The Macroeconomic Effects of Macroprudential Policy

Evidence from a Narrative Approach

Diego Rojas
Carlos Vegh
Guillermo Vuletin
Abstract

This paper analyzes the macroeconomic effects of macroprudential policy—in the form of legal reserve requirements—in three Latin American countries (Argentina, Brazil, and Uruguay). To correctly identify innovations in changes in legal reserve requirements, a narrative approach—based on contemporaneous reports from the IMF and central banks in the spirit of Romer and Romer (2010)—is developed in which each change is classified into endogenous or exogenous to the business cycle. This distinction is critical in understanding the macroeconomic effects of reserve requirements. In particular, while output falls in response to exogenous increases in legal reserve requirements, it is not affected when using all changes and relying on traditional time-identifying strategies. This bias reflects the practical relevance of the misidentification of endogenous countercyclical changes in reserve requirements. The empirical frontier is also pushed along two important dimensions. First, in measuring legal reserve requirements, both the different types of legal reserve requirements in terms of maturity and currency of denomination as well as the structure of deposits are taken in account. Second, since in practice reserve requirement policy is tightly linked to monetary policy, the study jointly analyze the macroeconomic effects of changes in central bank interest rates. To properly identify exogenous central bank interest rate shocks, the Romer and Romer (2004) strategy is used.
The macroeconomic effects of macroprudential policy: Evidence from a narrative approach*

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1 Introduction

The Global Financial Crisis of 2008 triggered an intense debate on the pros and cons of using macroprudential policy, broadly defined as the use of prudential tools, such as reserve or capital requirements, to deal with systemic risk, credit/financial cycle, and macroeconomic stabilization. Although the discussion is certainly not novel – many emerging countries had resorted to macroprudential policy well before Lehman Brothers’ demise on September 15, 2008 – it took an urgent undertone in light of the sudden realization of the severe contractionary forces that could be unleashed by the abrupt unwinding of financial imbalances and systemic risk. Perhaps one of the best examples of the renewed debate on macroprudential policy is the resurgence of the so-called “Tobin tax” – a financial tax on short-term capital inflows – whose popularity had arguably reached a low point by the mid-2000’s, after gaining some limited popularity in previous decades thanks to its use by Chile.¹ The mere fact that even the IMF has come out in favor of using Tobin taxes under some circumstances is a dramatic illustration of the search for new macroprudential policy tools in the post-Lehman world (see Ostry et al., 2010).

While there is a blossoming theoretical literature (e.g., Korinek, 2011; Bianchi, Boz, and Mendoza, 2012; Bianchi, Liu, and Mendoza, 2016; Mendoza, 2016; Jiménez et al., 2017; Bianchi and Mendoza, 2018; Cizel et al., 2019; Meeks, 2017; Aikman et al., 2019), the empirical evidence on the determinants and effects of macroprudential policy has been rather limited, mainly because of the absence of readily-available panel datasets on macroprudential tools for long spans of time and the lack of sound identification strategies. In fact, many studies rely on SVAR-type, time-identification assumptions which, as will be shown in this paper, constitute a very poor identification strategy. The empirical literature has generally focused on understanding the relationship between macroprudential and monetary policy in response to external shocks as well as assessing the effectiveness of macroprudential policy.²

Most existing empirical studies, however, focus on a small set of countries (e.g., Vargas et al., 2010; Izquierdo et al., 2013) and/or a limited sample period (Gray 2011; Claessens and

¹See De Gregorio et al. (2000).
²See also Borio and Shim (2007), Vargas et al. (2010), Calderon and Serven (2014), IMF (2011), Ma et al. (2013), Montoro and Moreno (2011), De la Torre et al. (2012), Powell (2012, Chapter 6), Glocker and Towbin (2012), and Federico et al. (2014).
Ghosh, 2012). Some exceptions include, for example, Federico et al. (2014) who show – using a quarterly legal reserve requirement dataset for 52 countries dating back as early as 1970 – that macroprudential policies are much more frequently changed in developing and emerging economies (on average, once every 2 years) than in industrial countries (on average, once every 12 years). In particular, they show that in developing and emerging economies, this frequent change in macroprudential policy follows a countercyclical behavior (i.e., central banks reduce reserve requirements during episodes of capital outflows and output contractions), typically acting as a substitute of monetary policy which, unlike industrial countries, is often procyclical (i.e., central bank policy interest rates increase during episodes of capital outflows and output contractions). In other words, during bad times, for example, when capital is flowing out and credibility is at a low point, monetary policy is used in a procyclical manner in order to defend the currency and fight inflationary pressures, while macroprudential policy provides a second instrument that is used for macroeconomic stabilization purposes.

When focusing on the effects of macroprudential policy, most studies typically analyze the impact on domestic credit conditions (e.g., Montoro and Moreno, 2011; Terrier et al., 2011; Crowe et al., 2013; Lim et al., 2011; Tovar et al., 2012) and economic activity (e.g. Glocker and Towbin, 2012). However, the effectiveness of macroprudential policy as a macroeconomic stabilizing tool is still very much an open question.

The purpose of this paper is to contribute to the empirical literature on the macroeconomic effects of macroprudential policy, by focusing on legal reserve requirements (hereafter RR). The focus on RR is only natural for three main reasons: (i) RR are arguably the most common

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3Monetary policy procyclicality occurs because during episodes of capital outflows and pressures towards large depreciations occurring typically in bad times, central banks often attempt to defend the currency by increasing the policy rate. By the same token, central banks are typically reluctant to increase policy rates in good times for fear of attracting even more capital inflows. See Vegh and Vuletin (2012) for details about this monetary policy dilemma.

4In fact, this has been part of the standard IMF policy advice to developing countries. To quote Stanley Fischer, at the time of the Asian Crisis the IMF’s First Deputy Managing Director “[T]he first order of business was, and still is, to restore confidence in the currency. To achieve this, countries have to make it more attractive to hold domestic currency, which, in turn, requires increasing interest rates temporarily, even if higher interest costs complicate the situation of weak banks and corporations.”

5This was, for example, the position of the Turkish Central Bank as described in a Financial Times article on December 13th, 2010. The deputy governor argued that the way to deal with heavy capital inflows was to decrease interest rates (to reduce capital inflows and currency appreciation) while using other instruments (i.e., reserve requirements) to reduce credit growth.

6Naturally, in order for macroprudential policy to provide an effective second instrument, one would need to assume some imperfect substitutability between foreign and domestic assets (in order to create a wedge where a second instrument can operate), along the lines of Lahiri and Vegh (2003).
macroprudential tool especially in developing and emerging markets (Federico et al., 2014),
(ii) collecting time series data on RR is, in principle, “easier” than collecting data on other
prudential tools such as capital requirements (especially for long time spans), (iii) as is the case
when using cyclically-adjusted revenue measures to assess changes in tax policy (e.g., Romer
and Romer, 2010; Vegh and Vuletin, 2015; and Riera-Crichton et al., 2016), total banks'
reserves (calculated as the ratio of banks deposits at the central bank to bank deposits) are
not valid proxies for changes in policy instruments such as RR (Federico et al., 2014).7

In particular, we push the empirical frontier on several crucial dimensions. First, in terms
of measuring RR, while building upon existing data from Federico et al. (2014) that accounts
for the different types of RR in terms of maturity and currency denomination, we now con-
struct a novel metric of effective RR which also takes into account the structure of deposits.
Second, in terms of the identification of exogenous RR shocks, we develop a Romer and Romer
(2010) type of narrative for the nature of RR changes. When shocks to RR are properly iden-
tified as exogenous to the business cycle by using a narrative approach, we show that results
change dramatically. In other words, we use changes in RR exogenous to the business cycle to
analyze their macroeconomic effects, as opposed to those RR changes associated with the pol-
icy reaction function of the monetary authority to current or prospective output fluctuations.
This is the quintessential problem of reverse causality. Third, since it proves impractical to
analyze macroprudential policy in isolation, we also jointly analyze the macroeconomic effects
of the central bank policy interest rate (IR, hereafter) on the macroeconomy. To properly
identify exogenous IR shocks, we follow Romer and Romer’s (2004) approach and purge the
policy rate from systematic responses to information about future economic developments.
Given the time-consuming efforts needed to carry out the analysis along these several critical
dimensions, we focus our analysis on three Latin American countries (Argentina, Brazil, and
Uruguay) since the early 1990s.

The paper proceeds as follows. Section 2 describes the novel RR dataset and some broad
features of the data. Section 3 shows empirical evidence on the macroeconomic effects of
macroprudential and monetary policies relying on traditional time-identifying assumptions.
In line with the predictions of any standard macro model, we find a negative effect of central

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7For example, as will be discussed later in the paper, while total banks’ reserves may fluctuate due to
non-policy factors (including the structure of deposits). RR changes due to central bank policy take place, on
average, every 2 years in developing and emerging markets.
bank interest rate changes on output. Interestingly, we find a puzzling evidence regarding the effect of macroprudential policy on economic activity: macroprudential policy does not have effect on economic activity. We then turn to our new identifying strategy. To the best of our knowledge, this is the first instance in this macroprudential literature in which such a narrative approach has been used. Section 4 discusses the narrative analysis and classifies the motivation for each RR change. Using historical documents, including IMF and central banks reports, we classify changes in RR into (i) endogenous changes, which were mainly motivated by current or prospective output fluctuations (i.e., when output growth differs from normal) and (ii) exogenous changes, which were triggered by reasons exogenous to the business cycle, including microprudential factors and financial liberalization. As discussed before, since it proves impractical to analyze macroprudential policy without considering the role of monetary policy, Section 5 extends the analysis to identify unanticipated IR shocks following Romer and Romer’s (2004) approach. With our new measures of exogenous RR and IR shocks in hand, Section 6 examines their effects on output and also on market interest rate spreads (to have a sense of the transmission mechanism). These effects are estimated using Stock and Watson’s (2018) methodology. Our series of exogenous changes might only capture part of the unobserved true structural shocks due to, for example, measurement errors. While measurement errors would lead to bias if the shock were treated as the true shock, they do not compromise the validity of the shocks as an instrument. Thus, as proposed by Stock and Watson’s (2018), rather than using our series of exogenous changes directly as shocks, we use them as instruments for the original series within the local projection framework of Jorda (2005). We show that refining the identification method proves to be critical to correctly assessing the output effects of changes in reserve requirements. In particular, when properly identified, the effect of reserve requirements on economic activity is negative. That is to say, an increase in reserve requirements reduces output while a cut in reserve requirements increases it. We show that the countercyclical nature of endogenous changes in reserve requirements is at the heart of this bias. Section 7 offers some concluding remarks.
2 Reserve requirement data

Our starting point is the quarterly RR database put together by Federico et al. (2014), which identifies different types of RR in terms of maturity and currency of denomination. Based on this, we construct a metric of effective RR that also takes into account the structure of deposits for each of the three countries included in this paper (Argentina, Brazil, and Uruguay). As shown in Table 1, Panel A, we identify a total of 93 quarterly changes in RR. Specifically, Argentina, Brazil, and Uruguay changed RR on 49, 31, and 13 occasions, respectively. In other words, Argentina, Brazil, and Uruguay changed their RR, on average, about once every 7, 9, and 26 months, respectively.

To set the stage, we begin by briefly discussing some broad features of the data; in particular the varieties of RR (Section 2.1), long- and short-run properties (Section 2.2), and the variable effectively used to conduct the empirical analysis (Section 2.3).

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8The current version of this database comprises 66 countries, 15 industrial and 51 developing (see Federico et al., 2014, for details) and is available at www.guillermovuletin.com.


10Our study also uses other macroeconomic variables such as real GDP, inflation, central bank interest rates, and market interest rates, all at quarterly frequency. Most of these data were gathered from the IFS (IMF), the Global Economic Monitor (World Bank), and local sources. See Appendix 8 for a description of data and sources.
Table 1. Categories of changes in legal reserve requirements
Panel A. Total, exogenous, and endogenous changes

<table>
<thead>
<tr>
<th>Country</th>
<th>Total</th>
<th>Exogenous</th>
<th>Endogenous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina (1990:1-2018:1)</td>
<td>49</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Brazil (1994:3-2018:2)</td>
<td>31</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>Uruguay (1990:1-2018:2)</td>
<td>13</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>62</td>
<td>31</td>
</tr>
</tbody>
</table>

Panel B. Types of exogenous changes

<table>
<thead>
<tr>
<th>Country</th>
<th>Financial liberalization</th>
<th>Liquidity regulation</th>
<th>Microprudential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina (1990:1-2018:1)</td>
<td>11</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Brazil (1994:3-2018:2)</td>
<td>3</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Uruguay (1990:1-2018:2)</td>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>20</td>
<td>28</td>
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</tbody>
</table>

Panel C. Types of endogenous changes

<table>
<thead>
<tr>
<th>Country</th>
<th>Good times</th>
<th>Bad times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina (1990:1-2018:1)</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Brazil (1994:3-2018:2)</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Uruguay (1990:1-2018:2)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>18</td>
</tr>
</tbody>
</table>

Notes: See Section 4 for the identification of endogenous and exogenous changes in legal reserve requirements, and a description of each type. Source: Author's calculation. See Appendix for a detailed description of data sources.
2.1 Varieties of legal reserve requirements

Figure 1 illustrates the varieties of RR in our sample: (i) RR that vary according to maturity (the case of Brazil) and (ii) RR that vary according to both maturity and currency of denomination (the cases of Argentina and Uruguay). The existence of RR based on currency of denomination in many developing countries should perhaps come as no surprise given the widespread phenomenon of “dollarization” or, more broadly, foreign currency deposits. As a general rule, short-term deposits (i.e., demand deposits) as well as foreign currency deposits are typically associated with higher RR than longer-term local-currency based deposits. For example, the historical average RR on demand deposits in Brazil has been 53 percent compared to about 19 and 17 percent for savings and term deposits, respectively. This differential RR structure has been aimed at, naturally, guaranteeing more liquidity in banks for short-term deposits. Regarding currency denomination, in Uruguay, for example, the average RR for deposits in local currency has been 9 percent compared to about 15 percent for foreign currency deposits. This differential reflects concerns with sudden reversals in foreign currency flows (Quizpe and Rossini, 2010) that may spell trouble for the banking sector due to currency mismatches in banks’ balance sheets (Reinhart et al., 2003).

2.2 Long- and short-run properties of legal reserve requirements

To get an idea of how RR have evolved over time, Figure 2 plots the simple average and standard deviation of RR for each country. With the exception of Uruguay which, compared to other developing countries, has been relatively open from a financial point of view, Argentina and Brazil show a declining trend in their average RR, reflecting financial liberalization and financial deepening. The average RR has decreased in Argentina and Brazil from values close to 30 and 50 percent in the mid-1990s to 19 and 26 percent in 2018, respectively. We also see an increase in average RR during 2005-2010, reflecting the greater reliance on macroprudential policy in the period surrounding Lehman’s fall on September 15, 2008. Another general feature – particularly in Argentina and Brazil – has been an important reduction in the dispersion of RR associated with different types of deposits. For example, while in 1995 RR in Brazil ranged from 90 percent on demand deposits to 27 percent on term deposits, the range had narrowed to between 40 and 34 percent in 2018.
Figure 1: Levels of legal reserve requirements

Panel A. Argentina

Panel B. Brazil

Panel C. Uruguay

Source: See Appendix for a detailed description of data sources.
Figure 2: Mean and standard deviation of legal reserve requirements

Panel A. Argentina

Panel B. Brazil

Panel C. Uruguay

Source: Author’s calculation. See Appendix for a detailed description of data sources.
How synchronized are changes in different types of RR? Figure 3 shows the change in RR for each country. While the levels of RR tend to vary across different categories of deposits (Figure 1), their changes appear to be positively related (Figure 3). Indeed, in virtually all cases we cannot reject the null hypothesis that such correlations are positive and statistically significant (Table 2). Naturally, this high degree of synchronicity and positive association in changes in RR implies that changes in the simple average of RR is highly related to simultaneous changes in RR for different types of categories of deposits (Table 2).
Figure 3: Changes in legal reserve requirements

Panel A. Argentina

Panel B. Brazil

Panel C. Uruguay

Source: Author’s calculation. See Appendix for a detailed description of data sources.
### Table 2. Correlation between changes of legal reserve requirements

#### Panel A. Argentina: 1990:1-2018:1

<table>
<thead>
<tr>
<th></th>
<th>Δ local-demand RR</th>
<th>Δ local-saving RR</th>
<th>Δ local-term RR</th>
<th>Δ foreign-demand RR</th>
<th>Δ foreign-saving RR</th>
<th>Δ foreign-term RR</th>
<th>Δ average RR</th>
<th>Δ ERR</th>
<th>Δ ECRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ local-demand RR</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Δ local-saving RR</td>
<td>0.52***</td>
<td>1</td>
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<tr>
<td>Δ local-term RR</td>
<td>0.44*** 0.43***</td>
<td>1</td>
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<tr>
<td>Δ foreign-demand RR</td>
<td>0.66*** 0.68*** 0.39***</td>
<td>1</td>
<td></td>
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<tr>
<td>Δ foreign-saving RR</td>
<td>0.42*** 0.70*** 0.31*** 0.99***</td>
<td>1</td>
<td></td>
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<tr>
<td>Δ foreign-term RR</td>
<td>0.37*** 0.27*** 0.67*** 0.71*** 0.98***</td>
<td>1</td>
<td></td>
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<tr>
<td>Δ average RR</td>
<td>0.57*** 0.77*** 0.64*** 0.92*** 0.91*** 0.77***</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>Δ ERR</td>
<td>0.77*** 0.61*** 0.69*** 0.74*** 0.90*** 0.95*** 0.85*** 1</td>
<td></td>
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<tr>
<td>Δ ECRR</td>
<td>0.78*** 0.86*** 0.70*** 0.82*** 0.79*** 0.59*** 0.96*** 0.90*** 1</td>
<td></td>
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</table>

#### Panel B. Brazil: 1994:3-2018:2

<table>
<thead>
<tr>
<th></th>
<th>Δ demand RR</th>
<th>Δ saving RR</th>
<th>Δ term RR</th>
<th>Δ average RR</th>
<th>Δ ERR</th>
<th>Δ ECRR</th>
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<tbody>
<tr>
<td>Δ demand RR</td>
<td>1</td>
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<tr>
<td>Δ saving RR</td>
<td>0.29*** 1</td>
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<tr>
<td>Δ term RR</td>
<td>0.22*** 0.30*** 1</td>
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<tr>
<td>Δ average RR</td>
<td>0.78*** 0.02*** 0.72*** 1</td>
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<tr>
<td>Δ ERR</td>
<td>0.43*** 0.62*** 0.16 0.51*** 1</td>
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<tr>
<td>Δ ECRR</td>
<td>0.73*** 0.65*** 0.75*** 0.99*** 0.52*** 1</td>
<td></td>
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</table>


<table>
<thead>
<tr>
<th></th>
<th>Δ local-demand RR</th>
<th>Δ local-saving RR</th>
<th>Δ local-term RR</th>
<th>Δ foreign-demand RR</th>
<th>Δ foreign-saving RR</th>
<th>Δ foreign-term RR</th>
<th>Δ average RR</th>
<th>Δ ERR</th>
<th>Δ ECRR</th>
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<tbody>
<tr>
<td>Δ local-demand RR</td>
<td>1</td>
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<td></td>
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<tr>
<td>Δ local-saving RR</td>
<td>0.88*** 1</td>
<td></td>
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<tr>
<td>Δ local-term RR</td>
<td>0.57*** 0.78***</td>
<td>1</td>
<td></td>
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<tr>
<td>Δ foreign-demand RR</td>
<td>0.42*** 0.01 0.01 1</td>
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<tr>
<td>Δ foreign-saving RR</td>
<td>0.42*** 0.01 0.01 1</td>
<td></td>
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</tr>
<tr>
<td>Δ foreign-term RR</td>
<td>0.25*** -0.63 -0.01 0.80*** 0.88*** 1</td>
<td></td>
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</tr>
<tr>
<td>Δ average RR</td>
<td>0.65*** 0.36*** 0.76*** 0.70*** 0.76*** 0.66***</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Δ ERR</td>
<td>0.59*** 0.65 0.15 0.59*** 0.56*** 0.83*** 0.83*** 1</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Δ ECRR</td>
<td>0.54*** 0.15 0.12 0.99*** 0.99*** 0.88*** 0.85*** 0.99*** 1</td>
<td></td>
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</tbody>
</table>

Notes: RR, ERR, and ECRR stand for legal reserve requirement, effective legal reserve requirement, and effective constant legal reserve requirement, respectively. See Section 2.3 for details regarding the construction of ERR and ECRR.

Source: Author’s calculation. See Appendix for a detailed description of data sources.
2.3 Effective legal reserve requirements

While central banks’ macroprudential policy tools involve the selection of RR for different types of categories of deposits (for example, their maturity and currency of denomination), a proper metric to evaluate its impact on the macroeconomy should also consider the structure of deposits. Much like the average marginal income tax rate measure on the income tax front (e.g., Romer and Romer, 2010), an effective RR measure should weight the RR for each different type of category of deposits based on the importance of each type of deposit as a proportion of total deposits in the system:

\[
effective \text{ RR}_t = \sum_i RR_i \omega_{it}, \quad i = 1, \ldots, N
\]

\[
\omega_{it} = \frac{Deposit_{it}}{Total \ deposits_t},
\]

where \(i\) is the category of maturity and currency (e.g., demand deposits in local currency) and \(t\) is the time (defined by year and quarter). Since such effective RR measure could change over time due to changes in RR (i.e., \(\Delta RR_i\)) and/or may also fluctuate due to changes in non-policy factors such as changes in the structure of deposits (i.e., \(\Delta \omega_{it}\)), we propose to use an effective measure of RR with constant weights based on the historical average structure of deposits for the empirical analysis regarding the macroeconomic effects of macroprudential policy:

\[
effective \text{ constant } RR_t = \sum_i RR_i \times \overline{\omega}_i, \quad i = 1, \ldots, N
\]

\[
\overline{\omega}_i = \frac{1}{T} \sum_t \frac{Deposit_{it}}{Total \ deposits_t}, \quad t = 1, \ldots, T
\]

Figure 4 shows the change in this new measure for each country. Interestingly, Table 2 also shows that the correlation between effective RR (ERR, hereafter) and effective constant RR (ECRR, hereafter) is extremely high for all countries analyzed pointing that, in practice, most of the sources of changes in ERR is due to changes in RR as opposed to changes in the structure of deposits.

Moreover, it is worth noting that changes in ERR and ECRR are tightly related to changes in total banks’ reserves, calculated as the ratio of banks’ deposits at the central bank to banks’
deposits (which includes both mandatory and voluntary banks’ reserves). For Argentina, Brazil, and Uruguay, the correlation coefficients between exogenous changes in ECRR and changes in total banks’ reserves are 0.31, 0.68, and 0.99, respectively (statistically significant at the one percent level in all cases). This suggests that exogenous ECRR changes are important determinants of changes in total banks’ reserves.

3 Evidence from traditional identification strategy

Before turning to the new identifying strategy, this section relies on the traditional time identifying strategy used in the monetary policy (Leeper et al., 1996; Bernanke et al., 1997, 2005; Christiano et al., 1999) and the macroprudential policy (Lim et al., 2011; Tovar et al., 2012; Glocker and Towbin, 2012) literatures, which assume that innovations in central bank policies have no contemporaneous effects on macroeconomic outcomes.11

We first estimate the effects of monetary and macroprudential policies on economic growth using quarterly data and the following panel SVAR:12

\[ A_0 \Delta Y_{i,t} = \sum_{l=1}^{4} A_l \Delta Y_{i,t-l} + \alpha_i + \mu_{i,t}, \]

where subscripts \( i \) and \( t \) denote country and time, respectively, \( A \) are matrices of parameters, \( \alpha_i \) is the country fixed effect, \( \Delta Y \) is a vector composed by real GDP growth rate, inflation, \( \Delta ECRR^{all} \) (the percentage point change in effective constant legal reserve requirement), and \( \Delta IR^{all} \) (the percentage point change in the central bank interest rate), in that order, and \( \mu \) is the error term.13,14 It is important to note that for now (i.e., when evaluating the evidence

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11See Coibion (2012) for an excellent review and a discussion of the limitations of this approach for the case of the monetary policy in the United States.

12While the empirical monetary literature in the United States and other industrial countries has mostly relied on the use of monthly data (typically using industrial production as a proxy for economic activity), this is not the dominant approach when focusing on developing countries (e.g., Disyatat and Vongsinsirikul, 2003; Le, 2009). First, for many developing countries monthly industrial production is unavailable or available only very recently. For example, while Argentine monthly industrial production is available at best since early 2000s, quarterly real GDP is available since 1990. Even when available, the quality and/or relevance of industrial production monthly data, in particular as a proxy for economic activity, is doubtful. For example, while both quarterly and annual data indicate that Argentina grew 4.1 percent in 2008, monthly data suggest a drastic fall of 12.7 percent.

13For the IR we use the monetary policy rate published by the central bank in the case of Argentina, the SELIC rate in the case of Brazil, and the money market rate in the case of Uruguay. See Appendix 8 for details.

14We use four lags. Our results for the case of eight lags remain almost the same as in the four-quarter
Figure 4: Change in effective constant legal reserve requirements

Panel A. Argentina

Panel B. Brazil

Panel C. Uruguay

Notes: ECRR stands for effective constant legal reserve requirement. See Section 2.3 for details regarding the construction of ECRR.

Source: Author’s calculation. See Appendix for a detailed description of data sources.
from traditional identification strategy), all changes in ECRR and IR are used to identify macroprudential and monetary shocks (as opposed to exogenous ones). $A_0$ is assumed to be a lower triangular matrix with ones on the diagonal. In other words, while both central bank policy instruments can respond to real GDP growth and inflation contemporaneously, the opposite is not allowed (and can only occur with one quarter lag). In particular, in the Cholesky decomposition the orthogonalized IRFs are calculated by ordering GDP growth first followed by inflation, changes in reserve requirements, and changes in the policy rate.\textsuperscript{15} Figure 5 shows our findings.\textsuperscript{16} We find a negative effect of IR on economic activity (Panel B). In particular, a one percentage-point increase in IR reduces output up by $-0.47$ ($se = 0.21$) percentage points after a year of the shock. Interestingly, we find a puzzling result (i.e., contrary to the predictions of any standard macro model) regarding the effect of RR on economic activity (Panel A): increases in reserve requirements do not have a negative effect on economic activity (i.e., the effect is statistically zero).

What if changes in macroprudential and monetary policies were allowed to affect economic activity within the same quarter? We now estimate the effects of monetary and macroprudential policies on economic growth using the single-equation approach proposed by Jordà (2005) and Stock and Watson (2007), which is based on linear “local projections” (LP). The use of LP provides several advantages over the traditional SVAR methodology pioneered by Blanchard-Perotti (2002). Specifically, LP can be estimated by single-regression techniques (least-squares dummy variables, LSDV, in our case) and are more robust to potential misspecifications. The cumulative response of output growth at the horizon $h$ is estimated based

\textsuperscript{15}Our results are robust to changing the ordering between reserve requirements and the policy rate, and between inflation and GDP growth.

\textsuperscript{16}In all regressions, the quarters surrounding the Argentina 2001-2002 crisis (specifically, 2001:4, 2002:1, and 2002:2) were eliminated because they represent extreme outliers in terms of the GDP growth. The fall in GDP for 2002:1 was 11.3 percent. This figure is about twice as large as the next largest fall in GDP observed in the sample. Results do not change qualitative and are not shown for the sake of brevity.
Figure 5: Cumulative response of GDP, not allowing for a contemporaneous effect of IR and ECRR changes. Using SVAR

Panel A. Response of GDP to ECRR

Panel B. Response of GDP to IR

Notes: IR and ECRR stand for central bank interest rate and effective constant reserve requirement, respectively. Impulse response function following the panel SVAR described in Section 3. Dark, medium, and light grey areas show 68, 90, and 95 percent confidence intervals, respectively. Confidence intervals based on 1000 Monte-Carlo simulations.

Source: Author’s calculation. See Appendix for a detailed description of data sources.
on the following regression:

\[
\Delta y_{i,t+h} = \alpha_{i,h} + \beta_h \Delta ECR R^\text{all}_{i,t} + \delta_h \Delta I R^\text{all}_{i,t} + \sum_{l=1}^{4} \left( \psi_{l,h} \Delta ECR R^\text{all}_{i,t-l} + \theta_{l,h} \Delta I R^\text{all}_{i,t-l} \right) + \\
+ \sum_{l=1}^{4} (\lambda_{l,h} \Delta y_{i,t-l} + \phi_{l,h} \pi_{i,t-l}) + \sum_{l=0}^{h-1} \left( \omega_{l,h} \Delta ECR R^\text{all}_{i,t+h-l} + \nu_{l,h} \Delta I R^\text{all}_{i,t+h-l} \right) + \\
+ \mu_{i,t+h},
\]

(1)

Unlike SVAR specifications, the estimated coefficients contained in the polynomial lags associated with \( \psi_h \) and \( \theta_h \) are not used directly to build the impulse response function (IRF) values but only serve as controls, “cleaning” the \( \beta_h \) and \( \delta_h \) coefficients from the dynamic effects of output and inflation and the effects of past changes in ECRR and IR.\(^{17}\) It is important to note that, in this LP approach, each step in the cumulative IRF is obtained from a different individual equation. Defining \( \Delta y_{i,t+h} \) as the cumulative output growth from \( t-1 \) to \( t+h \) (i.e., \( \Delta y_{i,t+h} = y_{i,t+h} - y_{i,t-1} \)), the cumulative IRF values are obtained directly from the \( \beta_h \) and \( \delta_h \) estimated coefficients at each time horizon \( h \). Therefore, each coefficient \( \beta_h \) and \( \delta_h \) represents the step in the cumulative IRF at a forward time \( h \) and is read as the accumulated response of output growth to a one percentage point increase in effective constant reserve requirements or central bank interest rate, respectively. In order to correct for the potential bias in the local projections estimator when ignoring shocks occurring between periods \( t+1 \) and \( h \), we add a vector of leads of our main shocks (see Teulings and Zubanov, 2014).

Note that now, unlike the SVAR specification above, contemporaneous changes in effective constant reserve requirements and central bank interest rates are allowed to affect economic activity in the same quarter. Figure 6 shows our findings. While we continue to find a negative effect of IR on economic activity (Panel B), we still find no effect of RR on economic activity (Panel A).\(^{18}\) In sum, so far, we seem to find robust evidence that, based on a traditional identification strategy, policy rates have a negative effect on output, yet macroprudential policy does not have a negative effect on economic activity (i.e., the effect is statistically

\(^{17}\)Moreover, according to Montiel Olea and Plagborg-Møller (2021), lag augmentation obviates the need to correct standard errors for serial correlation.

\(^{18}\)The same qualitative results are found from a SVAR that allows for GDP growth to response within the same quarter to changes in effective constant reserve requirements and the central bank interest rate (i.e., from an SVAR using a Cholesky decomposition in which the policy instruments (RR and IR) are ordered before inflation and GDP growth).
4 New measure of reserve requirement shock

This section presents a new narrative-based measure of reserve requirement changes à la Romer and Romer (2010). Subsection 4.1 presents the criteria and sources to identify the motivation for each RR change. Armed with this classification scheme, Subsection 4.2 presents the new measure of RR shocks resulting from applying the criteria.

4.1 Sources and identifying motivation

The sources of the narrative analysis are primary documents issued by policymakers both at international and country institutions at the time. Our key sources are IMF reports including Staff Reports and Recent Economic Developments, as well as central banks’ documents including working papers and monetary and financial stability reports, among others. Following Romer and Romer’s (2010) identification strategy, changes in RR are differentiated between those that were mainly motivated by current or projected fluctuations in output, which we will call endogenous, from those that were triggered by other reasons, which we will call exogenous. In the rest of this subsection, we present our categorization strategy and also provide, as examples, shorter versions of some of the narratives which are fully developed in the Online Appendix.

Endogenous changes in reserve requirements are typically implemented to offset developments that would cause output growth to differ from trend. This includes macroprudential cases where policymakers were intentionally responding to current or projected economic activity, including those events related to fluctuations in capital flows. What follows is a brief description of two episodes of changes in RR that took place in Argentina. They involved an increase in RR in 1993 (during the Convertibility Plan euphoria) and a series of decreases in RR in 1995 (right after the Tequila crisis) and are categorized as endogenous (good times) and endogenous (bad times), respectively.

Endogenous (good times): In the third quarter of 1993, RR increased on all deposits by 3 percentage points. The strong economic upswing that followed the adoption of the Convertibility Plan in March 1991 continued at a more moderate pace in 1993, as real GDP
Figure 6: Cumulative response of GDP, allowing for a contemporaneous effect of IR and ECRR changes. Using LP

Panel A. Response of GDP to ECRR

Panel B. Response of GDP to IR

Notes: IR and ECRR stand for central bank interest rate and effective constant reserve requirement, respectively. Impulse response function following the Local-Projection (LP) model described by equation (1) of Section 3. Dark, medium, and light grey areas show 68, 90, and 95 percent confidence intervals, respectively. Standard errors clustered at country level.

Source: Author’s calculation. See Appendix for a detailed description of data sources.
rose by about 6 percent and consumer price inflation declined to 7.4 percent (from 18 percent in the previous year). A high real interest rate continued attracting capital inflows, which exceeded the external current account deficit by a large margin and gross international reserves increased by more than US$4 billion to over US$15 billion by the end of 1993. As a result, the peso appreciated 5.5 percent, and merchandise imports grew by 13 percent whereas exports rose by around 7 percent. Two important developments added fuel to this scenario of high growth and trade and current account deficits: the privatization of the state oil company (YPF), which raised about US$2 billion from abroad, and the floating of over US$1 billion of government bonds in December 1993. On the fiscal side, excluding privatization proceeds, the economy registered a primary fiscal surplus of 1.8 percent of GDP. This increase in RR, intended to cool off the economy and sterilize the capital inflow, is categorized as endogenous (good times).

Endogenous (bad times): Four years of rapid economic growth fueled by large private capital inflows came to an end in the first few months of 1995, when the Mexican crisis triggered an outflow of capital from Argentina that in turn precipitated a sharp contraction in domestic demand and activity. The capital outflow was reflected in a decline of almost US$8 billion in deposits in the Argentine banking system (or around 18 percent of total deposits) between late December 1994 and mid-May 1995, a sharp decline in the stock and bond markets, and a surge in interest rates. The financial crisis in the first half of 1995 weakened the financial system. The Central Bank responded to these events by lowering reserve requirements on several occasions during 1995 in order to strengthen the banking system’s liquidity position and promote lower interest spreads.

*Exogenous changes in reserve requirements* are those not taken to offset factors pushing growth away from normal. We group these changes under 3 categories: financial liberalization, microprudential purposes, and liquidity regulation. The quintessential exogenous change would be due to financial liberalization considerations; that is, a reduction in RR motivated by a belief that lower RR will increase private credit and output in the long run. Such an action is completely different from the stabilization measures discussed above because the goal is to raise normal growth, not to offset shocks that may lead to below-normal growth. For example, in early 1990s, Argentina gradually reduced their RR from 79 percent in 1992 to about 40 percent in early 1993. In those years, the authorities continued their efforts to
bring about a transformation of the structures and institutions of the economy, moving away from decades of overregulation and state intervention and toward a flexible, dynamic, and open economy based on private initiative.

On other occasions, central banks change RR for microprudential regulation purposes including measures aiming at improving financial intermediation as well as guaranteeing the solvency of the financial system. For example, while the financial markets in Uruguay are closely linked to international markets, the financial system continued in early 1991 to be characterized by a wide spread between lending and deposit rates in domestic currency. In the third quarter of 1991, the Central Bank of Uruguay reduced the RR on local currency demand and savings deposits by 2 percentage-points to narrow this spread and facilitate financial intermediation.

Another reason not associated to actions aiming at stabilizing output is related to the use of RR for liquidity regulation purposes. In these cases, central banks change RR to affect market’s liquidity needs in an effort to ease pressure on inflation, exchange rate, and interest rates. For example, in March 1999, the Central Bank of Brazil increased the RR on term deposits from 20 percent to 30 percent. The confidence crisis that resulted from the financial problems faced by Russia and Asia in 1997-1998, together with increased concerns about debt sustainability, led to capital flowing out of Brazil and ended with the floating of the exchange rate in January 1999. As a result, the year 1999 saw stagnant growth and flat/contracting domestic demand. At that time, a new policy framework was envisaged to keep inflation under control without further compromising the fiscal accounts. To attain such an objective, the authorities implemented in the first quarter of 1999 various monetary policy measures, which included changes in RR. In particular RR on term deposits were raised from 20 percent to 26.5 percent on March 5th 1999, and further increased to 30 percent on March 12th 1999.

4.2 Applying the criteria

Panel A in Table 1 shows that out of a total of 93 quarterly RR changes, our narrative analysis identifies 62 as exogenous and 31 as endogenous. Panel B indicates that less than half of exogenous changes (28 out of 62) are associated with microprudential arguments. The remaining 34 exogenous cases are split between financial liberalization (14) and liquidity
regulation (20). Panel C shows that almost 60 percent of endogenous changes (or 18 out of 31) are associated with bad times and the remaining cases with good times.

Figure 7 shows endogenous and exogenous changes in the ECRR measure for each country, as well as the composition of endogenous changes into those corresponding to measures aiming at offsetting output fluctuations in good and bad times. Macropudrential use of RR (i.e., endogenous changes) has been common in our three Latin American economies in the period surrounding the 2008 global crisis. Interestingly, yet not surprisingly, the use of RR for macroprudential (i.e., output stabilization) purposes has not been, by any means, a recent phenomenon as some of the latest papers in the literature seem to suggest. Changes in RR have been frequently used for countercyclical purposes in the past. For example, the central banks of Argentina and Brazil actively used them before and after the financial crisis of 1995. Argentina also reduced the RR on several occasions in 2001 in an attempt to stimulate economic activity after several quarters of negative output growth.

5 New measure of central bank interest rate shock

The exogenous shock to the interest rate is calculated based on the strategy proposed by Romer and Romer (2004) and relying on data from the World Economic Outlook (WEO) historical forecast data. This dataset contains 2-years of historical data and 6-years of forecast data, for three variables: GDP growth, inflation, and the current account balance as percent of GDP. The 6-years of forecast data appear twice every year, once in the Spring and once in the Fall. For instance, in 1991 there is historical data for 1989 and 1990 as well as forecast data for the years 1991-1996 that were projected in the Spring and in the Fall.19

The Spring forecast of inflation and GDP growth is used as the forecast for the second and third quarters while the Fall forecast is taken as the forecast for the fourth and first quarter. In the spirit of Romer and Romer (2004), the change in the policy rate for each country is regressed on two lags of inflation, GDP growth, the policy rate, and on (2-quarter) forecasted values for inflation, the growth rate as well as changes in lags and in forecasted values of these variables. The residuals from this regression represent the exogenous shocks to the policy rate

19The WEO historical data used in this paper corresponds to the April 17, 2018 update. This version does not have inflation forecast for Argentina in 2014.
Figure 7: Endogenous and exogenous changes in effective constant reserve requirements (ECRR)

Panel A. Argentina: Endogenous and exogenous

Panel B. Argentina: Endogenous, good and bad times

Panel C. Brazil: Endogenous and exogenous

Panel D. Brazil: Endogenous, good and bad times

Panel E. Uruguay: Endogenous and exogenous

Panel F. Uruguay: Endogenous, good and bad times

Notes: ECRR stands for effective constant legal reserve requirement. See section 2.3 for details regarding the construction of ECRR and Section 4 for the identification of endogenous and exogenous changes in legal reserve requirements.

Source: Author’s calculation. See Appendix for a detailed description of data sources.
(i.e., $\Delta IR^{\text{exog}}$). Specifically, for each country, we run the regression

$$\Delta IR_t = \theta_0 + \theta_1 IR_{t-1} + \theta_2 IR_{t-2} + \sum_{k=-2}^{2} (\omega_k \pi_{t+k} + \delta_k D\pi_{t+k} + \beta_k \Delta y_{t+k} + \gamma_k D\Delta y_{t+k}) + \mu_t, \quad (2)$$

where $\pi$ represents inflation and $DX_{t+k} = X_{t+k} - X_{t+k-2}$ for variable $X$. The residuals from the above regression are used as our policy rate shock. This shock purges the policy rate from systematic responses to information about future developments. In other words, these residuals show changes in the policy rate that are not taken in response to information about future economic developments. Figure 8 shows the findings for each country.

6 Evidence from new identification strategy

Armed with our new measures of exogenous macroprudential shocks (Section 4) and monetary policy shocks (Section 5), we now re-examine the effects of these policies on economic activity. In light of the discussion in, for example, Stock and Watson (2008, 2012, 2018), Mertens and Ravn (2013, 2014), and Ramey (2016), we know that our series of exogenous changes based on the narrative approach captures only part of the unobserved true structural shocks due to measurement errors. While measurement errors would lead to bias if the shock is treated as the true shock, they do not compromise the validity of the shocks as an instrument. Therefore, rather than using our series of exogenous changes directly as shocks, we use them as instruments for the original series.\footnote{Note that here we use the fact that only two forecasts (Spring and Fall) are available per year.} Specifically, we follow the strategy put forward in Stock and Watson (2018) and use our measure of exogenous changes as an external instrument in the framework of local projection regressions.

For our series of exogenous changes based on the narrative approach to be a good instrument, it should: (i) be relevant (i.e., they should be correlated with the changes in the original monetary and reserve requirement series), (ii) be contemporaneously exogenous (i.e., not contemporaneously correlated with other shocks), and (iii) present lead-lag exogeneity (i.e., be uncorrelated with past and future shocks) or, in other words, not be linearly predictable given past values of the structural shocks (see Stock and Watson, 2018). We implement this

\footnote{If our series of exogenous changes are used directly as shocks, results are very similar. Results are not shown for the sake of brevity.}
Figure 8: Endogenous and exogenous changes in central bank interest rate (IR)

Panel A. Argentina

Panel B. Brazil

Panel C. Uruguay

Notes: IR stands for central bank interest rate. See Section 5 for the identification of exogenous and endogenous changes in central bank interest rates. Results based on equation (3).
Source: Author’s calculation. See Appendix for a detailed description of data sources.
approach by estimating the following regression for each horizon $h$:

$$
\Delta y_{i,t+h} = \alpha_{i,h} + \beta_h \Delta ECRR_{i,t}^{all} + \delta_h \Delta IR_{i,t}^{all} + \sum_{l=1}^{4} \left( \psi_{l,h} \Delta ECRR_{i,t-l}^{all} + \theta_{l,h} \Delta IR_{i,t-l}^{all} \right) + \\
+ \sum_{l=1}^{4} \left( \lambda_{l,h} \Delta y_{i,t-l} + \phi_{l,h} \pi_{i,t-l} \right) + \sum_{l=0}^{h-1} \left( \omega_{l,h} \Delta ECRR_{i,t+h-l}^{exog} + \nu_{l,h} \Delta IR_{i,t+h-l}^{exog} \right) + \\
+ \mu_{i,t+h},
$$

(3)

where the variables $\Delta ECRR_{i,t}^{all}$ and $\Delta IR_{i,t}^{all}$ are instrumented by their exogenous counterparts. As pointed out above, the narratives are constructed such that this instrument is (contemporaneously) exogenous. Several issues are worth noting before turning to our findings. The first stage results suggest that they are relevant. Table 3 presents the Montiel and Pflueger’s (2013) effective F-value as well as its critical value and Shea’s partial $R^2$ for each horizon $h$. For both instruments, the effective F-value is much greater than its critical value and the partial $R^2$s are relatively high, pointing that our instruments are relevant. Furthermore, according to Stock and Watson (2018), for lag-exogeneity to hold, the instruments should be unforecastable by (a linear regression of them on) lags of the variables in the model. Table 4 presents the F statistics and the $R^2$ of running a linear regression of our instruments $\Delta ECRR_{i,t}^{exog}$ and $\Delta IR_{i,t}^{exog}$ on four lags of real GDP growth, inflation, $\Delta ECRR_{i,t}^{all}$ and $\Delta IR_{i,t}^{all}$, for each country and all together as a panel. The low values of the $R^2$ as well as not significant F tests indicate that our instruments are not (linearly) forecastable by lags of the variables in the system. That is to say, lag-exogeneity holds for our instruments. In light of these supporting findings, the model (3) is estimated using the exogenous changes in RR and in the policy rates as instruments.
Figure 9 presents the results from this empirical strategy. Unlike the findings based on the traditional time-identifying approach of Section 3, Panel A in Figure 9 shows a negative effect of RR changes on economic activity. In particular, a one percentage-point increase in ECRR reduces output by $-0.11$ (se = 0.02) percent after two quarters. These findings differ substantially from those obtained in Section 3 when using all ECRR changes and/or the time-identifying strategy (Panels A in Figures 5 and 6). In those cases, changes in ECRR do not have a negative effect on economic activity. This striking difference shows in a very clear way
the practical relevance regarding the strategy used to identifying policy innovations that are free of endogenous movements in ECRR. Panel B in Figure 9 shows, as in previous findings, that there is a fall in economic activity in response to a policy rate increase. Interestingly, the fall in economic activity in response to a policy rate increase is smaller (in absolute value) under the new identification approach than under the traditional time-identifying strategy from shown in Panel B in Figure 5.

Panels C and D in Figure 9 shed some light regarding the transmission mechanism through which changes in ECRR and IR affect the economy. In line with the predictions of any standard macro model, increases in ECRR and IR increase the market interest rate spread (defined as lending minus deposit interest rates) especially in the short and long run, respectively.

6.1 Biases due to misidentification

Why is the effect of macroprudential policy on output negative when using properly identified exogenous changes and zero when relying on the traditional approach? In other words, what is the nature of the bias associated with the misidentification?

To illustrate this point, we now estimate the cumulative response of output growth at the horizon $h$ using the following regression:

$$
\Delta y_{i,t+h} = \alpha_{i,h} + \beta_h \Delta ECRR_{i,t}^{endog} + \delta_h \Delta IR_{i,t}^{endog} + \sum_{l=1}^{4} \left( \psi_{l,h} \Delta ECRR_{i,t-l}^{all} + \theta_{l,h} \Delta IR_{i,t-l}^{all} \right) + \\
\sum_{l=1}^{4} \left( \lambda_{l,h} \Delta y_{i,t-l} + \phi_{l,h} \pi_{i,t-l} \right) + \sum_{l=0}^{h-1} \left( \omega_{l,h} \Delta ECRR_{i,t+1+h-l}^{endog} + \nu_{l,h} \Delta IR_{i,t+1+h-l}^{endog} \right) + \mu_{i,t,h},
$$

which is identical to specification (1) except that endogenous changes in ECRR and IR are used to identify the shock. Of course, by construction, this is a faulty strategy precisely because these policy changes are contaminated with endogeneity considerations. Yet we still use this approach solely with the purpose of illustrating the source of bias due to misidentification behind the traditional approach.

Figure 10 shows the findings. Panel A illustrates the fact that, relying on endogenous macroprudential policy, increases in ECRR seem to be positively correlated with economic activity. This suggests that reserve requirements have been used countercyclically along the
IR and ECRR stand for central bank interest rate and effective constant reserve requirement, respectively. Impulse response function following the Instrumental-Variable Local-Projection (IV-LP) strategy described in Section 6. Results based on equation (3) of the main text using the exogenous changes in legal reserve requirements and in the policy rate as instruments. Dark, medium, and light grey areas show 68, 90, and 95 percent confidence intervals, respectively. Standard errors clustered at country level. The market interest rate spread is defined as the difference between the lending and the deposit interest rates.

Source: Author’s calculation. See Appendix for a detailed description of data sources.
business cycle, decreasing in bad times and increasing in good times. This countercyclical
evidence of endogenous changes in RR is in line with the findings for developing countries
of Federico et al. (2014). This important source of bias due to misidentification will tend
to underestimate the negative effects of changes in ECRR policy on output when compared
to the traditional time-identifying strategy (much like we observe in Panel A in Figure 5).
In contrast, for central bank interest rate policy, the findings shown in Panel B in Figure 10
suggest that endogenous changes in IR are essentially procyclical on impact. This procyclical
evidence of endogenous changes in IR is consistent with the typical finding in developing
economies from Vegh and Vuletin (2012) and Federico et al. (2014). This important source
of bias due to misidentification will tend to overestimate the negative effects of changes in IR
on output when compared to the traditional time-identifying strategy (much like we observe
in Panel B in Figure 5). These findings reinforce our arguments that the mere use of timing
assumptions to identify innovations in macroprudential and monetary policies proves to be a
poor identification strategy.

7 Conclusions

This paper has brought to light novel evidence on the macroeconomic effects of macroprudential policy. The main contribution of the paper has been to correctly identify innovations in reserve requirements by following a narrative approach (based on contemporary reports from the IMF and Central Banks) that allows us to distinguish between changes in reserve requirements exogenous to the business cycle from endogenous ones. We also push the frontier on the measurement front by creating a novel effective reserve requirement measure that takes into account the structure of deposits as well as on the identification of monetary policy shocks by creating a new central bank interest rate shock series based on Romer and Romer’s (2004) approach. We show that identification via the narrative approach turns out to be critical in assessing the output effects of changes in reserve requirements. In particular, when properly identified, an increase in reserve requirements leads to a fall in output. In contrast, when traditional time-based identification methods are followed, an increase in reserve requirements has no effect on output. We show that the countercyclical nature of endogenous changes in reserve requirements is at the heart of this bias.
Figure 10: Cumulative response of GDP to IR and ECRR endogenous changes.

Panel A. Response of GDP to ECRR

Panel B. Response of GDP to IR

Notes: IR and ECRR stand for central bank interest rate and effective constant reserve requirement, respectively. Impulse response function following the Local-Projection (LP) model described by equation (4) of Section 6.1. Dark, medium, and light grey areas show 68, 90, and 95 percent confidence intervals, respectively. Standard errors clustered at country level.

Source: Author’s calculation. See Appendix for a detailed description of data sources.
References


[22] International Monetary Fund. Western Hemisphere Department. 2011. Regional Economic Outlook, October 2011, Western Hemisphere: Shifting Winds, New Policy Challenges. IMF.


8 Appendix. Definition and sources of variables

All data are at quarterly frequency.

**Real GDP**: Data is from the Global Economic Monitor, World Bank, and national central banks. GDP is seasonally adjusted.

**Monetary policy rate**: We take short-term interest rates as a proxy for the stance of monetary policy. For Brazil we used the SELIC. The SELIC is the target rate for overnight interbank loans collateralized by government bonds, registered with and traded on the Sistema Especial de Liquidacao e Custodia (IFS/IMF). For Argentina we used the monetary policy rate from the central bank. For Uruguay we used the money market rate, i.e. the overnight rate on loans between private banks (IFS, IMF). Data is from IFS/IMF and national central banks.

**Interest rate spread**: Lending minus deposit interest rates, according to the definitions used by the IFS, IMF. Sources: IFS/IMF.


**Inflation**: Based on consumer price index. Source: IFS/IMF.

**Nominal exchange rate**: Nominal bilateral exchange rate (against USD). Source: IFS/IMF.

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22Please visit the Central Bank of Argentina website for more details.