open -7.908* and closed -13.583). This seems to point out a higher level of credit growth in pegs than in flexible regimes. These results are consistent with Obstfeld, Ostry and Qureshi (2017). According to them and to the economic literature in general, the guarantee provided by a peg can encourage foreign deposits and foreign borrowing by domestic borrowers. In addition, unsterilized foreign exchange intervention to maintain the peg can contribute to this phenomenon.

Our results for the impact of real GDP growth and private sector credit to GDP ratio are also consistent with their other findings. We find a positive and statistically significant 1% coefficient for the lagged real GDP growth, meaning that economic growth fuels credit growth.

We also find a negative and statistically significant 1% coefficient for the lagged private sector credit to GDP ratio. It means that a higher level of financial development implies lower credit growth.

As shown in Table 1, the coefficient of $\beta 2\ Fixed\ it * VXO$ in (1) – ie. an economy / year without capital controls - negative and statistically significant at 5%. A one standard deviation shock to the VXO leads to a decrease of credit growth by 2.75% in a fixed exchange rate regime with capital controls. As a reminder, the VXO enables us to proxy the global financial cycle. Therefore, we can see that in this case the economy is not well protected against foreign shocks.

The same coefficient in (2) - an economy with capital controls - is -0.161. This coefficient is, in absolute terms, smaller than the coefficient of (1) and not statistically significant. Therefore, the comparison of the coefficient of $\beta 2\ Fixed\ it * VXO$ in (1) and (2) leads to the conclusion that capital controls do allow a country's monetary policy in fixed exchange rate regimes to better absorb the Global Financial Cycle.

These findings are coherent with the Mundell-Fleming trilemma. According to the trilemma, an economy cannot have at the same time both a fixed exchange rate regime, no capital controls and monetary autonomy. Our findings confirm that, to have a fixed exchange rate regime and autonomy, an economy must protect itself with capital controls.

Now, if we look at the coefficients for $\beta 2\ Flexible\ it * VXO$ in (3) – an economy with a flexible exchange rate regime and no capital controls - we find a positive and statistically significant 10% coefficient. This coefficient of 1.882** suggests that flexible exchange rate regimes react better to foreign shocks than economies with fixed exchange rate regimes, without (coefficient of -2.65**) but even with capital controls (coefficient of -0.161). To say it differently: even without capital controls, a flexible exchange rate regime is still more favorable than a fixed exchange rate regime. This is coherent with Obstfeld, Ostry and Qureshi (2017), as they state that flexible exchange rate regimes without capital controls provide more protection against foreign shocks than fixed exchange rate regimes without capital controls. Therefore, we can state that we agree with this statement and that, in emerging economies, *the trilemma is still alive.* On the contrary, Rey's suggestion that open economies are not more protected by a flexible exchange rate regime than by a fixed exchange rate regime – *transforming the trilemma in a dilemma* - seems not to hold.

Yet, interestingly, the coefficient for $\beta 2\ Flexible\ it * VXO$ in (4) – an economy with capital controls – is higher than without capital controls (coefficient of 3.511), although not statistically significant. Despite the fact that this interpretation is not robust because it lacks significance, this finding could mean that real credit growth is less negatively impacted in a regime with controls than without, even with flexible exchange rates. Therefore, although the previous regressions provided us with a message coherent with Mundell and Fleming - stating that economies are more protected by flexible exchange rate regimes – the regression (4) states a slightly different message. Indeed, it suggests that economies, even in flexible exchange rate regimes, are most protected when using capital controls. Therefore, this is coherent with both

Han and Wei (2016), as they seem to obtain the same results when looking at monetary autonomy through the prism of interest rates: "A combination of capital controls and a flexible exchange rate (..) may provide the most autonomy."

Until now, our main findings from the first methodology are the following:
1. *The trilemma is still alive:* an economy with a fixed exchange rate regime without capital controls has less autonomy than an economy with capital controls
2. *Flexible regimes should still be preferred to fixed regimes:* a flexible exchange rate regime still protects economies more than a fixed exchange rate, even with capital controls
3. *Capital controls and a flexible regime, a top choice:* although our results are not robust, and one should read this interpretation with a pinch of salt, it seems that the most protection comes from a combination of flexible exchange rate regimes and capital controls

2. Second methodology

a. Fixed & Intermediate regimes

This section intends to provide knowledge on the level of protection granted by fixed and intermediate regimes, relatively to flexible regimes.

First, we focus on the estimation (5) – economies / years without capital controls. The results for this analysis can be found in Table 2. The coefficient $\beta 3$ $Fixed$ $it * VXO$ is negative and statistically significant at 5% (-3.172**). This coefficient enables us to conclude that, in open economies, credit growth in a fixed exchange rate regime is more affected by the GFC than in a flexible exchange rate regime country. Once again, this is coherent with Mundell and Obstfeld, Ostry and Qureshi (2017): in open economies, one must prefer flexible exchange rates to fixed exchange rates. The coefficient of $\beta 4$ $Intermediate$ $* VXO$ is harder to interpret as it is not statistically significant – we are unable to conclude for the protection granted by intermediate regimes in this section.

In (6), economies that implement capital controls, the coefficient for $\beta 3$ $Fixed$ $it * VXO$ and $\beta 4$ $Intermediate$ $* VXO$ are also negative and high (in absolute terms) but not statistically significant. Therefore, in this section, we are unable to conclude on the impact of capital controls.

In a nutshell, we can again conclude that the trilemma is alive: when an economy seeks monetary autonomy and open capital accounts, it should prefer flexible to fixed exchange rate regimes.

b. Intermediate and flexible regimes

In this last section, as explained in the methodology, we try to flip the analysis to see if more information can be released. Thus, we look at the level of protection granted by intermediate and flexible exchange rate regimes compared to fixed regimes.

In an open economy (7), $\beta 3\ Intermediate_{it} * VXO$ is positive and statistically significant at 5% (coefficient of 2.505**); $\beta 4 Flexible * VXO$ is also positive and statistically significant at 10%. (3.304**). A few observations can be made here. First, $\beta 4 Flexible * VXO$ is slightly more positive than $\beta 3\ Intermediate_{it} * VXO$, leading us to think that in an open economy, a flexible regime provides more insolation than an intermediate regime. Second, intermediate and flexible enable economies to better react than in a fixed exchange rate regime. The intermediate regime includes exchange rate bands, crawling pegs and managed exchange rates, while flexible includes independent regimes and fixed pegged regimes. Therefore, we can conclude that there is only a significant difference between fixed and all the rest. This is interesting as it shows that even *middle-ground* policies (Klein and Shambaugh, 2013) in terms of exchange rates will provide more protection than a fixed regime. This is consistent with Klein and Shambaugh's findings that even non-pure floats provide monetary autonomy (in terms of policy rates).

Regarding capital controls, the coefficients for both interaction terms $\beta 3\ Intermediate_{it} * VXO$ and $\beta 4 Flexible * VXO$ in economies with capital controls are not statistically significant. Once again, here, we cannot conclude on the role of capital controls.

From the second methodology, our key take-away is that:
1. *Even if exchange rate regimes are not pure floats, they are still favorable to pegs*

V. Conclusion

Although we must remain prudent and consider further analysis on this subject, we can draw interesting conclusions from our analysis.

Once again, the objective of this paper is to look at the real economy. While most of the literature has focused on interest rates autonomy with regards to the base country, we build on Rey's findings that monetary policy can be transmitted through other channels than policy rates. Therefore, we look at the final recipient of monetary policy: the real economy, from which we believe real credit growth is a key representative. Therefore, although some of our results seem to confirm other findings on interest rates' independence, we bring a different perspective by focusing on credit growth.

We find results in tune with the Mundell-Fleming theory: when exposed to foreign financial influences, emerging economies with a fixed exchange rate regime must protect themselves with capital controls. Otherwise, their domestic credit growth will be likely to sharply decrease when experiencing a financial shock. However, emerging economies will always be more protected by a flexible or intermediate regime than by a fixed regime – even with barriers on

capital flows. This confirms that the trilemma has not morphed into a dilemma: flexible exchange rate regimes still provide more protection than fixed regimes. We could go even further: all other types of regimes than pegs are to be preferred. Lastly, as agreed with Rey and Wei and Han, emerging countries under flexible regimes are still vulnerable to foreign shocks: when seeking the most protection, they must build a combination of capital controls and flexible exchange rates.

Our analysis could have been taken further with regards to several aspects. First, although credit growth is a key aspect of the real economy, it could be interesting to expand our analysis to other interesting variables, such as real house prices or other risky assets. Indeed, this could have given us a broader picture of the consistency of our results. In addition, to expand the variation of exchange rate regimes in our sample, it would be interesting to include more emerging economies – especially in the African continent – but also to compare with advanced economies. Results have been found by Rey on the role of exchange rate regimes in advanced economies but not on the role of capital controls. Therefore, with a greater access to data sources, one should consider looking at these aspects.

VI.   Appendix
Table 1. First methodology

	(1)	(2)	(3)	(4)
	Open	Closed	Open	Closed
	Real credit growth (1991-2013)	Real credit growth (1991-2013)	Real credit growth (1991-2013)	Real credit growth (1991-2013)
Fixed regime	9.608***	1.195		
	(3.452)	(6.387)		
Fixed regime x VXO	-2.750**	-0.161		
	(1.096)	(2.122)		
Flexible regime			-7.908*	-13.583
			(4.016)	(11.834)
Flexible regime x VXO			1.882*	3.511
			(0.977)	(3.395)
Lagged real GDP	0.329***	0.553**	0.305***	0.521**
	(0.077)	(0.238)	(0.086)	(0.203)
Lagged private sector credit (%GDP)	-0.083***	-0.142***	-0.077***	-0.147***
	(0.018)	(0.035)	(0.017)	(0.037)
Linear trend	-0.392	0.495	-0.328	0.531
	(0.495)	(0.584)	(0.501)	(0.590)
Global financial crisis	-7.195	8.692	-7.519	8.894
	(8.603)	(10.053)	(8.506)	(9.983)
Constant	56.234	-59.172	48.552	-62.869
	(66.907)	(78.294)	(67.561)	(78.900)
Observations	1,333	1,008	1,333	1,008
R-squared	0.331	0.260	0.329	0.266
Adjusted R2	0.265	0.164	0.263	0.172
No. of countries	27	23	27	23
Country fixed effects	Yes	Yes	Yes	Yes
Quarter-year effects	Yes	Yes	Yes	Yes
Robust standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Table 2. Second methodology – Fixed & Intermediate exchange rate regimes

	(5)	(6)
	Open	Closed
	Real credit growth (1991-2013)	**Real credit growth (1991-2013)**
Fixed regime	13.089**	13.967
	(5.058)	(12.125)
Intermediate regime	4.214	13.405
	(3.386)	(12.046)
Fixed regime x VXO	-3.172**	-3.507
	(1.239)	(3.677)
Intermediate regime x VXO	-0.729	-3.470
	(0.844)	(3.448)
Lagged real GDP	0.301***	0.521**
	(0.084)	(0.206)
Lagged private sector credit (%GDP)	-0.088***	-0.148***
	(0.019)	(0.036)
Linear trend	-0.504	0.336
	(0.458)	(0.608)
Global financial crisis	-8.390	9.351
	(7.984)	(10.088)
Constant	69.630	-40.749
	(62.360)	(80.727)
Observations	1,377	1,008
R-squared	0.331	0.266
Adjusted R2	0.266	0.170
No. of countries	28	23
Country fixed effects	Yes	Yes
Quarter-year effects	Yes	Yes
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 3. Second methodology – Intermediate & flexible exchange rate regimes

	(7)	(8)
	Open	Closed
	Real credit growth (1991-2013)	**Real credit growth (1991-2013)**
Intermediate regime	-8.777**	-0.562
	(3.219)	(6.468)
Flexible regime	-13.308**	-13.967
	(5.261)	(12.125)
Intermediate regime x VXO	2.505**	0.037
	(1.073)	(2.166)
Flexible regime x VXO	3.304**	3.507
	(1.333)	(3.677)
Lagged real GDP	0.302***	0.521**
	(0.084)	(0.206)
Lagged private sector credit (%GDP)	-0.081***	-0.148***
	(0.018)	(0.036)
Linear trend	-0.235	0.535
	(0.515)	(0.606)
Global financial crisis	-7.555	8.797
	(8.525)	(10.053)
Constant	37.484	-62.896
	(69.264)	(81.469)
Observations	1,333	1,008
R-squared	0.337	0.266
Adjusted R2	0.271	0.170
No. of countries	27	23
Country fixed effects	Yes	Yes
Quarter-year effects	Yes	Yes
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 4. Replication of Table 1, Obstfeld, Ostry and Qureshi (2017), P.30

	Real credit growth in EMEs				
	(2)	(3)	(4)	(5)	(7)
Fixed regime	12.051***	12.819***	12.461***	12.674***	12.186**
	(3.725)	(3.693)	(3.848)	(4.266)	(4.904)
Intermediate regime	0.989	2.158	2.414	4.278*	3.647
	(2.448)	(2.446)	(2.490)	(2.376)	(2.729)
Log VXO	-0.428				
	(0.836)				
Fixed x Log	-2.960**	-3.287***	-3.207***	-3.547***	-4.386***
	(1.178)	(1.138)	(1.162)	(1.268)	(1.446)
Intermediate x Log	0.226	-0.159	-0.250	-1.036	-1.150
	(0.779)	(0.769)	(0.790)	(0.679)	(0.725)
Lagged real GDP growth	0.431***	0.399***	0.401***	0.266***	0.465***
	(0.078)	(0.092)	(0.091)	(0.081)	(0.078)
Lagged private credit (%GDP)	0.103***	-0.105***	-0.112***	-0.138***	-0.112***
	(0.013)	(0.012)	(0.014)	(0.018)	(0.017)
Lagged capital account oppeness	0.059***	0.053**	0.054***	0.010	0.025
	(0.020)	(0.020)	(0.019)	(0.015)	(0.028)
Fixed x real US T-bill rate			-0.412*		
			(0.219)		
Intermediate x real US T-bill rate			0.013		
			(0.124)		
Lagged Net capital flows					0.029*
					(0.017)
Lagged central bank policy rate					-0.170
					(0.145)
Trend	0.005				
	(0.013)				
Global financial crisis	1.197				
	(0.890)				
Constant	-1.217	-1.487	-1.319	4.712*	3.395
	(4.083)	(2.284)	(2.199)	(2.568)	(3.646)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Quarter-years effects	No	Yes	Yes	Yes	Yes
Observations	2,080	2,080	2,080	1,523	1,402
R-squared	0.205	0.252	0.257	0.351	0.348
Adjusted R2	0.188	0.202	0.206	0.308	0.287
No. of countries	35	35	35	34	30

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