ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics
Master Thesis [programme International Economics]

The International Credit Channel of Monetary Policy Interest Rates and QE: Supply of Credit in Brazil

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Abstract:

I identify the international credit channel of monetary policy and demonstrate how foreign monetary policy moves across borders affecting the credit supply in emerging markets using Brazilian supervisory bank-level data and headquarter country information. Brazil, as an emerging market with a high presence of global financial institutions, is subject to spillover effects of core country central bank's traditional (interest rate changes) and non-traditional (QE programs) monetary policies. Global financial institutions headquartered in core countries respond to core country monetary policies by changing their Brazilian supply of credit, perhaps because of reach-for-yield effects and flight home effects. It is unclear whether the time to maturity makes any difference on how sensitive loans are to monetary policy changes. Generally, the supply of credit in Brazil is more responsive to economic conditions and central bank monetary policies in core countries than domestically.

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Section I: Introduction

There is a growing understanding of the consequences of the degree of banking globalization and the financial interconnectedness. The 2007-2009 financial crisis brought the issue to the forefront and has led to a better insight on the channel for transmissions of financial shocks, particularly with large banks increasingly entering emerging markets (Moghadam and Viñals, 2010; Mihaljek, 2007; Lane and McQuade, 20013). Cetorelli and Goldberg (2010) provide evidence on the potential transmission channels, namely, portfolio rebalancing, foreign direct investment (FDI), and lending. When looking at lending, banks that suffer a shock to their liquidity tend to reduce their lending abroad and financing to foreign affiliates (Ongena et al., 2013; Buch and Goldberg, 2014). Concurrently, in response to the unprecedented scope of the financial crisis, monetary policy became a focal point for economic stimulus and financial stability. US Quantitative Easing, as a novel nontraditional monetary policy, and interest rate changes have an international spillover effect (Fratzscher 2018, Morais et al. 2019). Stanley Fischer (2014), of the Federal Reserve, warns of new challenges with the rising of potential international spillovers of domestic monetary policy; European monetary policy may have far-reaching effects in the globalized nature of European banks. Raghuram Rajan (2014) of the Reserve Bank of India shares a similar concern from the perspective of an emerging market. Clearly, with the reliance on monetary policy and with growing global financial cycle interconnectedness, the channel of how domestic monetary policy shocks manifest in foreign financial systems is crucial in understanding the consequences of monetary policy spillovers and for domestic policymakers to take this into account in their mandate.

In this paper, I aim to examine the international credit channel of monetary policy and examine whether foreign monetary policy moves across borders affecting the credit supply in emerging markets. Specifically, I study how, in Brazil, credit provided by financial institutions with headquarters in the US, the UK and the Eurozone are affected by the conventional and unconventional monetary policy conducted by the central banks in the aforementioned countries. Even though in 2012 President Dilma expressed concerns regarding expansionary monetary policies in advanced economies causing "monetary tsunami", there is little, at best disputed, evidence on whether this is the case (Dyer and Leah, 2012). This paper aims to fill this gap in the literature.

I contribute to the literature on the international credit channel and spillover effect of interest rates and QE programs on the Brazilian supply of credit: the effect of monetary policy actions by foreign core country central banks on the loan volume of the Brazilian supply of credit, whether the monetary policy effect on the Brazilian supply of credit depends on the type of monetary policy used (traditional and nontraditional), and whether foreign and local financial institutions respond differently based on the maturity of the credit in response to monetary policy actions.[1]

On the back of the 2007-2009 financial crisis there was a new realization of the extent of interconnectedness of the global finance cycles. The world is more financially integrated than it has ever been, broadly speaking (Moghadam and Viñals, 2010). As an indication, advanced economies' cross-border investment positions were at 438% of GDP in 2007 from

[1] The US, the UK, and the Eurozone make up the core country group.

68% of GDP in 1980, while emerging market economies' cross-border investment positions were at 73% of GDP in 2007 from 35% of GDP in 1980 (Lane and McQuade, 2013). Cross-border investment positions have grown and have grown with a larger margin for advanced economies than emerging markets. The consequences are potentially beneficial but could also be detrimental. It lies deeply ingrained in the argument for or against globalization. While globalization has brought accelerated development and ubiquitous wealth growth, it has also propagated instability and complicated economic policymaking. The growth of countries' external portfolios makes exchange rates and asset prices of these countries more receptive to foreign shocks and causes the reallocation of wealth (Lane and Milesi-Ferretti, 2006). Capital inflows and outflows move to the beat-of-the-drum of the global financial cycles. Importantly, the global financial cycle moves to the beat-of-the-drum of monetary conditions of the core countries: the US, the UK and the Eurozone. The capital flows and the financial sector leverage, changes in risk aversion and uncertainty, in foreign countries are interrelated to the monetary conditions of the US (Bekaert et al. 2012, and Bruno and Shin (2013). An argument is made that paints the high-level of interconnectedness in brighter light; namely, the argument of risk-sharing acting as a stabilizing force when shocks occur. Financial globalization is crucial in spurring emerging markets to the income levels and stability of more advanced economies (Fischer, 1998 and Summers, 2000). However, the literature on this is inconclusive, perhaps even to the contrary (Eichengreen, 2001; Kose et al., 2009; Obstfeld, 2009). It may be the case that international banks actually amplify financial shocks (Giannetti and Laeven (2012). We often look to the international credit channel to explore how monetary conditions in core countries affect the decision-making of global financial institutions, in terms of capital flows.

Hau and Lai (2017) show that equity funds will propel financial shocks into foreign countries and into non-financial shocks. A shock or the fear of financial distress, for instance, can happen in any part of the business or location of a globalized financial institution and quickly spread across the business or borders. Global banks transmitted the financial crisis of 2007-2009 to emerging markets by contracting their cross-border lending, their local lending via local affiliates, and their domestic credit supply because of negative shock to their cross-border lending balance sheet (Cetorelli and Goldberg, 2010). It would seem reasonable that equity prices should be based on the region, country, sector, and company specific factors, however, a large part of the variance of these prices can simply be sourced to one global factor despite the heterogeneity in the underlying assets (Miranda-Agrippino and Rey, 2012). Thus, prices and capital flows in emerging markets respond much more to the global financial cycles, which are reliant on the monetary conditions in core countries, than to the financial cycles or monetary conditions in the domestic emerging market. Morais et al. (2019) provides a comprehensive analysis on the international credit channel exactly around this conjecture of the overwhelming influence of the monetary conditions in core countries. In their analysis using Mexican bank and loan level data they identify an international risk-taking channel, where, for example, a monetary policy loosening in a core country would improve the value of assets and collaterals so that a global financial institution has a higher tolerance for risk and goes searching for this risk with riskier assets in emerging markets, and vice versa for a monetary policy tightening. There is an international spillover of core country monetary policy on emerging markets (Khawaja and Mian, 2008). Additionally, Morais et al. (2019) finds that, as monetary conditions worsen in a core country, global financial institutions go looking for

more welcoming monetary conditions in a foreign country called a reach-for-yield. The amount of domestic and foreign loans of international banks are determined by the funding conditions in the countries of the headquarters of these banks (Giannetti and Laeven, 2012). It is even the case that an increase in the minimum bank capital requirements has a negative impact on the cross-border bank loan supply with a higher sensitivity to core country bank-specific capital requirement changes (Aiyear et al., 2014). Meanwhile, from the core country perspective, global banks are insulated from the domestic monetary policy through their foreign credit operation. Liquidity shocks in core countries are smoother using their foreign affiliates. There is substantial evidence of the international transmission of monetary policy (Cetorelli and Goldberg, 2012). Moreover, with the rising popularity of nontraditional monetary policies following the 2007-2009 financial crisis, QE programs are set to continue, while many experts warn of the consequences of not returning to 'normalcy' (Probst, 2019; Summers and Stansbury, 2019). Countries have become more reliant on monetary policies, citing bygone anti-Keynesian ideas. The prevailing sentiment across Europe considers monetary policy as the main macroeconomic tool (Kaletsky, 2019; Giles, 2020). My study not only builds on the evidence of the international transmission of monetary policy, but adds to a gap in the literature in terms of the effects of the international credit channel on an emerging market through core country traditional and nontraditional monetary policy. Particularly, the changes in the supply of credit in an emerging market for the interaction of the country a global financial institution is headquartered in and core country monetary policies will be insightful in understanding the ramifications of shocks outside the borders of their occurrence.

Given the spillover of monetary policy shocks from core countries to emerging markets through the international credit channel, as my analysis centers on, a contentious debate arises. International credit flows, as established earlier, are globally and highly cyclical, but, often, in contradiction to individual country's economic condition cycles and monetary policy intentions (Rey, 2013). This is an issue paramountly faced by countries that are periphery to the core countries because of the monetary policy "trilemma", which lays out the predicament of having to choose which two of three policies to control: a fixed exchange rate, free capital movement, or monetary policy independence (Obstfeld and Taylor, 1998, and Tica et al., 2019). With countries facing ever-more pressure to free capital movement, perhaps the predicament is boiled down to a choice between two policies, a fixed exchange rate or monetary policy independence. Rey (2013) takes this predicament further and argues that the domestic "monetary policy is constrained regardless of the exchange rate regime." So, when there is free capital mobility, core country monetary policy is transmitted through the global financial cycle, despite the best efforts of the exchange rate regime, whether floating or fixed. The consequences should not be taken lightly as large asset price bubbles or excess credit creation may emerge, potentially even leading to financial crises. Any country should have monetary policy autonomy to invoke their righteous authority. In other words, they should not be at odds with international spillover of monetary policy, an issue I explore. I go further in analyzing how this outside influence manifests itself in the supply of credit and the supply of credit for different maturities of loans.

In the empirical analysis, I use data from the Banco Central do Brasil (BCB), the central bank of Brazil, which provides a deep and interesting set of credit operation level data. The data set contains quarterly supervisory information on the supply of credit from credit

supplying institutions operating in Brazil to non-financial corporations and legal persons from Q2 2012 to Q4 2019 with information on the ownership of these institutions. The credit registry of the BCB takes stock of loan volume by type of loan and maturity which represents 99% of the supply of credit in Brazil. The loan volume and maturity data coupled with information on the country of origin of each financial institution allows me to study whether credit supply in Brazil is linked to foreign monetary policy through their financial institutions with credit operations in Brazil.

In my identification strategy, I follow a similar methodology to the literature to isolate the credit supply from changes in demand of credit (Khwaja and Mian, 2008 and, Morais et al., 2019). I run an OLS regression of the loan volume in the Brazilian supply of credit provided by a financial institution in a given quarter on the quarterly lagged monetary policies (interest rates and QE) of the BCB, the Fed, the BoE, and the ECB. To disentangle changes in supply from changes in demand, I use institution fixed effects, quarter fixed effects and controls to test for the international transmission of monetary policy. I control for economic conditions in each country. I add variables for the interaction of the country in which the financial institution is headquartered in with the monetary policy. Thus, the relationship between loan volume and the monetary policies, interaction variables, and economic conditions will inform my analysis.

To analyze the international credit channel of monetary policy, I focus on the total loan volume provided by each financial institution to legal persons and non-financial institutions in Brazil. First, I study how the Brazilian supply of credit is affected by domestic and foreign monetary policy. Then, I explore whether this effect is different for loans with different maturity levels. I am interested in how the institutions' credit operations react to central bank interest rate changes and the assets held on the central bank's balance sheet as a share of GDP. The monetary policy will provide the credit conditions, or the change in credit conditions. As a measure of conventional monetary policy, I use the central bank's overnight rates: the Federal Funds rate, the SONIA, the EONIA, and the Selic rate for the central banks of the US, the UK, the Eurozone, and Brazil, respectively. As a measure of unconventional monetary policy, I use the annual real change in the total assets held on the balance sheet of the four central banks as a percentage of GDP. I would expect that as interest rates increase, financial institutions are more likely to supply credit with credit conditions worsening and the loan volume should decrease. As the balance sheet expands (QE), I would expect that financial institutions are more likely to supply credit with credit conditions improving and the loan volume should increase.

I find the following results. Firstly, I find significant estimated effects for traditional and nontraditional monetary policies of the various central banks on the loan volume in the Brazilian supply of credit for the complete, short maturity, and long maturity samples. Thus, there is, to some extent, a spillover of core country monetary policies. For the BCB, a marginal, but slightly positive relationship was found for interest rate changes and loan volume, while a balance sheet expansion (QE) tended to shrink the loan volume in the Brazilian supply of credit. Larger effects, in terms of magnitude, were estimated for the core country central bank monetary policies on the loan volume.

Secondly, the Eurozone headquartered financial institutions tend to change their supply of credit in Brazil to core country monetary policy changes and financial institutions with core country nationalities tend to change their supply of credit in Brazil to the Fed monetary policy changes. There is evidence for the international risk-taking channel. For interest rate hikes by

core country central banks, the loan volume falls, and for balance sheet expansions (QE) by core country central banks the loan volume rises. However, this result was somewhat vague.

Finally, the loan volume of the Brazilian supply of credit moves much more and much clearer with the core country's business cycle than for the Brazilian business cycle. This result was consistent for all three samples.

From the results, I conclude that there is evidence that the supply of credit in Brazil, provided by financial institutions with headquarters in a core country, are affected by core country traditional and nontraditional monetary policy. It can be said that there is a foreign monetary policy spillover from the actions of the central banks of core countries onto the supply of credit in an emerging market. However, in general, the results are only robust to some extent. Whenever dealing with the global financial system, controlling for effects is always going to be complex with the number of variables that could affect the credit conditions or the institution specific credit operations, such as pandemics, terrorist attacks, or other disruptions. This is even more so the case in the analysis of Brazil in the 2012 to 2019 period where there were a lot of institutional, political, economic, and social tribulation. Additionally, the Eurozone suffered from the Euro crisis which may throw-off the effects. Still, whether it is a positive, a negative, or an indiscernible effect, the result will inform if there is indeed a spillover. There are likely other unobserved global shocks, but these are assumed to be mostly equal across countries. Even so, to a satisfied degree, the outcomes were consistent with an effect of traditional and nontraditional monetary policy in core countries on the supply of credit in Brazil through the international credit channel.

I, therefore, contribute to the literature on the spillover effect of interest rates and QE programs, and, at the same time, the identification of the international credit channel. In the trilemma-dilemma debate on fixed exchange rates, full capital mobility, and monetary policy, the consequences of my findings suggest that core countries have a responsibility to consider the international effect of central bank monetary policy actions. While academics and central bankers have raised the issue, there is still a tendency for core country central banks to overlook the potential spillover effects in times of crisis (Eichengreen et al., 2011). Core country central banks have increased their collaboration, as was evident in the response to the financial crisis of 2007-2009, but to date there is no comprehensive international forum that truly engages the central bankers to act uniformly. There would be global benefits to a more international and sweeping approach in monetary policy. From the perspective of the BCB, I observe the limitations of core country monetary policy spillover into emerging markets.

Additionally, in terms of the contributions to the literature at the bank level, the behavior of financial institutions will continue to be difficult to calculate when they take into account the various local shocks in the country they are headquartered in and the countries they operate in (Cetorelli and Goldberg, 2012). It leads to the spillover effect measured in my study, but also flight-home effects, reach-for-yield effects, international risk-taking effects, to name a few (Morais et al., 2019; Gianetti and Laeven, 2012; Hashimoto and Wacker, 2016). But it is unclear exactly how much weight is given to the credit conditions and monetary policy actions in the country an international financial institution is headquartered in and an international financial institution is operating in. I find strong relationships, but also contradictory relationships for the effect on credit operations. As mentioned earlier, global

financial institutions play an important role in the supply of credit in emerging markets, so that the discussion has broad implications.

The remainder of the paper is structured with six further sections: Section II offers context to the analysis on the Brazilian economy; Section III outlines the data utilized; Section IV summarizes and discusses the empirical strategy which includes the identification and econometric methodology; Section V provides the results; Section VI is the robustness check; and Section VII concludes.

Section II: Brazilian economy

Brazil emerged with optimism after financial difficulty in the 90's (Economist, 2007). In the 00's, it had the strongest economic growth and social progress of any emerging market. Almost 30 million people escaped poverty and inequality decreased significantly. The awarding of the FIFA World Cup and the Summer Olympic Games indicated that the country was on the brink of breaking through the middle-income trap (Canuto, 2014). However, all this momentum and success unraveled post-2013. One of the most notable recessions in the history of Brazil was in the period of 2015-2017. The GDP fell by 3.6% in 2015 and 3.5% in 2016, with a slow recovery starting in early 2017. This, as can be seen in Figure I, is at odds with most other countries of similar size and the global trend in GDP growth. The economic crisis arose with the disclosure of widespread corruption amongst top politicians and Petrobras, falling commodity prices caused by a decreasing demand in China, and New Economic Matrix, a series of policies seeking to stimulate consumption, expand credit, and make the Brazilian industry more competitive internationally. The Brazilian industry's share of the Brazilian GDP fell, credit rating agencies lowered their credit ratings for Brazil, a political crisis emerged where Dilma Rousseff was ultimately impeached, and unemployment rates and income inequality soared. In the last decade, looking at the 100 most valuable mergers and acquisitions there were only four instances of a Brazilian company acquiring a foreign company (Sambo and Pacheco, 2014; World Bank, 2019; Reuters, 2018). The landscape of the Brazilian economy reflects a natural resource heavy industry, large companies, and a high rate of foreign direct investment (CIA, 2020).

The 2007-2009 financial crisis warranted a potent and 'creative' response. The scope of the 2007-2009 financial crisis was unprecedented. The Fed immediately cut the Federal Funds rate to the zero-lower bound (ZLB). The BoE and ECB soon followed. The BCB also cut their rates, but not nearly to the extent of the aforementioned central banks. At this time, the core countries had exhausted their traditional monetary policies. Non-traditional monetary policy was promoted in the form of Quantitative Easing (QE), a large-scale asset-purchasing program which aims to inject money into the financial system and drive interest rates lower (Cerretano, 2020). The Fed led the way and had a sustained large-scale asset purchasing operation towards the end of 2009. The BoE had a smaller but similarly sustained operation, while the ECB had a short-term QE program that ended at the start of 2009. The core country central banks found strong upside to the purchasing programs so that they would continuously revert back to quantitative easing programs throughout the next decade. In fact, with Mario Draghi becoming the new President of the ECB, the ECB increased their commitment to large-scale asset purchasing and, on 8 December 2011, announced they would be issuing three-year

term 1% interest loans called LTRO (Lane and Milesi-Ferretti, 2006). The balance sheet expansion, in terms of real annual percentage change in total assets held over GDP, continued to increase until the peak in 2018 when the core country central banks truly tapered off their programs. Importantly, there was significant variation in the magnitude and course of the QE programs over the time span of my analysis.

Section III: Data

In this section, I will talk through the data used in my empirical analysis. For the empirical analysis, I combine information in three different dimensions. The first contains quarterly supervisory information on the credit provided by each financial institution. The second data set provides the country in which financial institutions are headquartered. The third set is the aggregated data from each country's respective central bank of consolidated balance sheets, monetary policy interest rates, and economic indicators. I use a macroeconomic data set with information on GDP from each country. The first and second data set spans from the second quarter in 2012 to the fourth quarter in 2019 and the last two quarterly data sets span from the first quarter in 2012 to the third quarter in 2019.

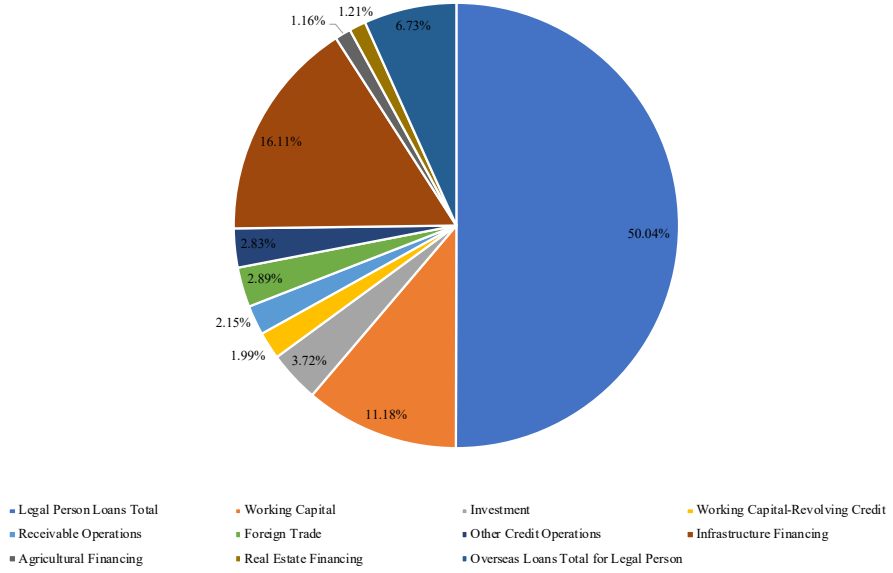
1. Quarterly supervisory information

The first data set is the quarterly supervisory information on the supply of credit from financial institutions and non-financial institutions, at the credit operation level. I use information on the loan volume provided by financial institutions, such as Itaú, Santander, Citibank, or Barclays, and also non-financial institutions, like Lojas Lebes, BMW, or Caterpillar, at a quarterly frequency. This data comes from the Central Bank of Brazil (BCB) which has information on loans provided by all financial institutions, such as commercial banks, development banks, and public banks, and some non-financial institutions, such as investment funds, and securities organizations operating in Brazil that provide a supply of credit to non-financial corporations and legal persons equal to or greater than R$5,000, since Q1 2012 (roughly US$2,500), and R$200, since Q2 2016 (roughly US$35). Around 99% of the total supply of credit in Brazil. For all registered institutions, I have information on the control (one of government owned, domestic private, foreign controlled private), business model category, aggregation type (one of independent institution or conglomerate), segment, and Brazilian headquarter. Unfortunately, there is no info on the maturity for loans provided to individuals. Thus, for the maturity risk-taking analysis, I will focus only on loans to institutions.

In total, I have 3,347,424 observations from the credit-operations-quarter level. These are the supplies of credit of each institution operating in Brazil in terms of types of loans (one of "working capital", "investment", "working capital-revolving credit", "receivable operations", "foreign trade", "other credit options", "infrastructure financing", or "agricultural financing", "legal person loans total", and "overseas legal person loans total") per maturity group (by the number of days the loan is due within). In Figure I and Figure II (*Appendix*: Figure II), I present the composition of total credit in terms of the first and last quarter in the dataset. The legal person loans total makes up the greatest percentage of the total supply of credit, where infrastructure financing and working capital are the next biggest sections of the

total supply of credit. To highlight a couple differences from the first to the last quarter in the dataset, the relative Working Capital percentage of the credit shrinks, while the relative Overseas Loans Total for Legal Person percentage of the supply of credit grows. In general, the credit composition stays relatively consistent throughout the time span.

FIGURE I:
Percentage of total supply of credit by the purpose/type of loan (As of Q2 2012)
This table reports the statisitcs for the observations from the second quarter 2012 credit operation level data for more detail on the type or purpose of loan.



The maturity information allows me, in the second stage of my testing, to divide my full sample into a short and long maturity loan volume group. The short and long maturity loan volume groups are based on how many days are left on the loans. I define short maturity as loans with currently 360 or less days until maturity and long maturity as loans with currently 361 or more days until maturity. So, not based on the original maturity assigned for the loan. For private person loans ("legal person loans total") and private overseas person loans ("overseas legal person loans total"), no distinction is made for the maturity group so that in the analysis for the credit supply maturity these types of loans are not included. The individual observations of the supply of credit are the value of outstanding credit in thousands of Brazilian reals (R$) and I refer to these observations as 'loan volume' for simplification.

2. Financial institution headquarter country information

The second data set has information on the financial institutions' headquarters. To obtain this information, I use the Unicad registration information, the BIC database, and the ECB database. I reference the country of the institution headquarters as the bank nationality throughout my analysis. While the quarterly supervisory information on the supply of credit of institutions operating in Brazil does provide me with the type of control the specific country of the headquarters is not provided. Thus, using the Unicad registration information, the Bank BIC Code database, and the ECB database, each institution can be distinguished for the country of the headquarter. Unicad, the Information on Entities of Interest to the Central Bank, is an

integrated system created by the BCB that collects databases of registration information. The system contains information about different individuals and legal entities that in any way have a relationship with the entities supervised by the BCB. They publish the headquarters of institutions controlled by foreign groups. The Bank BIC Code database collects the unique code identifier for most banks that are usually used for transferring money internationally between banks. They help me identify the control of banks from the supervisory data on credit operations in Brazil. The ECB database aggregates different sources of registration information throughout the Eurozone and the UK, providing the headquarter information of institutions registered in these countries. Each system does not fully cover the institutions in my scope so that I have had to use them all in combination. The three systems cover the headquarter information to match with all foreign controlled private institutions from the supervisory data on credit operations in Brazil, while the government owned and domestic private controlled institution headquarters are already provided in the supervisory data on credit operations in Brazil. Of course, the control and headquarter of the institutions being analyzed are subject to change. I use the information on the type of control to pinpoint any changes in the control and headquarter retroactively. Therefore, I assume that if the type of control does not change, the country of an institution's headquarter does not change either.

Figure III plots the share of financial institutions from Brazil, the US, the UK and the Eurozone. The category "Other" corresponds to financial institutions for which I do not have information on the country headquartered in. This causes a loss of observations, but fortunately this is only for 54 institutions (2.88% of all institutions). In Figure IV (*Appendix*), I present the make-up of financial institutions by country headquartered in, excluding unidentified financial institution's headquarter country.

FIGURE III:
Percentage of all institutions by bank nationality
This table reports the statisitcs for the observations from the credit operation level data for more detail on the nationality of the financial institutions.

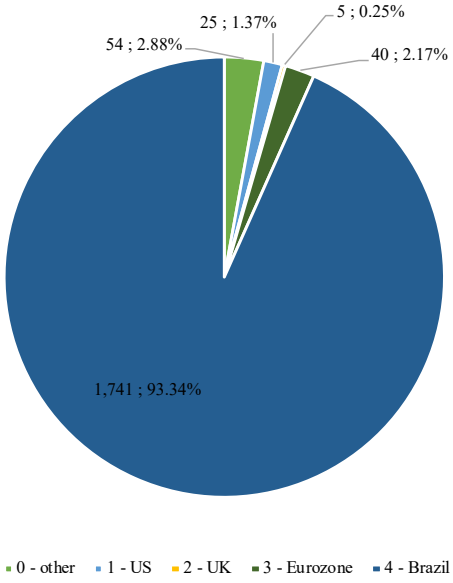


Figure III shows that of all the institutions operating in Brazil, US headquartered institutions make up 1.37%, US headquartered institutions make up 1.37%, UK headquartered

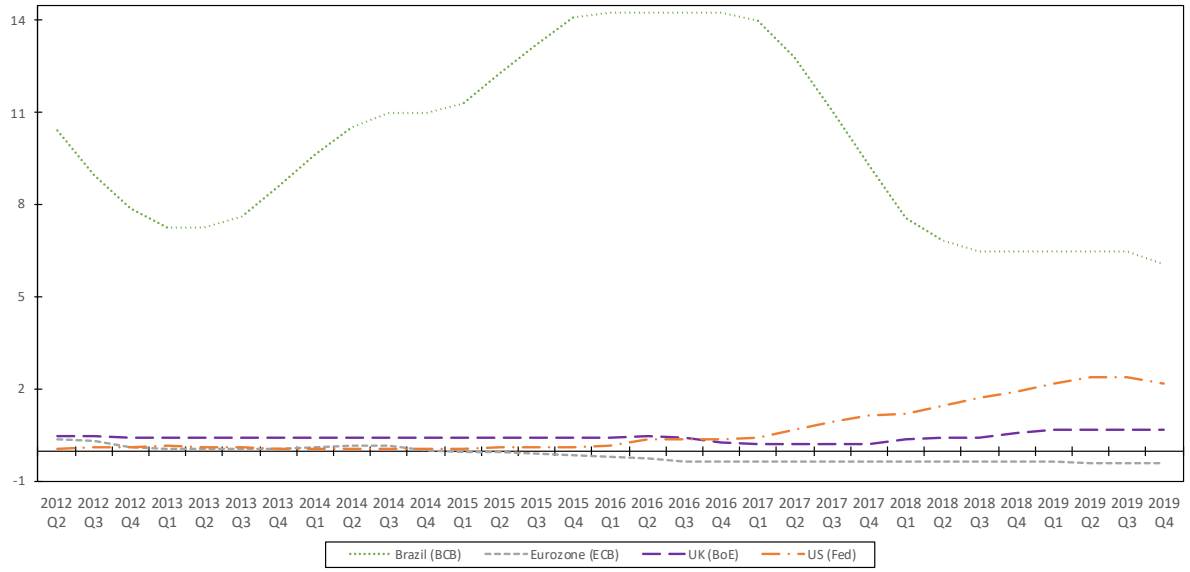
institutions make up 0.25%, Eurozone headquartered institutions make up 2.17%, and Brazil headquartered institutions make up 93.34%. To show that institutions operating in Brazil are affected by the country in which the institution is headquartered in, at least to some extent, matching the country of the headquarter to the institution is vital.

3. Monetary policy variables information

The third data set aggregates monetary policy variables, interest rates, and quantitative easing, and macroeconomic indicators. For each country, the US, the UK, the Eurozone and Brazil, I obtain the real GDP, the interest rates, and the consolidated central bank's balance sheet information from the respective central banks for each country.

The Brazilian interest rate used is the SELIC rate (intrate-br), the UK monetary policy rate used is the SONIA rate (intrate-uk), the US monetary policy rate used is the Federal Funds rate (intrate-us), and the Eurozone monetary policy rate used is the EONIA rate (intrate-eu). These variables, seen in Figure V, aim to capture the traditional monetary policies. The difference between the trends in the core country interest rates and the Brazilian interest rates is obvious. The core countries have more stable and much lower interest rates in the period. More recently, the Fed and, to a lesser extent, the BoE gradually worked its interest rate higher, while the ECB has employed a persistent negative interest rate.

FIGURE V:
Interest Rates of Brazil, the Eurozone, the UK, and the US Central Banks
The below figure plots the evolution of the interest rates (the central bank overnight interest rates) over time in Brazil, the Eurozone, the UK, and the US, respectively.



To measure the extent of quantitative easing at a given point in time, I use the real annual change in the total assets held by the central bank as a proportion of GDP. In contrary to the quantitative easing programs in the direct aftermath of the 2007-2008 financial crisis, the real annual change in the total assets held on the balance sheet of the central bank over GDP remained moderate from the beginning of 2012 to the end of 2019, where the average and median annual real change is near 0% for the four countries analyzed. However, this does

not imply that there was no annual real change. For instance, in 2012 the BoE made large-scale asset-purchases (32% increase) worth more than GB£100 billion taking the total amount to GB£375 billion. The BCB has not officially committed to quantitative easing programs. Still, I find larger real annual changes in the total assets held on the balance sheet of the central bank over GDP. The BCB sold off a large proportion of the assets held on their balance sheet in 2015 (33% decrease) and, in the following year, added a large proportion of assets to their balance sheet (32% increase) despite the GDP falling consistently in both years. This variability, seen in Figure VI will help highlight any differential effect of non-traditional monetary policies across the countries and their matching central banks on institutions operating in Brazil.

FIGURE VI:
Quantitative Easing/Balance Sheet Changes of Brazil, the Eurozone, the UK, and the US Central Banks
The figure plots the evolution of the quantitative easing programs over time in Brazil, the Eurozone, the UK, and the US, respectively.

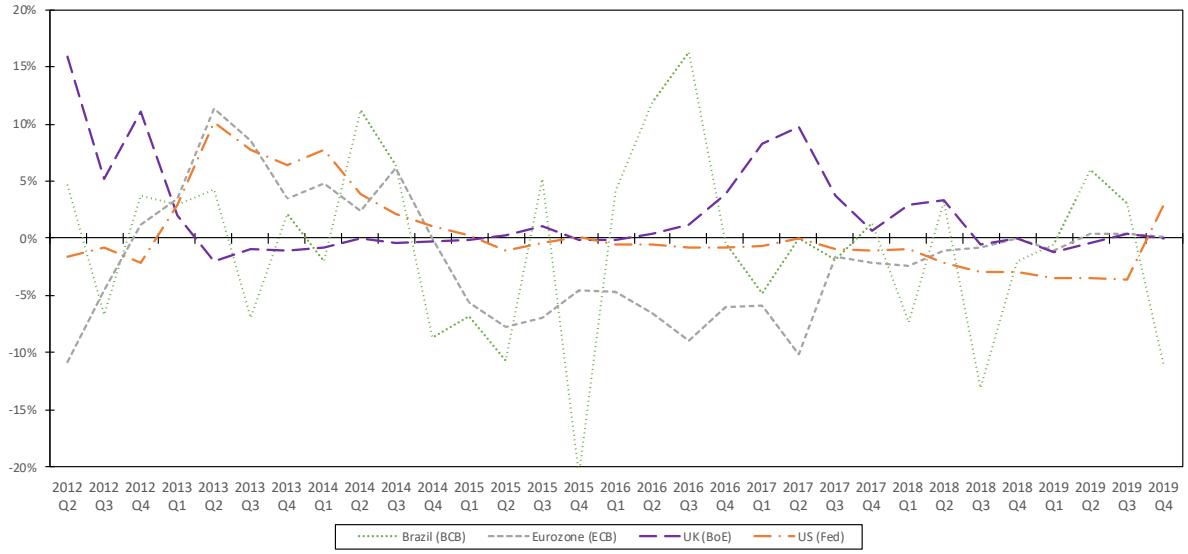


Table I presents summary statistics for the variables in my analysis. The quarterly average loan volume for financial institutions is 4,464 thousands of Brazilian real (R$) and the quarterly median loan volume for financial institutions is 2,814,119 thousands of Brazilian real (R$) for the 38,871 observations in my complete loan volume sample after removing unidentified financial institution nationalities and missing loan volumes. See Table III in the *Appendix* for the definitions of the variables.

Table I
Summary Statistics

This table reports the statistics for the observations from the quarter bank level data. The total supply of credit (*loan_total*) comprising of 38,871 observations, the quantitative easing as the quarterly real change in total balance sheets assets over GDP, interest rates, and real GDP for each country is presented, comprising of 27 observations. The total supply of credit observations are all in thousands of Brazilian real (R$). The real GDP observations are all in hundred thousands of the matching currency of the country.

Variables	Mean	Median	Standard Deviation	Minimum	Maximum
loan_total	2,814,119	4,464	35,600,000	0	827,000,000
qe_us	0.006	-0.007	0.035	-0.036	0.101
qe_uk	0.021	0.003	0.042	-0.021	0.159
qe_eu	-0.015	-0.011	0.054	-0.108	0.113
qe_br	-0.005	-0.001	0.077	-0.206	0.162
intr_us	0.651	0.160	0.776	0.070	2.400
intr_uk	0.447	0.448	0.128	0.211	0.710
intr_eu	-0.112	-0.125	0.241	-0.377	0.368
intr_br	9.967	9.636	2.819	6.103	14.250
r_gdp_us	17,538.19	17,468.90	933.86	16,198.81	19,221.97
r_gdp_uk	444,383.80	446,887.70	19,625.09	410,249.10	473,542.20
r_gdp_eu	2,514,823.00	2,496,400.00	102,198.30	2,382,453.00	2,683,847.00
r_gdp_br	299,151.40	298,475.90	7,248.01	286,284.00	311,505.40
observations (N)	38,871				

Section IV: Empirical strategy

A. Outcome for total loan volume in the Brazilian supply of credit

To study the effect of foreign monetary policy on the supply of credit in Brazil, I follow the methodology and identification strategy used in Morais et al. (2019). I run an OLS regression of the credit for each institution in a given quarter on the quarterly lagged monetary policies (interest rates and QE) of each of the four countries considered[2]. Each monetary policy is also interacted with a dummy variable that equals 0 if the institution providing the loan is headquartered in Brazil, one if US, two if UK, and three if Eurozone.

I use quarterly credit operation level data to regress an institution's loan volume with the traditional and nontraditional monetary policy actions of the country in which the institution is headquartered and, then, to regress an institution's supply of credit in terms of short or long term maturity with the traditional and nontraditional monetary policy actions of the country in which the institution is headquartered, to identify the effect of core countries' monetary policy on Brazil's local supply of credit. Note that I test both the loan volume using actuals (or levels) and using logs. This is done to see the effect of monetary policy on loan volume including

[2] The impact of foreign lagged traditional and non-traditional monetary policy is generally persistent within a range of one to four quarters, and then declines (Morais et al. 2019; Buch et al. 2018). Additionally, I find evidence that interest rate changes spur a prompter response by institutions compared to QE programs. I expect faster transmission of monetary policy changes from the BCB to institutions operating in Brazil compared to monetary policy changes from core country central banks on institutions operating in Brazil by proximity. Taking all this into account, lagging monetary policy by one-quarter is a good compromise. For the third data set, the monetary policy actions are assumed to take at least one quarter to have an impact on the loan volume and the supply of credit of institutions operating in Brazil. Thus, the data spans from 3/2012 to 9/2019.

zeroes and to avoid selection bias. My main analysis remains in logs, while the at levels analysis feeds the robustness check.

In particular, the specification for the estimation of the effect of monetary policy on loan volume is as follows:

$$loan\_volume_{i,t} = \rho + \sum_{country} [\alpha_{country} intrate\_country_{t-1} + \beta_{country} intrate\_country_{t-1} * bank\_nationality_i] + \sum_{country} [\gamma_{country} qe\_country_{t-1} + \delta_{country} qe\_country_{t-1} * bank\_nationality_i] + \sum_{country} X_{i,t} + \varepsilon_{i,,t}$$

Where $loan\_volume_{i,t}$ corresponds to total credit issued by institution i, in quarter t. This is measured in R$ thousands (Brazilian real). I test the dependent variable $loan\_volume_{i,t}$ at levels and with logs as explained earlier[3]. $intr\_country_{t-1}$ is the one-quarter-lagged monetary policy rate of country (US, UK, Europe, Brazil), $bank\_nationality_i$ is an indicator variable for the country in which the institution has its headquarters (with the baseline being Brazil). $qe\_country_{t-1}$ measures the annual real change in the balance sheet of the central bank (with respect to its GDP) of a country in the previous quarter (t-1).

Thus, I compare the value of the supply of credit issued by each institution (i), in a given quarter (t), interacted with an indicator variable for the country in which the institution is headquartered in ($bank\_country_i$), which should explain whether a institution is affected by quarterly lagged traditional ($intrate\_country_{t-1}$) and non-traditional ($qe\_country_{t-1}$) monetary policies in each of the four countries considered.

To control for each country's business cycles, $X_{i,t}$is a vector that includes the one-quarter lagged quarterly real GDPs of each country in the analysis. These are all tested in logs and then in levels according to whether the dependent variable (loan volume) is in logs or in levels, respectively.

I use a fixed effects model to control for bank fixed effects as the group/id in the panel data and the interaction term monetary policy $qe\_country_{t-1} * bank\_nationality_i$ or $intr\_country_{t-1} * bank\_nationality_i$ to control for country fixed effects.

The coefficients of interest are the $intrate\_country_{t-1}$ and $qe\_country_{t-1}$ ($\alpha_{country}$ and $\gamma_{country}$). Also, the interactions of $intrate\_country_{t-1}$ with bank nationality $qe\_country_{t-1}$ with bank nationality. The coefficients of these interactions allow me to understand if monetary policy in the UK, for instance, operates through UK banks to affect the supply of credit in Brazil. They estimate the effect the monetary policy of each country has on the loan volume in Brazil over time. While the interaction between $intrate\_country_{t-1} * bank\_nationality_i$ and $qe\_country_{t-1} * bank\_nationality_i$ can be considered as controls

[3] I realize that in the relevant literature and by the nature of my data, it is useful to see the effect of monetary policy on loan volume using logs to linearize the relationship and simplify the model. The results of the at levels and the logs should provide estimates that show a similar relationship, but in different ways. If the loan volume is zero for an institution, for example, then this still tells us something about their loan supply behavior, so it is important to include such an observation. But, it is also important to recognize that residuals are skewed positively and that it is useful to interpret the explanatory variables in my analysis in terms of percentage changes (or elasticities) in the loan volume, which using logs allows.

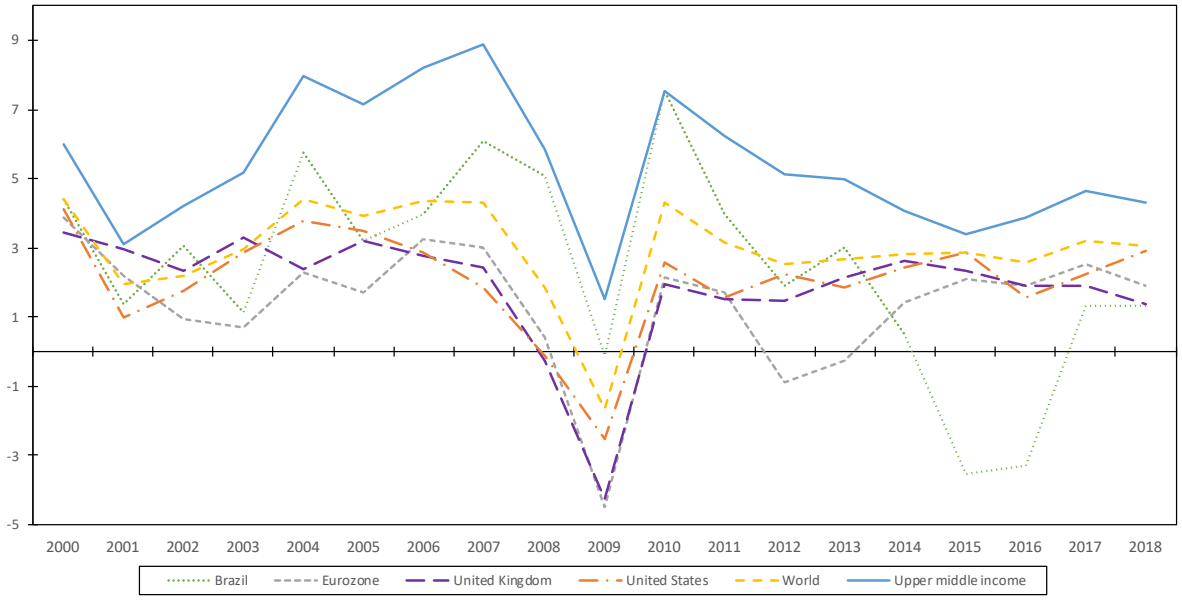
to estimate the effect of $intrate\_country_{t-1}$ and $qe\_country_{t-1}$ on $loan\_volume_{i,t}$, they also play an important role in explaining whether there may be an effect on the interaction between countries and the monetary policy in countries on $loan\_volume_{i,t}$. Whether the country-specific characteristics interact with the monetary policy conditions of a country to change the supply of credit in Brazil.

The primary challenge in isolating the effect of monetary policy on the supply of credit in Brazil is avoiding or trying to wash out the effect of demand for credit. I try to solely look at the supply for credit. This is a theme throughout the key relevant literature. Similar studies employ firm*quarter fixed effects that help control for changes in demand (Khwaja and Mian 2008, Rey 2013, Morais et al. 2019). However, this would require bank-level data at the quarter frequency, which is not readily available in Brazil, or emerging market countries, in general. I do not have this data, an issue, as I cannot control for the borrower's fixed effects. So, I analyze the effect with the caveat that I am not able to wash out the changes in demand for credit completely. Additionally, there are also other characteristics that could be confounding effects including changing regulation or the landscape around credit may vary from an institution in one quarter to another quarter across countries.

Given this, in the estimated specification, I control for financial institution fixed effects, quarter fixed effects, and economic conditions. This allows me to control for shocks that affect all banks at the same time in terms of the supply of credit. The institution-specific characteristics and time-specific characteristics are controlled for. Note, that the fixed effects for institution-specific characteristics are time variant and the quarter fixed effects for time-specific characteristics are institution variant.

Given the highly global interconnected nature of both economic and financial conditions, especially between the core country central banks of the Fed, BoE, and ECB, there is a concern for multicollinearity. In response, I control for business cycles, so that the potential for the high level of correlations between the residual monetary policies is minimized. Additionally, in comparing business cycles of Brazil to the core countries, Eurozone, the World, and Upper middle-income countries, there is less co-movement between the GDP growth in general, as seen in Figure VII.

FIGURE VII:
Business Cycles of Brazil, Eurozone, UK, US, World, and Upper middle income countries
(real annual percentage change in GDP)
The real annual percentage change in GDP for 2000 to 2018. The figure plots the Businss Cycle over time.



To control for economic conditions in each country, the vector $X_{i,t}$ includes the one-quarter lagged annual growth rates of each country. These are included as logs. This allows me to better separate changes in monetary policy from other changes in economic activity.

B. Outcome for the long and short maturity loan volume in the Brazilian supply of credit

In a second stage, I assess whether the effect of monetary policy is different for loans with different maturities. To do so, I split the sample into two groups, namely a short maturity (SM) loans group and long maturity (LM) loans group[4]. I then estimate a similar regression to the baseline specification for each sample, the short maturity loans group and long maturity loans group, assessing whether the estimated coefficients are different. Conditioning the sample for short and long maturity, I will have two different outcomes (beyond the total sample outcomes) for α, β, γ, and δ. The rationale for testing for two different groups of maturity is that the effect of monetary policy may be more sensitive depending on the maturity of the supply of credit. The effect may be more pronounced in one case which could give a novel and clearer understanding to how the international credit channel operates. Perhaps, for example, the short maturity loans group will react stronger to a monetary policy change than the long maturity loans group. Further, the two maturity groups could react differently to the specific monetary policy, an interest rate change or a balance sheet change.

I recognize that maturities may correlate with unobserved time-invariant characteristics of institutions. A given institution may tend to provide a more long-term maturity supply of credit and, therefore, the institution may be impacted differently by monetary policies than a given institution that tends to provide a more short-term maturity supply of credit. In response,

[4] As described before, the first corresponds to all loans due between 15 days to and with 360 days, while the second group corresponds to loans with a maturity equal to or greater than 361 days.

the institution fixed effects for institution-specific characteristics are controlled for along with the quarter fixed effects for time-specific characteristics are controlled for as before. This isolates the monetary policy effect on the supply of credit for both maturity groups.

I use the baseline specification from the effect of monetary policy on the total loan volume from earlier in now estimating the effect of monetary policies on the two different maturity groups of the supply of credit. The *A. Outcome for total loan volume in the Brazilian supply of credit* results should indicate whether the monetary policy in the country of which the institution is headquartered in effects the institution's loan volume in the Brazilian supply of credit for institutions headquartered in the US, the UK, the Eurozone, and Brazil. The *B. Outcome for the long and short maturity loan volume in the Brazilian supply of credit* results should indicate whether the monetary policy in the country of which the institution is headquartered in effects the institution's short maturity loan volume and long maturity loan volume in the Brazilian supply of credit for institutions headquartered in the US, the UK, the Eurozone, and Brazil. Perhaps, there will be differences in effect of the BCB's monetary policy on institutions' total loan volume, short maturity loan volume, and long maturity loan volume in the Brazilian supply of credit for institutions headquartered in the US, the UK, the Eurozone, and Brazil. The analysis for each outcome drives the identification strategy of whether the core countries' central monetary policy affects the Brazilian supply of credit provided by institutions with headquarters in a core country.

Section V: Results

In this section, I present the results. Using the data on the supply of credit from credit supplying institutions operating in Brazil to non-financial corporations and legal persons at the credit operation level, I test whether there is a spillover of core countries' monetary policy on the Brazilian supply of credit. I present the findings for the effect of traditional and nontraditional monetary policy of the UK, the EU, the US, and Brazil. Specifically, the effect of a monetary policy shock on the loan volume and the maturity of the local supply of credit in Brazil, as an emerging market, by institutions headquartered in a core country.

For each output, in column 1 you will find the baseline specification, in column 2 you will find the specification with economic conditions controls, and in column 3 you will find the specification with economic conditions controls and the interaction between monetary policy and country control.

A. Outcome for total loan volume in the Brazilian supply of credit.

In Panel IB the results for the effect of the various foreign monetary policies on the local Brazilian supply of credit by loan volume at logs are presented.

For the basic specification (column 1), there is a significant effect of Fed interest rate changes on the loan volume in the Brazilian supply of credit. In this instance, a 1% Fed interest rate increase leads to a 0.5% increase in loan volume of the Brazilian supply of credit. Also, for column 2 and column 3, there is a significant effect of Fed QE changes on the loan volume in the Brazilian supply of credit. A 1% Fed balance sheet expansion (QE) leads to a 0.611% increase and a 0.633% increase in loan volume of the Brazilian supply of credit, in each

Panel IB

The Impact of Foreign Monetary Policies on the Brazilian Supply of Credit by Loan Volume

The table reports the OLS regression estimates for the period of Q2 2012 to Q4 2019 concerning the total loan volume of the short maturity supply of credit observations at the quarter level from institutions with credit operaitons operating in Brazil. The dependent variable is loan volume, at levels, measured in thousands of Brazilian real ($R). Interest Rate is the overnight policy rate of country, which is one of the US, the UK, the Eurozone, or Brazil. Balance Sheet/QE is the ratio of the annual real change in central bank assets to GDP of country. Bank Naitonality is a dummy indicating whether bank headquarters are in country. Standard errors are reported in the parentheses. *,**,*** significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
	Log Loan Volume	Log Loan Volume	Log Loan Volume
Fed Interest Rate	0.502***	-0.0326	0.00331
	(18.70)	(-0.57)	(0.06)
BoE Interest Rate	-0.141*	0.205**	0.138
	(-1.91)	(1.98)	(1.32)
ECB Interest Rate	-0.629***	-0.112	-0.0958
	(-9.86)	(-0.96)	(-0.82)
BCB Interest Rate	0.0682***	0.0106	0.0145
	(13.89)	(1.11)	(1.52)
Fed Balance Sheet/QE	0.111	0.611*	0.633*
	(0.39)	(1.81)	(1.86)
BoE Balance Sheet/QE	-2.905***	-0.223	-0.349
	(-13.93)	(-0.75)	(-1.17)
ECB Balance Sheet/QE	-0.127	0.107	0.0849
	(-0.54)	(0.41)	(0.32)
BCB Balance Sheet/QE	-0.368***	0.0247	0.0168
	(-5.15)	(0.33)	(0.22)
Log real GDP US		9.325***	9.302***
		(5.41)	(5.42)
Log real GDP UK		4.798*	4.877*
		(1.83)	(1.87)
Log real GDP Eurozone		-4.867*	-4.949*
		(-2.02)	(-2.06)
Log real GDP Brazil		1.059	1.064
		(1.27)	(1.28)
*Eurozone*Fed Interest Rate*			-0.554***
			(-3.58)
*UK*Fed Interest Rate*			-1.949***
			(-2.70)
*US*Fed Interest Rate*			-0.934***
			(-4.06)
*Eurozone*BoE Interest Rate*			1.663***
			(3.99)
*UK*BoE Interest Rate*			-3.544
			(-1.50)
*US*BoE Interest Rate*			1.052
			(1.63)
*Eurozone*ECB Interest Rate*			0.287
			(0.73)
*UK*ECB Interest Rate*			-4.502***
			(-3.41)
*US*ECB Interest Rate*			-0.823
			(-1.51)
*Eurozone*BCB Interest Rate*			-0.0378*
			(-1.82)
*UK*BCB Interest Rate*			-0.547***
			(-4.61)
*US*BCB Interest Rate*			-0.113**
			(-2.68)
*Eurozone*Fed QE*			-0.827
			(-0.49)
*UK*Fed QE*			-2.099
			(-0.32)
*US*Fed QE*			0.289
			(0.12)
*Eurozone*BoE QE*			2.234*
			(1.93)
*UK*BoE QE*			17.16***
			(3.40)
*US*BoE QE*			2.257
			(1.26)
*Eurozone*ECB QE*			1.158
			(0.90)
*UK*ECB QE*			-10.54**
			(-2.05)
*US*ECB QE*			0.616
			(0.31)
*Eurozone*BCB QE*			0.438
			(1.05)
*UK*BCB QE*			-0.147
			(-0.09)
*US*BCB QE*			-0.150
			(-0.24)
Financial Institution (Bank) Fixed Effect	Yes	Yes	Yes
Quarter (Time) Fixed Effect	Yes	Yes	Yes
Bank Nationality*Monetary Policy Control	No	No	Yes
Business Cycle (real GDP) Control	No	Yes	Yes
ρ (cons)	8.610***	-85.76***	-85.41***
	(136.97)	(-3.42)	(-3.42)
observations (N)	28785	28785	28785
R^2	within = 0.2176	within = 0.2270	within = 0.2362
	between = 0.0106	between = 0.0096	between = 0.0000
	overall = 0.0248	overall = 0.0255	overall = 0.0073

Statistical Significance:
t statistics in parentheses
* p<0.10 ** p<0.05 *** p<0.01"

respective case. The Fed monetary policy has an estimated effect on the loan volume. Particularly for the Fed balance sheet expansion, there is evidence that there is a Fed monetary policy spillover on the loan volume in Brazil. This is in contrast to the BCB balance sheet expansion which has a smaller negative effect.

I explore the consequences of Fed balance QE deeper. As the Fed expands their balance sheet, the market for the supply of credit in the US should contract while financial institutions in the US are stimulated. If it is the case that the supply of credit in Brazil then increases, it could be that US financial institutions are moving their supply of credit from the US to the Brazilian credit markets. As credit supply conditions worsen in a core country, global financial institutions go looking for more welcoming credit supply conditions in a foreign country (Morais et al., 2019).

In the basic specification (column 1), I find a significant negative effect of BoE balance sheet expansion on the loan volume. The loan volume is highly responsive to BoE QE, much more than the BCB QE. It is important to mention that this dramatic result is based on a limited number of UK financial institution observations.

The core country business cycle influences loan volume in the Brazilian supply of credit more than the Brazilian business cycle. Specifically, the real GDP in the UK and US have a positive relationship with the loan volume in Brazil, whereas the real GDP in the Eurozone has a negative relationship with the loan volume in Brazil. This is an interesting contrast. Often in my analysis, I find that the relationship between core countries, as a group, and Brazil are not straightforward. This could be simply attributed to the recent economic history (downturns, crisis, political turmoil, etc.) amongst the countries in my analysis, but also the weight financial institutions place on real GDP data in the country they are headquartered in and what signals they draw from this data.

Next, I look at the results for the interaction variable for bank nationality*monetary policy. There is evidence to suggest that the Fed monetary policy for each of the Eurozone, UK, and US interaction variables has a strong positive relationship with the Brazilian supply of credit. The Brazilian supply of credit is influenced by Fed interest rates from the US financial institutions, but also by Fed interest rates from the UK and Eurozone financial institutions. This is an intriguing revelation that shows that the US, through institutions in core countries, has a monetary policy spillover on the Brazilian supply of credit. Additionally, to enforce this idea, the BCB interest rate changes have a smaller estimated effect in terms of magnitude.

The results around the QE interacted with bank nationality are less convincing, specifically for Eurozone*BoE QE and UK*BoE QE. While the number of observations is limited, and the large, estimated effects make me wary, it would suggest that BoE QE, through financial institutions headquartered in the Eurozone and the UK, have a significant and large, by magnitude, estimated effect on loan volume from the Brazilian supply of credit.

B. Outcome for the short and long maturity loan volume in the Brazilian supply of credit.

In Panel IIB and Panel IIIB (*Appendix*), the results for the effect of the various foreign monetary policies on the local Brazilian short- and long-maturity supply of credit by loan volume at logs are presented, respectively.

For the short-term maturity loan group baseline specification outputs (column 1), I find significant explanatory variables that suggest that the four central bank monetary policies influence the loan volume, particularly the traditional monetary policies. However, they quickly lose their significance as I add controls and the interaction variables.

A core country central bank interest rate change has a stronger estimated influence on the loan volume than an interest rate change by the BCB. The direction of the core country effects is inconsistent though and the Fed interest rate effect dissipates as economic condition controls are added. If the Fed increased the interest rate, the estimation suggests a rise in the loan volume, whereas if the BoE or ECB increased their interest rate, it suggests a fall in the loan volume.

There is a significant positive effect of BoE and BCB balance sheet expansion on the short maturity loan volume of the Brazilian supply of credit. However, the significance for these effects do not continue as we add controls, which in itself is meaningful evidence that these results are inconclusive.

Finally, for the log short maturity loan volume analysis, I find significant estimated effects in the column 3 output. Initially, I want to point to the positive effects of the real GDP US and the real GDP UK. While this is an interesting outcome alone, it also emphasizes the importance of the economic conditions control. Similarly, for the interaction variables, the significance in the coefficients provide evidence of their importance in my analysis beyond the conclusions we can draw from the results.

For the Fed interest rate, interacted with core countries, I find significant effects where it is estimated that a Fed interest rate increase decreases the short maturity loan volume for core country headquartered financial institutions. Given the consistent result, it is implied that the Fed interest rate change has a spillover effect on the short maturity loan volume in the Brazilian supply of credit. The negative relationship would also imply that the core country headquartered institutions may be bringing their assets 'home' to their domestic market with the core country central bank's interest rate increase. Thus, decreasing their outstanding loan volume in Brazil. The latter mechanism is similar to the flight home effect, where the credit conditions in the core country headquartered institution's domestic market improves, so the institution decreases their credit operations in the foreign, emerging market and brings their assets 'home' (Gianetti and Laeven, 2012). The significant estimated effect for Eurozone*BoE Interest Rate, UK*BCB Interest Rate, and UK*ECB Interest Rate on loan volume enforces this idea, but it does not explain what happens to the loan supply in the core countries' markets.

The results in QE interacted with country may be suffering from a small sample of observations too. There are significant estimated effects for the BoE balance sheet changes and the Eurozone or US. I worry less about the small sample given it's the UK's central bank interaction and not the UK country dummy variable interaction. The result for the Eurozone*BoE QE and US*BoE QE interaction variables describe a positive relationship with the short maturity loan volume of the Brazilian supply of credit. I find that as the BoE expands their balance sheet, interacted with Eurozone or the US, the loan volume notably increases. It would suggest that there is a spillover effect of core country nontraditional monetary policy on the short maturity loan volume in the Brazilian supply of credit.

According to the baseline specification (column 1) for the Fed Interest Rate an increase should increase the long maturity loan volume, whereas a BoE and ECB interest rate increase

should decrease the long maturity loan volume (at logs). Institutions with loan operations in Brazil react oppositely and more strongly to an interest rate change of the Fed compared to the BoE and ECB. More strikingly, when looking at the BCB interest rate estimated effects, I find only a marginal change in long maturity loan volume relative to the magnitude for the estimated effects of the Fed, BoE, and ECB. This result, for the BCB interest rate change, remains consistently marginal for all three specifications.

In terms of the estimated effect of balance sheet changes, the same pattern in significant results emerges to some extent. Namely, a Fed balance sheet expansion would increase the long maturity loan volume, where the BoE and BCB balance sheet expansion would decrease the long maturity loan volume in the Brazilian supply of credit. Note, the stronger responsiveness of loan volume to the BoE balance sheet. The loan volume is more influenced by a core country nontraditional monetary policy, in the BoE, versus that of the BCB. But, this cannot be replicated for the other specifications (column 2 and 3).

The long maturity loan volume moves remarkably and positively with the business cycle of the US. The relationship is also positive for the estimated effect of real GDP Brazil and the long maturity loan volume, however with a smaller magnitude. It could be said that the long maturity loan volume in the Brazilian supply of credit moves closer to the US business cycle than the Brazilian business cycle. It would be expected that Brazil, as an emerging market and given its close relationship with the US, would move to the beat of the economic conditions in the US, however the extent to which this is implied in this result is stunning. Contrarily, the long maturity loan volume moves oppositely to the real GDP in the Eurozone. This result is less intuitive but could be explained by the European debt crisis that occurred during the time period of my analysis. Still, it is still intriguing that there is an estimated negative relationship.

In column 3, there is a significant negative effect of Fed interest rate changes interacted with the Eurozone on the long maturity loan volume in the Brazilian supply of credit. Eurozone bank nationality interacted with the BoE interest rates also has a significant but negative estimated effect on the long maturity loan volume. The BCB has a limited influence on the long maturity loan volume, especially when compared to the estimated effects for Fed and BoE, in the interaction with the Eurozone. Herein lies a unique result of the core country traditional monetary policy effect against the Brazilian traditional monetary policy effect, implying a spillover of monetary policy of core country central banks on the emerging market.

For the most part, the results in both outcomes (*A.* and *B.*) were meaningful in exploring whether there is a monetary policy spillover effect from core country central banks on an emerging market, like Brazil. There are multiple potential explanations for why financial institutions respond the way they do to monetary policies or economic conditions. It may simply be the case that financial institutions respond to the changing economic outlooks, to the signaling effect of the central bank's actions, or a mixture of both, as expected; with an economic conditions improvement, interest rate decrease, and a balance sheet expansion, the credit markets should theoretically improve. It could also be that financial institutions react to interest rate or balance sheet actions with skepticism over the viability of these monetary policies in specific situations and conditions. Central bank balance sheet changes, specifically QE programs, are accompanied with much ambivalence over their effectiveness and consequences. This is not a study on the effectiveness of QE, but rather looks at the responses of the loan volume in the Brazilian supply of credit around such central bank balance sheet

changes for the case of foreign monetary policy spillover. I draw no confident conclusions from the effect of QE or interest rate changes in the general sense.

Section VI: Robustness Check

I take a look at the at levels output and review how they compared to the logs outputs. Panel IA, Panel IIA, and Panel IIIA *(Appendix)* shows the output of the regression at levels. These results are less intuitive but may provide some robustness. It hints at an, to some extent, effective regression, because of the significant estimations, and number of observations.

For core country central bank interest rate increases in the baseline specification (column 1), the effect on the loan volume for the Brazilian supply of credit is both positive and negative. A 1% BoE interest rate increase leads to a $R703,630 thousand increase in loan volume of the Brazilian supply of credit, while a 1% ECB interest rate increase leads to a $R609,010 thousand decrease in loan volume of the Brazilian supply of credit. Recall, the observations for the UK national financial institutions are the most limited, thus the BoE interest rate may have fewer channels to have an effect on the Brazilian supply of credit in my analysis. Solely based on producing a significant result, though, it can be said there may be a relationship between these monetary policies and the loan volume.

There is a positive relationship between BCB interest rates and the loan volume, but the magnitude of this estimated coefficient is much smaller to the estimated coefficients of BoE and ECB interest rate changes. Thus, the loan volume is more responsive to the core country monetary policy change than the Brazilian monetary policy change.

In terms of the balance sheet changes, the estimated effect is mostly negative. Again, I find a notable difference in the magnitude of the estimated coefficients, where the loan volume is more responsive to the core country monetary policy than the Brazilian monetary policy.

The interaction variables Eurozone*BoE QE and Eurozone*ECB QE also produce significant estimated effects of $R-21,549,900 and $R-14,441,857 thousand on loan volume, respectively. It can be seen, in this case, that QE has a stronger estimated effect compared to interest rate changes. The direction suggests that the monetary policies of the BCB, BoE, and ECB interacted with the Eurozone have a negative relationship with the loan volume in Brazil. This makes a lot of sense with the ECB and BoE given their proximity and ties to the Eurozone, however, the same cannot be said about the BCB's interaction with the Eurozone. The measurable nature of the at levels analysis gives us an indication of the magnitude of the estimated coefficients in measurable terms and provides some robustness to our earlier results.

The output for short maturity loans at levels found little significant estimated effects. This is a meaningful output that shows that the results are less clear. Despite this, there are some interesting significant estimated effects in column 3. I find that the ECB Interest Rate with the Eurozone dummy and BCB Interest Rate interacted with the Eurozone dummy has an estimated negative effect on the loan volume. The Eurozone*ECB Interest Rate has a more than eight times stronger magnitude than the Eurozone*BCB Interest Rate. For Eurozone headquartered institutions, the short maturity loan volume is much more responsive to the ECB interest rate changes than the domestic central bank interest rate changes.

There are significant estimated effects for balance sheet changes as well. For the interaction variables Eurozone*BoE QE, UK*BoE QE, and Eurozone*ECB QE, I find a

negative estimated effect with a balance sheet expansion. Given the relation of the Eurozone and the UK, and the ECB and the BoE, their interactions provide evidence of a monetary policy spillover of core countries through financial institutions headquartered in a core country on the loan volume in the short maturity Brazilian supply of credit. The BoE QE, therefore, seems to have more influence on the loan compared to the other central banks in this instance.

The long maturity outputs produce sparse significant estimates. This in itself provides some insight to the landscape of the long maturity Brazilian supply of credit. Perhaps, the insight that these loans are less likely to respond to changing interest rates, QE, or economic conditions in core countries or Brazil.

For Fed interest rate changes, as a core country central bank, in column 1 and 2, increasing their interest rate by 1% would decrease the long maturity loan volume of the Brazilian supply of credit by about R$150,000,000 in both specifications. I highlight this output as it shows some resemblance to the Flight Home Effect.

Section VI: Conclusion

I examine whether traditional and non-traditional monetary policy of core countries spillover to emerging markets, specifically the effect of interest rate changes and balance sheet changes (QE) on the supply of credit in Brazil. I measure the change in the total, short maturity, and long maturity loan volume supplied by financial institutions operating in Brazil. Brazil is a prominent emerging market, has an influential central bank, and has had an interesting recent financial and economic past. While these factors do not necessarily make an analysis of the Brazilian supply of credit the obvious choice, the addition of detailed and quarterly credit supply data provided by the BCB, makes Brazil an attractive choice for analysis.

The key difficulty faced in my analysis of the international credit channel and the spillover effect of core country central bank monetary policy on the supply of credit is disentangling demand from supply. To make conclusions on the results, it needs to be the case that a change in the supply of credit is determined by the supply of financial institutions and not by demand. I take measures in ensuring this given the loan volume bank-level data I have, the economic conditions data, and matching financial institutions to the countries they are headquartered in using fixed effects and controls. Admittedly, this is an impossible task since there is no deep borrower information readily available. However, to the best of this analysis' ability, the unobserved effects are avoided.

I find that monetary policies of the core countries effect the loan volume for the comprehensive, short maturity, and long maturity samples. The fact that there was a relationship, despite it being unclear whether these relationships had a positive or negative effect, does give some indication of a foreign influence on the Brazilian supply of credit. Importantly for my analysis, larger effects, in terms of magnitude, were estimated for the core country central bank monetary policies and economic conditions versus Brazilian central bank monetary policies and economic conditions on the loan volume. Particularly, the core county monetary policy interacted with the Eurozone variables and the core country interacted with the Fed monetary policy variables showed the strongest relationships with the loan volume. This would suggest that Eurozone headquartered financial institutions tend to change their Brazilian supply of credit to the core country monetary policy changes and that financial

institutions with core country nationalities tend to change their Brazilian supply of credit to the Fed monetary policy changes. Further, the loan volume moves much clearer with the core country economic conditions than for the Brazilian economic conditions, illustrating how financial institutions respond more sensitively to core country business cycles.

However, it is not necessarily clear whether core country financial institutions repatriate their credit operations, which we name the flight home effect, or expand their credit operations, in a reach-for-yield effect. It appears that, for interest rates hikes by core country central banks incited the loan volume to fall, while for balance sheet expansions by core country central banks the loan volume would rise.

Thus, I make contributions in the three main ways. I explore the effect of traditional and nontraditional monetary policies, and economic conditions on an emerging market's supply of credit both from foreign and domestic central banks. I look at the potential influence and spillover core country central banks have on the supply of credit of an emerging market. And I provide insight into how global and domestic financial institutions supply credit in an emerging market given core country interest rate, QE and economic condition changes. I build on the literature related to the international credit channel, on the trilemma emerging markets face in the wake of lower interest rates and growing asset-purchasing programs, and the interconnectedness of global economic and financial systems. I demonstrate the core country spillover effect of both traditional and nontraditional monetary policy and economic conditions on the total, short maturity, and long maturity loan volume in the supply of credit of an emerging market.

Understanding the spillover effect of core country monetary policy and the international credit channel is important from the perspective of the growing banking globalization and financial interconnectedness. Central bankers and academics warn of the consequences of traditional and nontraditional monetary policy spillovers and highlight the responsibility that core country central banks have in their monetary policy actions (Rey, 2013; Eichengreen et al. 2011; Fischer, 2014; Rajan, 2015). There are wide and dire consequences (Bernanke, 1983). Where periphery countries, emerging countries like Brazil, cannot temper the international spillovers of monetary policies in the current highly globalized financial cycles against financial instability, responsibility should be taken at the sources of these highly globalized financial cycles themselves (Rey, 2013). The central bank framework needs to consider, foremost, financial stability, and, secondly, pledge international coordination amongst core countries (Eichengreen et al. 2011). It would be useful to explore solutions to a more collaborative effort in dampening global financial shocks in response to financial crises and further understanding the channels of the international transmission of traditional and nontraditional monetary policy shocks.

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Appendix

FIGURE II:
Percentage of total supply of credit by the purpose/type of loan (As of Q4 2019)
This table reports the statisitcs for the observations from the fourth quarter 2019 credit operation level data for more detail on the type or purpose of loan.

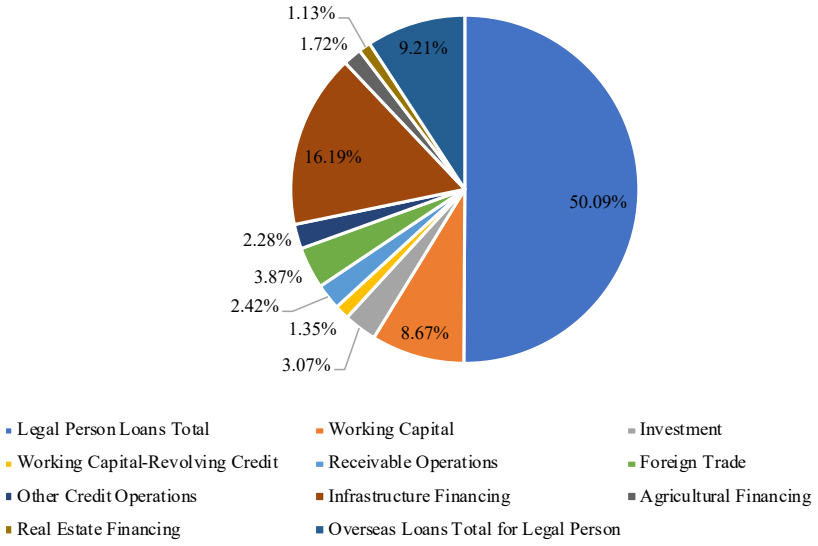

FIGURE IV:
Percentage of all institutions by bank nationality
This table reports the statisitcs for the observations from the credit operation level data for more detail on the nationality of the financial institutions.

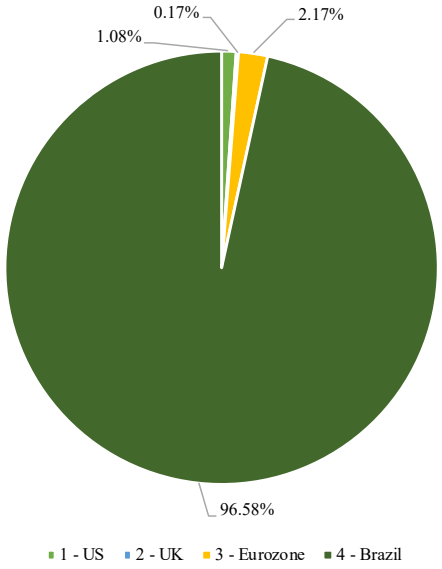

Table II
Definition of terms and variables

Descriptions for the terms and variables used throughout my analysis.

Variable	Defintion
Loan volume	The value of the outstanding loans of a fianncial insitituion with credit operations in Brazil in a given quarter (thousands of Brazilian real R$).
Loan maturity	The category of days left before the loan is due for the value of the outstanding loans of a fianncial insitituion with credit operations in Brazil in a given quarter (thousands of Brazilian real R$).
Type of loan	The category for the use of the loan as reported to the BCB supervisory registry for the value of the outstanding loans of a fianncial insitituion with credit operations in Brazil in a given quarter (thousands of Brazilian real R$).
Interest rate	Overnight bank rates from the central bank.
Quantitative easing	An asset-purchasing programme that expands the total assets on the central bank's balance sheet (measures as the real annual percantage change over GDP).
Credit operation	The outstanding loan business of a finaincial institution, which involves screening, evaluation of risk, and ensuring credit worthiness, sourced from the financial insitituion's assets.
Bank Nationality	The country in which the financial institution has their main headquarters.

Panel IA

The Impact of Foreign Monetary Policies on the Brazilian Supply of Credit by Loan Volume

The table reports the OLS regression estimates for the period of Q2 2012 to Q4 2019 concerning the total loan volume of the short maturity supply of credit observations at the quarter level from institutions with credit operaitons operating in Brazil. The dependent variable is loan volume, at levels, measured in thousands of Brazilian real ($R). Interest Rate is the overnight policy rate of country, which is one of the US, the UK, the Eurozone, or Brazil. Balance Sheet/QE is the ratio of the annual real change in central bank assets to GDP of country. Bank Naitonality is a dummy indicating whether bank headquarters are in country. Standard errors are reported in the parentheses. *,**,*** significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
	Loan Volume	Loan Volume	Loan Volume
Fed Interest Rate	-75142.8	-457072.3	-460113.7
	(-0.54)	(-1.50)	(-1.50)
BoE Interest Rate	703630.8*	799375.7	765288.1
	(1.84)	(1.45)	(1.38)
ECB Interest Rate	-609010.3*	-672656.6	-634726.6
	(-1.86)	(-1.11)	(-1.04)
BCB Interest Rate	81437.4***	66066.0	68741.1
	(3.19)	(1.31)	(1.35)
Fed Balance Sheet/QE	-1439225.1	-1815540.1	-1723433.6
	(-0.98)	(-1.04)	(-0.97)
BoE Balance Sheet/QE	-3509191.2***	-1482275.1	-1012224.7
	(-3.26)	(-0.97)	(-0.66)
ECB Balance Sheet/QE	160921.1	158765.1	448670.7
	(0.13)	(0.12)	(0.33)
BCB Balance Sheet/QE	-695543.8*	-332266.7	-257116.6
	(-1.86)	(-0.84)	(-0.64)
real GDP US		715.8	708.0
		(1.39)	(1.38)
real GDP UK		-10.48	-9.925
		(-0.33)	(-0.31)
real GDP Eurozone		-1.368	-1.374
		(-0.27)	(-0.27)
real GDP Brazil		17.28	17.22
		(1.21)	(1.21)
*Eurozone*Fed Interest Rate*			-103640.6
			(-0.11)
*UK*Fed Interest Rate*			983875.3
			(0.23)
*US*Fed Interest Rate*			229299.7
			(0.17)
*Eurozone*BoE Interest Rate*			846632.4
			(0.34)
*UK*BoE Interest Rate*			-1430319.9
			(-0.10)
*US*BoE Interest Rate*			630508.9
			(0.17)
*Eurozone*ECB Interest Rate*			-1946457.2
			(-0.84)
*UK*ECB Interest Rate*			690107.7
			(0.09)
*US*ECB Interest Rate*			274852.7
			(0.08)
*Eurozone*BCB Interest Rate*			-213296.2*
			(-1.73)
*UK*BCB Interest Rate*			441247.3
			(0.64)
*US*BCB Interest Rate*			72377.0
			(0.29)
*Eurozone*Fed QE*			-4709752.4
			(-0.47)
*UK*Fed QE*			-9941575.4
			(-0.27)
*US*Fed QE*			2089718.6
			(0.15)
*Eurozone*BoE QE*			-21549900.5***
			(-3.12)
*UK*BoE QE*			-23625039.7
			(-0.82)
*US*BoE QE*			1016066.0
			(0.10)
*Eurozone*ECB QE*			-14441857.0*
			(-1.88)
*UK*ECB QE*			1989985.8
			(0.07)
*US*ECB QE*			285430.0
			(0.02)
*Eurozone*BCB QE*			-2786943.9
			(-1.13)
*UK*BCB QE*			-6746154.3
			(-0.71)
*US*BCB QE*			-430223.7
			(-0.12)
Financial Institution (Bank) Fixed Effect	Yes	Yes	Yes
Quarter (Time) Fixed Effect	Yes	Yes	Yes
Bank Nationality*Monetary Policy Control	No	No	Yes
Business Cycle (real GDP) Control	No	Yes	Yes
ρ (cons)	1748994.7***	-7563026.7	-7631042.7
	(5.34)	(-0.99)	(-1.00)
observations (N)	38871	38871	38871
R^2	within = 0.0032	within = 0.0036	within = 0.0048
	between = 0.0006	between = 0.0006	between = 0.0000
	overall = 0.0001	overall = 0.0001	overall = 0.0000

Statistical Significance:
t statistics in parentheses
* p<0.10 ** p<0.05 *** p<0.01"

Panel IIB

The Impact of Foreign Monetary Policies on the Brazilian Short Maturity Supply of Credit by Loan Volume

The table reports the OLS regression estimates for the period of Q2 2012 to Q4 2019 concerning the total loan volume of the short maturity supply of credit observations at the quarter level from institutions with credit operaitons operating in Brazil. The dependent variable is loan volume, at levels, measured in thousands of Brazilian real ($R). Interest Rate is the overnight policy rate of country, which is one of the US, the UK, the Eurozone, or Brazil. Balance Sheet/QE is the ratio of the annual real change in central bank assets to GDP of country. Bank Naitonality is a dummy indicating whether bank headquarters are in country. Standard errors are reported in the parentheses. *,**,*** significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
	Log Loan Volume (SM)	Log Loan Volume (SM)	Log Loan Volume (SM)
Fed Interest Rate	0.456***	-0.0863*	-0.0652
	(19.95)	(-1.78)	(-1.34)
BoE Interest Rate	-0.173***	0.210**	0.164
	(-2.77)	(2.39)	(1.85)
ECB Interest Rate	-0.597***	-0.0339	-0.0376
	(-11.00)	(-0.34)	(-0.38)
BCB Interest Rate	0.0690***	0.00923	0.0119
	(16.53)	(1.14)	(1.47)
Fed Balance Sheet/QE	-0.188	0.363	0.362
	(-0.78)	(1.26)	(1.25)
BoE Balance Sheet/QE	-2.701***	-0.144	-0.260
	(-15.23)	(-0.57)	(-1.03)
ECB Balance Sheet/QE	-0.171	0.112	0.105
	(-0.86)	(0.50)	(0.47)
BCB Balance Sheet/QE	-0.346***	0.0304	0.0312
	(-5.71)	(0.47)	(0.48)
real GDP US		7.915***	7.887***
		(5.40)	(5.41)
real GDP UK		5.681***	5.758***
		(2.55)	(2.60)
real GDP Eurozone		-3.817*	-3.812*
		(-1.87)	(-1.87)
real GDP Brazil		0.508	0.527
		(0.72)	(0.75)
*Eurozone*Fed Interest Rate*			-0.436***
			(-3.32)
*UK*Fed Interest Rate*			-2.679***
			(-3.01)
*US*Fed Interest Rate*			-0.447**
			(-2.27)
*Eurozone*BoE Interest Rate*			1.141***
			(3.23)
*UK*BoE Interest Rate*			3.841
			(0.84)
*US*BoE Interest Rate*			0.598
			(1.09)
*Eurozone*ECB Interest Rate*			0.424
			(1.28)
*UK*ECB Interest Rate*			-7.172***
			(-5.38)
*US*ECB Interest Rate*			0.538
			(1.15)
*Eurozone*BCB Interest Rate*			-0.0469***
			(-2.66)
*UK*BCB Interest Rate*			-0.540***
			(-4.25)
*US*BCB Interest Rate*			-0.0584
			(-1.61)
*Eurozone*Fed QE*			-0.795
			(-0.55)
*UK*Fed QE*			3.702
			(0.54)
*US*Fed QE*			0.789
			(0.38)
*Eurozone*BoE QE*			1.995**
			(2.03)
*UK*BoE QE*			7.862
			(1.50)
*US*BoE QE*			3.712**
			(2.43)
*Eurozone*ECB QE*			0.103
			(0.09)
*UK*ECB QE*			-9.322*
			(-1.84)
*US*ECB QE*			0.928
			(0.54)
*Eurozone*BCB QE*			0.00340
			(0.01)
*UK*BCB QE*			-1.445
			(-0.88)
*US*BCB QE*			0.310
			(0.57)
Financial Institution (Bank) Fixed Effect	Yes	Yes	Yes
Quarter (Time) Fixed Effect	Yes	Yes	Yes
Bank Nationality*Monetary Policy Fixed Effect	No	No	Yes
Business Cycle (real GDP) Control	No	Yes	Yes
ρ (cons)	7.597***	-92.97***	-94.02***
	(142.27)	(-4.37)	(-4.44)
observations (N)	28604	28604	28604
R^2	within = 0.2496	within = 0.2607	within = 0.2695
	between = 0.0073	between = 0.0067	between = 0.0014
	overall = 0.0217	overall = 0.0223	overall = 0.0056

Statistical Significance:
t statistics in parentheses
* p<0.1 ** p<0.05 *** p<0.01"

Panel IIA

The Impact of Foreign Monetary Policies on the Brazilian Short Maturity Supply of Credit by Loan Volume

The table reports the OLS regression estimates for the period of Q2 2012 to Q4 2019 concerning the total loan volume of the short maturity supply of credit observations at the quarter level from institutions with credit operaitons operating in Brazil. The dependent variable is loan volume, at levels, measured in thousands of Brazilian real ($R). Interest Rate is the overnight policy rate of country, which is one of the US, the UK, the Eurozone, or Brazil. Balance Sheet/QE is the ratio of the annual real change in central bank assets to GDP of country. Bank Naitonality is a dummy indicating whether bank headquarters are in country. Standard errors are reported in the parentheses. *,**,*** significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
	Loan Volume (SM)	Loan Volume (SM)	Loan Volume (SM)
Fed Interest Rate	-14531.5	-22893.0	-22286.6
	(-0.73)	(-0.52)	(-0.51)
BoE Interest Rate	94851.1*	61669.2	65315.7
	(1.73)	(0.78)	(0.82)
ECB Interest Rate	-39106.3	-17547.0	1363.7
	(-0.83)	(-0.20)	(0.02)
BCB Interest Rate	7340.6**	4325.2	6033.6
	(2.01)	(0.60)	(0.83)
Fed Balance Sheet/QE	20795.4	71150.7	105336.1
	(0.10)	(0.28)	(0.42)
BoE Balance Sheet/QE	-246269.6	-14447.4	131853.9
	(-1.60)	(-0.07)	(0.60)
ECB Balance Sheet/QE	-10843.7	-60065.3	63322.9
	(-0.06)	(-0.31)	(0.32)
BCB Balance Sheet/QE	-75664.9	-51463.6	-34842.4
	(-1.42)	(-0.90)	(-0.60)
real GDP US		86.75	85.80
		(1.18)	(1.17)
real GDP UK		0.421	0.545
		(0.09)	(0.12)
real GDP Eurozone		-0.730	-0.732
		(-1.01)	(-1.01)
real GDP Brazil		0.363	0.369
		(0.18)	(0.18)
*Eurozone*Fed Interest Rate*			-130681.3
			(-0.99)
*UK*Fed Interest Rate*			362929.1
			(0.58)
*US*Fed Interest Rate*			71917.9
			(0.37)
*Eurozone*BoE Interest Rate*			-444287.6
			(-1.26)
*UK*BoE Interest Rate*			-410878.2
			(-0.21)
*US*BoE Interest Rate*			526770.2
			(0.98)
*Eurozone*ECB Interest Rate*			-902932.9***
			(-2.72)
*UK*ECB Interest Rate*			50084.7
			(0.04)
*US*ECB Interest Rate*			-101427.2
			(-0.22)
*Eurozone*BCB Interest Rate*			-110003.3***
			(-6.24)
*UK*BCB Interest Rate*			161508.5*
			(1.65)
*US*BCB Interest Rate*			36293.3
			(1.02)
*Eurozone*Fed QE*			-1935951.9
			(-1.34)
*UK*Fed QE*			-1601738.4
			(-0.31)
*US*Fed QE*			523039.6
			(0.26)
*Eurozone*BoE QE*			-6268743.7***
			(-6.36)
*UK*BoE QE*			-8740454.9**
			(-2.12)
*US*BoE QE*			-252844.7
			(-0.17)
*Eurozone*ECB QE*			-5715046.9***
			(-5.21)
*UK*ECB QE*			-27543.8
			(-0.01)
*US*ECB QE*			-342871.3
			(-0.20)
*Eurozone*BCB QE*			-511102.4
			(-1.45)
*UK*BCB QE*			-1758718.7
			(-1.29)
*US*BCB QE*			-267537.5
			(-0.51)
Financial Institution (Bank) Fixed Effect	Yes	Yes	Yes
Quarter (Time) Fixed Effect	Yes	Yes	Yes
Bank Nationality*Monetary Policy Fixed Effect	No	No	Yes
Business Cycle (real GDP) Control	No	Yes	Yes
ρ (cons)	388588.8***	454130.1	419412.7
	(8.29)	(0.42)	(0.39)
observations (N)	38858	38858	38858
R^2	within = 0.0032	within = 0.0036	within = 0.0048
	between = 0.0006	between = 0.0006	between = 0.0000
	overall = 0.0001	overall = 0.0001	overall = 0.0000

Statistical Significance:
t statistics in parentheses
* p<0.1 ** p<0.05 *** p<0.01"

Panel IIIB

The Impact of Foreign Monetary Policies on the Brazilian Long Maturity Supply of Credit by Loan Volume

The table reports the OLS regression estimates for the period of Q2 2012 to Q4 2019 concerning the total loan volume of the short maturity supply of credit observations at the quarter level from institutions with credit operaitons operating in Brazil. The dependent variable is loan volume, at levels, measured in thousands of Brazilian real ($R). Interest Rate is the overnight policy rate of country, which is one of the US, the UK, the Eurozone, or Brazil. Balance Sheet/QE is the ratio of the annual real change in central bank assets to GDP of country. Bank Naitonality is a dummy indicating whether bank headquarters are in country. Standard errors are reported in the parentheses. *,**,*** significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
	Log Loan Volume (LM)	Log Loan Volume (LM)	Log Loan Volume (LM)
Fed Interest Rate	0.708***	0.0515	0.0781
	(27.14)	(0.94)	(1.42)
BoE Interest Rate	-0.405***	0.0435	0.00632
	(-5.68)	(0.44)	(0.06)
ECB Interest Rate	-0.442***	-0.0518	-0.0670
	(-7.11)	(-0.46)	(-0.59)
BCB Interest Rate	0.0765***	0.0182**	0.0209**
	(16.06)	(1.98)	(2.28)
Fed Balance Sheet/QE	0.455*	0.533	0.487
	(1.65)	(1.64)	(1.48)
BoE Balance Sheet/QE	-3.243***	0.0249	-0.0876
	(-15.96)	(0.09)	(-0.30)
ECB Balance Sheet/QE	0.113	0.314	0.334
	(0.50)	(1.25)	(1.31)
BCB Balance Sheet/QE	-0.431***	0.0957	0.0989
	(-6.23)	(1.31)	(1.34)
real GDP US		10.90***	10.88***
		(6.54)	(6.57)
real GDP UK		4.105	4.114
		(1.62)	(1.63)
real GDP Eurozone		-4.008*	-4.065*
		(-1.72)	(-1.76)
real GDP Brazil		3.889***	3.902***
		(4.83)	(4.87)
*Eurozone*Fed Interest Rate*			-0.639***
			(-4.38)
*UK*Fed Interest Rate*			0.946
			(0.86)
*US*Fed Interest Rate*			-0.287
			(-1.33)
*Eurozone*BoE Interest Rate*			1.573***
			(4.00)
*UK*BoE Interest Rate*			-7.472**
			(-2.57)
*US*BoE Interest Rate*			-0.598
			(-1.00)
*Eurozone*ECB Interest Rate*			0.190
			(0.52)
*UK*ECB Interest Rate*			0.649
			(0.47)
*US*ECB Interest Rate*			0.483
			(0.94)
*Eurozone*BCB Interest Rate*			-0.0647***
			(-3.21)
*UK*BCB Interest Rate*			-0.131
			(-0.99)
*US*BCB Interest Rate*			-0.0193
			(-0.49)
*Eurozone*Fed QE*			0.334
			(0.21)
*UK*Fed QE*			-2.828
			(-0.39)
*US*Fed QE*			2.202
			(0.97)
*Eurozone*BoE QE*			3.172***
			(2.90)
*UK*BoE QE*			1.043
			(0.20)
*US*BoE QE*			0.932
			(0.55)
*Eurozone*ECB QE*			0.792
			(0.65)
*UK*ECB QE*			-4.510
			(-0.82)
*US*ECB QE*			-2.387
			(-1.27)
*Eurozone*BCB QE*			-0.0207
			(-0.05)
*UK*BCB QE*			1.826
			(0.98)
*US*BCB QE*			-0.305
			(-0.52)
Financial Institution (Bank) Fixed Effect	Yes	Yes	Yes
Quarter (Time) Fixed Effect	Yes	Yes	Yes
Bank Nationality*Monetary Policy Fixed Effect	No	No	Yes
Business Cycle (real GDP) Control	No	Yes	Yes
ρ (cons)	7.009***	-142.0***	-141.3***
	(115.24)	(-5.87)	(-5.87)
observations (N)	26540	26540	26540
R^2	within = 0.3034	within = 0.3199	within = 0.3279
	between = 0.0068	between = 0.0066	between = 0.0000
	overall = 0.0335	overall = 0.0349	overall = 0.0170

Statistical Significance:
t statistics in parentheses
* p<0.1 ** p<0.05 *** p<0.01"

Panel IIIA

The Impact of Foreign Monetary Policies on the Brazilian Long Maturity Supply of Credit by Loan Volume

The table reports the OLS regression estimates for the period of Q2 2012 to Q4 2019 concerning the total loan volume of the short maturity supply of credit observations at the quarter level from institutions with credit operaitons operating in Brazil. The dependent variable is loan volume, at levels, measured in thousands of Brazilian real ($R). Interest Rate is the overnight policy rate of country, which is one of the US, the UK, the Eurozone, or Brazil. Balance Sheet/QE is the ratio of the annual real change in central bank assets to GDP of country. Bank Naitonality is a dummy indicating whether bank headquarters are in country. Standard errors are reported in the parentheses. *,**,*** significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
	Loan Volume (LM)	Loan Volume (LM)	Loan Volume (LM)
Fed Interest Rate	-41782.2	-156698.6*	-154006.6*
	(-1.04)	(-1.77)	(-1.74)
BoE Interest Rate	51088.1	148787.7	143156.3
	(0.46)	(0.93)	(0.89)
ECB Interest Rate	-165900.3*	-116370.8	-118510.1
	(-1.75)	(-0.66)	(-0.67)
BCB Interest Rate	18063.2**	5896.4	6375.3
	(2.44)	(0.40)	(0.43)
Fed Balance Sheet/QE	-476982.1	-536349.9	-539952.1
	(-1.12)	(-1.06)	(-1.05)
BoE Balance Sheet/QE	-925060.7***	-314371.4	-273734.5
	(-2.96)	(-0.71)	(-0.61)
ECB Balance Sheet/QE	148117.5	88630.2	90504.2
	(0.42)	(0.22)	(0.23)
BCB Balance Sheet/QE	-103003.0	-2355.8	-359.4
	(-0.95)	(-0.02)	(-0.00)
real GDP US		41.74	41.99
		(0.28)	(0.28)
real GDP UK		4.840	4.859
		(0.53)	(0.53)
real GDP Eurozone		-0.327	-0.338
		(-0.22)	(-0.23)
real GDP Brazil		3.296	3.300
		(0.80)	(0.80)
*Eurozone*Fed Interest Rate*			-143921.7
			(-0.54)
*UK*Fed Interest Rate*			466245.8
			(0.37)
*US*Fed Interest Rate*			44863.3
			(0.11)
*Eurozone*BoE Interest Rate*			189239.2
			(0.26)
*UK*BoE Interest Rate*			-848063.9
			(-0.21)
*US*BoE Interest Rate*			90896.6
			(0.08)
*Eurozone*ECB Interest Rate*			-128752.1
			(-0.19)
*UK*ECB Interest Rate*			839532.1
			(0.36)
*US*ECB Interest Rate*			242589.4
			(0.26)
*Eurozone*BCB Interest Rate*			-34152.2
			(-0.95)
*UK*BCB Interest Rate*			90620.6
			(0.45)
*US*BCB Interest Rate*			17448.4
			(0.24)
*Eurozone*Fed QE*			-204607.1
			(-0.07)
*UK*Fed QE*			3589558.4
			(0.34)
*US*Fed QE*			153812.1
			(0.04)
*Eurozone*BoE QE*			-1964210.0
			(-0.98)
*UK*BoE QE*			-1468752.5
			(-0.18)
*US*BoE QE*			197108.9
			(0.06)
*Eurozone*ECB QE*			-583697.9
			(-0.26)
*UK*ECB QE*			2299088.3
			(0.26)
*US*ECB QE*			588912.4
			(0.17)
*Eurozone*BCB QE*			-45116.5
			(-0.06)
*UK*BCB QE*			228331.5
			(0.08)
*US*BCB QE*			-175875.3
			(-0.16)
Financial Institution (Bank) Fixed Effect	Yes	Yes	Yes
Quarter (Time) Fixed Effect	Yes	Yes	Yes
Bank Nationality*Monetary Policy Interaction	No	No	Yes
Business Cycle (real GDP) Control	No	Yes	Yes
ρ (cons)	473227.3***	-2429260.0	-2414193.7
	(4.98)	(-1.09)	(-1.09)
observations (N)	38858	38858	38858
R^2	within = 0.0024	within = 0.0026	within = 0.0027
	between = 0.0003	between = 0.0003	between = 0.0000
	overall = 0.0001	overall = 0.0001	overall = 0.0000

Statistical Significance:
t statistics in parentheses
* p<0.1 ** p<0.05 *** p<0.01"