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**Reserve requirements, excess liquidity and bank lending:  
Evidence from the Caribbean and Central America**

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**Michael BREI**

Univ. Lille, CNRS, IESEG School of Management, UMR 9221 – LEM, Lille Economie Management, F-59000, France | [michael.brei@univ-lille.fr](mailto:michael.brei@univ-lille.fr)

**Alphonse NOAH**

University of Limoges, LAPE, UR13335, France |

**Dorian NOEL**

Central Bank of Trinidad and Tobago |



# Reserve requirements, excess liquidity and bank lending: Evidence from the Caribbean and Central America

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**Michael Brei\*, Alphonse Noah\*\*, and Dorian Noel\*\*\***

## **Abstract**

This paper investigates the impact of two major central bank policy instruments, namely adjustments in reserve requirements and policy rates, on individual banks operating in Central America and the Caribbean. Using information on 116 banks from 20 jurisdictions, we find that banks in the two regions respond to tighter reserve requirements by increasing their holdings of cash and eligible reserve assets. Importantly, there is a concomitant slowdown in lending one year after the central banks' policy tightening. Policy rate changes, however, show limited impact on bank reserves and credit intermediation. From this perspective, adjustments in reserve requirements represent an effective countercyclical policy tool in mitigating credit cycles, even in banking systems with excess liquidity. For the small island economies, the results should be interpreted with caution, as tighter reserve requirements are associated with heightened credit risks one year after the policy tightening, potentially reflecting increased risk-taking by banks in pursuit of higher yields.

Keywords: Central banks; prudential and monetary policy; small island economies; credit cycles.

\* University of Lille, CNRS, IESEG School of Management, UMR 9221, LEM, France

\*\* University of Limoges, LAPE, UR13335, France

\*\*\* Central Bank of Trinidad and Tobago

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## Introduction

Central banks have used reserve requirements to attain prudential and monetary policy objectives in a number of developing, emerging and small island economies. In some instances, their use has been motivated by the fact that a single instrument, the interest rate, may not be sufficient to deal with both price and financial stability objectives (Brei and Moreno, 2019). In others, where exchange rates are fixed and capital markets are open, central banks' ability to use policy rates is limited and thus reserve requirements constitute a crucial instrument to control liquidity in the banking system.

From a financial stability perspective, prudential regulators impose minimum reserve requirements to ensure that banks operate with adequate amounts of high-quality liquid assets. They do this to ensure that banks are in the position to withstand systemic funding shocks without recourse to external liquidity. While high levels of reserve requirements enhance banking system stability, there exists a flip side of reserve requirements given that these assets are not intermediated to households and firms, and thus are associated with general equilibrium costs.<sup>1</sup> High levels of (legal and excess) reserves are further known to reduce the effectiveness of monetary policy and to hinder the development of liquid financial markets (Gray, 2011).

From a monetary policy perspective, central banks use changes in reserve requirements to control liquidity in the banking sector. By increasing or reducing the level of reserves that banks have to hold in cash or low-yielding central bank balances against their deposits, they aim at influencing bank lending and interest rates. Indeed, most central banks covered in our study use reserve requirements quite frequently and actively to pursue monetary and countercyclical policies (Table 1 and Figure 1). Since required reserves are typically remunerated below market and deposit rates, higher reserve requirements act as an implicit tax on bank intermediation and drive a wedge between what a bank pays to its depositors and its cost of funds. Other things being equal, this compresses banks' net interest margin and thus creates incentives for banks to adjust the volume and pricing of loans, deposits or both.<sup>2</sup> When adjustments in deposit rates are constrained, e.g. due to interest rate controls, the cost effect arising from higher reserve requirements may incentivize banks to choose riskier assets, and thus they may be associated with heightened financial fragility (Glocker, 2021).

From the perspective of individual banks, reserve and liquid asset holdings in excess of what is legally required represent an insurance mechanism against liquidity risks (Diamond and Dybvig, 1983). Since banks lend at longer maturities than they are funded, banks are vulnerable to unexpected funding shocks, especially in environments where raising liquidity on short notice is expensive. Liquidity holdings thus represent a precautionary self-insurance mechanism that is particularly valuable in countries with small financial safety nets and limited

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<sup>1</sup> Recent theoretical contributions that study the macroprudential role of reserve requirements within a general equilibrium context include Bianchi (2011), Glocker and Towbin (2012), Kashyap and Stein (2012), Medina and Roldós (2014), and Agénor et al. (2018). Cantu et al. (2024) quantify for a large number of countries the trade-offs of using reserve requirements as a financial stability instrument, finding that the gains in terms of heightened financial stability outweigh the costs implied by lower economic growth.

<sup>2</sup> If deposit supply is relatively inelastic (due to high switching costs or bank market power), the cost of higher reserve requirements would be passed on to depositors in the form of lower deposit rates (Agénor et al., 2015; Brei and Moreno, 2019). If loan demand is relatively inelastic, some of the cost would be passed on to borrowers and one would observe less lending and higher loan rates (Tovar et al., 2012; Brei and Moreno, 2019). In less competitive and underdeveloped financial markets, where financial frictions tend to be high, banks will most likely respond by adjusting both lending and deposits rates, unless they are constrained by limits on minimum deposit rates.

lender of last resort facilities (LOLR), see Rochet and Vives (2004). According to this view, banks should hold more liquidity in environments where capital and interbank markets are underdeveloped, LOLR facilities are limited and liquidity risks are high.

Although banks may optimally choose to hold more liquid assets than what is legally required, in some banking systems banks hold liquidity in excess of the optimal level due to credit market imperfections (Agénor and Aynaoui, 2010). Such involuntary holdings of liquidity occur in environments in which financial markets are underdeveloped, investments are restricted to domestic markets, or credit is being rationed due to high levels of asymmetric information and adverse selection (Jaffee and Russell, 1976; Stiglitz and Weiss, 1981).<sup>3</sup> In such situations, countercyclical and monetary policies may be ineffective as they would not be binding for banks due to the excess liquidity on their balance sheets.

Against these backdrops, this paper examines the impact of both reserve requirements and policy rates on banks operating in Central America and the Caribbean. We focus on their impact on individual banks' asset portfolios in terms of liquidity holdings (reserve vs. securities holdings) and lending (performing vs. non-performing). Our study contributes to the existing literature in a number of ways. First, we study the effectiveness of two major central bank policy instruments, side-by-side, in a region plagued by excess liquidity and nascent financial markets. Moreover, we use detailed and official data on reserve requirements on the bank-level in an international setting and calculate effective reserve requirements faced by individual banks based on the maturity and currency composition of their deposits. And lastly, we take a comprehensive approach by studying the dynamic impact of the two central bank policy instruments on the quantity and quality of banks' major asset categories.

Using information on 116 banks from 20 jurisdictions, we find that changes in reserve requirements have significant impacts on banks. In response to tighter requirements, banks increase their holdings of reserve assets. A one percentage point (p.p.) increase in the required reserve ratio is associated with a 0.9 increase in reserve holdings in the small island economies with a slightly lower pass-through in Central America. Other liquid asset holdings and bank lending are affected with a one year lag. In the two regions, banks tighten credit conditions and reduce lending. More specifically, for each one p.p. increase in the required reserve ratio, the loan-to-assets ratio decreases by 0.3 p.p. in the small island economies and by 0.5 p.p. in the continental countries. This highlights their usefulness as a financial stability tool in mitigating credit cycles<sup>4</sup>, even in banking sectors plagued by excess liquidity. For the small island economies, there is some evidence that tighter reserve requirements are followed by riskier loan books. More specifically, in response to an increase in the reserve requirement by one standard deviation (8 p.p.), the non-performing loan ratio increases by 0.9 p.p. one year after the policy tightening. Central banks should thus monitor upcoming credit risks and banks' lending practices when using reserve requirements, as they might have unintended consequences. Such a risk-taking channel of reserve requirements, explained by banks' search for yield in response to reduced profit margins, has been found in other country settings, such

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<sup>3</sup> Credit rationing refers to situations in which the slope of the loan supply curve becomes negative: banks hold more liquid assets and lend less when loan rates raise. This is due to two conflicting effects of higher loan rates. At low loan rates, higher loan rates increase bank revenues and thus banks are inclined to lend. At high rates, once they impair borrowers' repayment capacity, higher loan rates can lead to lower bank revenues and thus to less lending (Waller and Lewarne, 1994).

<sup>4</sup> Similar results in different country settings have been found, amongst others, in Montoro and Moreno (2011), Izquierdo et al. (2013) Cordella et al. (2014), Federico et al. (2014), Glocker and Towbin (2015) and Primus (2016).

as in Elys et al. (2019) and Jiminéz et al. (2017), with theoretical explanations provided by Glocker (2021).

Changes in policy rates seem to have only minor impacts on banks' liquidity holdings and lending patterns. These results point to a limited effectiveness of central bank policies based on interest rates, which given the external constraints implied by fixed or very volatile exchange rates is not surprising, especially in environments with high and persistent excess liquidity, limited competition in the banking sectors, credit market frictions and substitutability of domestic and foreign bank funding. The impact of excess liquidity on central banks' ability to effectively implement monetary policy due to limited or weak transmission channels has been studied and documented by, amongst others, Caprio and Honohan (1991), Agénor et al. (2004), Ganley (2004), Saxegaard (2006), Agénor and Aynaoui (2010), Anderson-Reid (2011), Worrell et al. (2012), and Primus (2016).

The remainder of the paper is organized as follows. Section 2 discusses how central banks set reserve requirements in the region studied and reports summary statistics for the sample data. Section 3 describes the econometric framework and section 4 presents the empirical results. The final section concludes.

### Reserve requirement regulation: Trends and experiences in the Caribbean

Central banks in the Caribbean use reserve requirements for prudential and monetary policy purposes (Table 1).<sup>5</sup> Prudential policies often aim at reducing particular balance sheet vulnerabilities such as the reliance of banks on high levels of short-term or foreign-currency deposits. To reduce such exposure risks, central banks and prudential policymakers tend to impose higher required reserve ratios on such liabilities. For instance in Haiti and Jamaica, central banks impose higher reserve requirements on short-term deposits than on savings deposits (Table A1 in the Appendix).<sup>6</sup> For banks this means that they have to put aside more funds in the form of cash and low-yielding reserves per unit of short-term deposit than for long-term deposits, making them a costlier source of funds in terms of foregone revenues from lending and other investment opportunities. Banks thus would have incentives to shift their funding structure towards long-term deposits by reducing the remuneration of short-term deposits. In this regard, Kashyap and Stein (2012) show that differentiated reserve requirements can be a useful policy tool in taxing the externalities created by excessive short-term borrowing of banks.

While high and persistent levels of reserve requirements can be a sign of system-wide vulnerabilities, frequent changes in legal requirements point to monetary or countercyclical policies aimed at controlling short-term liquidity in the banking system and therewith credit and inflation dynamics.<sup>7</sup> Indeed, when central banks change reserve requirements they often

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<sup>5</sup> On a more global scale, Federico et al. (2014) estimate that, in contrast to industrial countries, approximately two thirds of developing countries have used reserve requirements as a macroeconomic (countercyclical) stabilization tool.

<sup>6</sup> When countries have different reserve requirements on foreign currency exposures, they tend to be higher for this type of liability. This may be done to discourage liability dollarization or capital inflows. But there are also cases of lower reserve requirements for foreign currency liabilities, as has been the case in Barbados. This may be done to attract foreign currency deposits either to support the capital account or to facilitate the provision of export credits (Gray, 2011).

<sup>7</sup> We refer to a countercyclical use if reserve requirements are raised during credit booms and decreased during busts. One should note that in particular cases central banks set reserve requirements to accommodate governments' demand for funding by requiring banks to hold liquidity in the form of local government securities,

intend to complement other prudential and monetary policy changes. Bianchi (2011) shows that capital and reserve requirements may have similar macroprudential effects, as both act as a tax, increase the cost of borrowing and reduce the likelihood of excessive credit growth. Medina and Roldós (2014) show that inflation-targeting augmented by countercyclical reserve requirements can be more effective than other monetary policy rules. Agénor et al. (2018) also point to the effectiveness of credit-based reserve requirements for countercyclical policies, particularly when capital mobility is limited and central banks intervene in foreign exchange markets. In the context of large and externally-driven capital inflows, central banks from small open economies have used changes in reserve requirements to complement monetary policies based on policy rates with the intention to curb credit growth without attracting further capital inflows (Brei and Moreno, 2019).<sup>8</sup>

In small island economies, the decision to use this type of policy instrument depends on the external financial environment and the exchange rate. Small size, partial dollarization, fixed exchange rates and high dependence on imports pose challenges to monetary and prudential policymakers (Worrell, 1995; Worrell et al., 2003; Gray, 2011). Central banks concerned with monetary and financial stability aim at maintaining stable exchange rates, while promoting credit and external conditions that encourage growth and price stability. The unpredictable external environment coupled with import dependence and oligopolistic financial systems poses challenges to central banks and they have to use a mix of direct and indirect policy tools to accomplish their objectives.

Central banks face significant foreign currency constraints. On first thought, there are difficulties stemming from frequent and unpredictable external shocks to commodity prices, foreign investments, tourism, or due to natural disasters. The concomitant fluctuations in the in- and outflow of foreign currency impose in turn substantial financial constraints on the economy, making liquidity and reserve management of paramount importance (Kemray, 2006; Worrell et al., 2012). A layer of complexity is however added when considering that the foreign currency constraint can also be triggered internally to the extent that domestic credit booms will inevitably spill over to the external sector by means of increased demand for imports and thus for foreign currency. These are two major reasons for which central banks use changes in reserve requirements with the objective to influence (directly) bank liquidity and (indirectly) credit growth, interest rates and the money supply.

While in advanced economies there is a consensus that monetary policy is most effective based on indirect market-based instruments, such as open market operations, it is less clear whether such policies work for small open economies with less developed financial markets and oligopolistic banking sectors (Worrell, 1995; Alexander et al., 1996; Walsh, 2010; Worrell et al., 2012; Primus, 2016). Most often, central banks use a mix of direct and indirect policy tools to accomplish their monetary policy objectives.<sup>9</sup> Direct policy instruments include interest rate controls, credit ceilings and directed lending. Even though such policy tools allow to control directly the cost of credit and its supply, they can lead to limited competition, overhang of

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as could have been the case in Haiti, Suriname and the other countries that allow reserves to be held in government securities.

<sup>8</sup> Other papers on this issue in different country settings include Montoro and Moreno (2011) on Brazil, Colombia and Peru for 2006-10; Cordella et al. (2014); Federico et al. (2014) on 52 countries (15 industrial and 37 developing) for 1970-2011; and Cantu et al. (2024) on 27 countries (5 advanced and 22 emerging) for 1996-2015.

<sup>9</sup> Box 1 in the Appendix offers a detailed description of the monetary policy frameworks of each country in our sample.

liquidity and disintermediation (Alexander et al; 1996). For instance, the Eastern Caribbean Central Bank uses the minimum savings rate to affect bank lending. Indirect monetary policy tools seek to alter liquidity conditions through the market. The most common instruments are open market operations, reserve requirements and central bank lending facilities. Most countries in our sample use a combination of these measures with reserve requirements being the traditional policy tool and open market operations gaining importance.

Nowadays most central banks in the region operate with two main policy instruments to achieve their objectives, a short-term interest rate and required reserve ratios (Primus, 2016). When not directly imposed, short-term interest rates are determined indirectly using open market operations on the primary market for securities.<sup>10</sup> If not used in isolation, reserve requirements are intended to complement and reinforce other policies: in some cases they complement fiscal policies, in others they are adjusted to ensure exchange rate stability or to slow down credit growth and inflationary pressures.<sup>11</sup> By requiring banks to hold a fraction of deposits in the form of cash and deposits at the central bank, reserve requirements directly link central bank and commercial bank liabilities. Higher reserve requirements will lead to lower bank liquidity and thus should affect the supply of credits.

While not all countries in our sample use reserve requirements actively (e.g. Bahamas, Eastern Caribbean Currency Union, Panama and Guatemala), other central banks do use them quite frequently (e.g. Barbados, Jamaica, Costa Rica and Suriname, see Figure 1). For instance, in the three major English-speaking Caribbean economies, central banks use them in combination with other policy instruments. In Barbados, where the central bank shifted from direct policies, involving adjustments to the minimum deposit rate, to market-based policies that target the three-month Treasury bill, the required reserve ratio is another central bank policy instrument along with the discount rate and foreign reserve management. In Jamaica, the central bank uses mainly open-market operations and reserve requirements. Or in Trinidad and Tobago, which is structurally very different due to its large resources of gas, the central bank uses the repo rate and open-market operations with reserve requirements being increasingly de-emphasized over time (CTT, 2005).

The main focus of this study are reserve requirements, four different types exist:

- single:  $RR = \tau \cdot D$
- by currency:  $RR = \tau_{LC} \cdot D^{LC} + \tau_{FC} \cdot D^{FC}$
- by maturity:  $RR = \tau_D \cdot D^{demand} + \tau_T \cdot D^{time}$
- by maturity and currency

Here  $\tau$  denotes the reserve requirement rate and  $D$  bank deposits (including any other funds that are subject to legal reserve requirements). Most central banks in our sample operate with

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<sup>10</sup> A common approach is to hold regular auctions of treasury or central bank bills with different amounts auctioned with the objective to affect bank reserves and therewith short-term interest rates (Alexander et al., 1996).

<sup>11</sup> In Barbados where the exchange rate is fixed since 1975, the central bank increased the ratio in 2017 to tighten its monetary policy stance thereby complementing fiscal measures to support the economy (CBB, 2017). In Jamaica where the exchange rate is flexible, the central bank used the ratio for prudential countercyclical policies. For example during 2008-09, it raised the requirement for domestic currency assets to counter currency depreciation by restricting Jamaican dollars to trade for foreign currencies (Runkel, 2022). In Trinidad and Tobago where a crawling band is in place, the central bank decreased the reserve requirement to complement other expansionary measures at the onset of the Covid-19 pandemic to increase liquidity in the banking sector (CTT, 2023). In Suriname, the central bank tightened the reserve requirement in local currency in April 2023 to reduce excessive credit growth.

a single reserve requirement, it applies to all deposits regardless of their maturity and currency composition (for details, see Table 1 and Table A1 in the Appendix). Typically reserve requirements apply to the stock of deposits, but there are cases in which on top marginal reserve requirements are imposed on new deposit inflows (Brei and Moreno, 2019). Some central banks use differential reserve requirements for local- vs. foreign-currency denominated deposits ( $D^{LC}$  and  $D^{FC}$ ) and to a lesser extent for short- vs. long-term deposits ( $D^{demand}$  and  $D^{time}$ ). When reserve requirements depend on the maturity and currency composition of deposits, each bank faces a different minimum reserve requirement, and it is thus important when calculating effective required reserve ratios to weight the different reserve requirement rates by bank-specific exposures to each type of deposit.<sup>12</sup>

Reserve requirements in the region are high relative to other parts of the world (Figure 2). While reserve requirement rates have been well below 5 percent of deposits in the advanced European economies and in North America, they fluctuated in the range of 15 to 20 percent in Central America and the Caribbean. While on average reserve requirements have been decreasing in the small island economies from a peak of 22 percent in 1995 to less than 15 percent in 2020, there is important heterogeneity across countries (Figure 1). For instance, in the Eastern Caribbean Currency Union (ECCU) reserve requirements are relatively low and flat (6 percent) whereas they are quite high and flexible in Haiti, Jamaica and Suriname.

Banks from the region do not only hold liquid assets for regulatory purposes. While some part of liquid asset holdings have been held for precautionary reasons, it has been noted that banks hold large amounts of liquidity in the form of excess reserves (see for instance, Maynard and Moore, 2005; Khemraj, 2007, 2009; Anderson-Reid, 2011; Deléchat et al., 2012; Jordan et al., 2012; Primus, 2017). This is confirmed by our data, as can be seen in Figure 3. Holdings of liquid assets, which consist of cash, reserves and securities, averaged 40 percent of deposits over our sample period with some banking sectors recording liquid asset ratios of more than 50 percent (Figure 3).<sup>13</sup> On the flip side this means that large parts of the countries' savings are not intermediated into bank loans to households and the corporate sector pointing to structural problems that lead to high intermediation margins (Birchwood et al., 2017).

Compared to European banks, Central American and Caribbean banks hold considerably more reserve assets, particularly since 2005 and in the small island economies (Figure 4, left-hand panel). When considering other liquid asset holdings such as securities investments, the picture is very different given that European banks hold much more of them (Figure 4, right-hand panel). This pattern is clearly related to differences in bank business models, deeper financial markets, and since 2008-09 to the quantitative easing measures employed in the aftermath of the global financial crisis.

## Data

The data on regulatory reserve requirements was obtained directly from central banks for the period 1990-2021. When the data was not provided (mainly in Central America), the information was completed with the updated dataset of Federico et al. (2014). The primary source for central bank policy rates are the monetary and financial accounts from the IMF-IFS

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<sup>12</sup> Because a breakdown is not available on the bank-level, the fraction of foreign-currency deposits of individual banks is assumed to be uniform and equal to that of the country's banking system.

<sup>13</sup> Banks from the small island economies hold more liquidity compared to those located on the continent, even though the difference is declining over time (Figure 2).

database. Depending on the country, we used the monetary policy-related interest rate or the discount rate. We complemented this information with data from central bank websites and the World Bank. The bank-level data is obtained from Fitchconnect. We work with the consolidated financial statements of banks, if available, based on the idea that banks manage the entire set of their assets. Where it is not possible to obtain consolidated statements, as in the case of foreign subsidiaries, we use banks' unconsolidated financial statement.

Our study focuses on deposit-taking entities which implies that we exclude non-bank entities from the sample. We also exclude banks with less than 5 observations and those for which we were unable to obtain relevant information. We aim to cover at least 75 percent of each banking sector's assets making sure that many small banks from a particular country do not dominate our panel. After applying our filters, the final sample covers 116 deposit-taking entities operating in 11 small island economies and 9 continental Caribbean and Central American jurisdictions. Of that total, 72 are domestically owned and the rest (44) are subsidiaries of foreign-owned banks. We decided to exclude the Covid-19 years, that is 2020 and 2021, given the pandemic represented a major systemic shock to the small open economies in our sample.

Table 2 reports summary information for the countries in our sample. At the end of 2019, total assets of the 116 banks in our study amounted to roughly US\$330 billion which amounts to an average of 73 percent of GDP.<sup>14</sup> Average reserve requirements amounted to roughly 14 percent of deposits in the small island economies, while they were by around 4 to 5 percentage points higher in the continental and Central American countries. As one can see, the banking systems can be very different in terms of liquidity, bank risks and profitability. For instance, in some countries banks hold large amount of low-yielding reserve assets with Haiti leading the country grouping (47.5 percent of deposits) followed by the Dominican Republic (28.6), Aruba (25.3) and Belize (23.4). When considering in addition securities holdings, the highest ratios are recorded in Haiti (66.4 percent of deposits), Jamaica (62.3), Trinidad and Tobago (51.8), and Guyana (51). In terms of credit market conditions, in St. Lucia the lending business appears to be very risky with non-performing loans averaging 15.9 percent of total loans followed by Aruba (15.1) and Guyana (12.9). In Haiti, banks record the lowest NPL ratios which is presumably due to credit rationing and banks' market power that affords them the opportunity to cream-skim the best creditors in markets.

### Econometric framework

Our objective is to disentangle the impact of two major central bank policy instruments on banks with a view of evaluating their relative effectiveness. First we will investigate the impact on banks' liquidity holdings distinguishing between highly liquid assets, including cash and reserves, and a broader definition that includes securities. In the second step, we will then examine whether banks' lending business was affected in terms of credit provision and credit risks measured by non-performing loans.

We use the following baseline specification:

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<sup>14</sup> The figures on the country level shown in Table 2 may not be representative due to data limitations or infrequent reporting of financial statements. Moreover, our study does not cover credit unions which might be large players in the banking systems in some countries such as in Barbados or the ECCU (RFSCC, 2021).

$$\Delta y_{ict} = \alpha + \beta^\tau \Delta \tau_{ict} + \beta^{\tau'} \Delta \tau_{ict-1} + \beta^i \Delta i_{ict} + \beta^{i'} \Delta i_{ict-1} \\ + \gamma X_{it} + \vartheta_t + \vartheta_i + \varepsilon_{it}$$

where  $\Delta y_{it}$  denotes the annual change in the outcome variable (liquidity holdings, lending) of bank  $i$  operating in country  $c$  in year  $t$ . The annual change in the required reserve ratio is denoted by  $\Delta \tau_{ict}$ , while changes in policy rates are denoted by  $\Delta i_{ict}$ . The vector  $X_{it}$  contains bank-specific and macroeconomic control variables,  $\vartheta_t$  are time fixed effects, and  $\vartheta_i$  are unobserved bank-fixed effects. Our identification of the contemporaneous effects hinges on the hypothesis that the changes in the two central bank policy instruments are exogenous and do not depend on the financial conditions of individual banks.

Given that central banks adjust their policy instruments actively, we opt for a specification in first differences which allows us examining bank responses to changes in the central bank's policy stance. As such, it allows capturing the direct responses of commercial banks to changes in central bank policies operating through adjustments in interest rates and reserve requirements, after controlling for monetary, external and bank-specific conditions. A further advantage of considering first-differences is that central banks have changed their policy framework over time so that annual changes in the policy variables are more meaningful when considering the short-term adjustment of banks compared to the policy variables in levels. A specification in levels would be better suited for studying the impact of longer-term prudential policies that address structural vulnerabilities, such as a sector-wide reliance on short-term deposits or the incidence of dollarization.

The required reserve ratio is determined for each bank individually, depending on its composition of deposits and the specific legal reserve requirement:

$$\tau_{ict} = \sum_{j=dem,sav,time} \tau_{l,ct}^j \cdot \frac{D_{l,ict}^j}{D_{ict}^{all}} + \sum_{k=dem,sav,time} \tau_{f,ct}^k \cdot \frac{D_{f,ict}^k}{D_{ict}^{all}}$$

The country-specific required reserve ratios for demand, saving and time deposits in local and foreign currency are denoted by  $\tau_{ct}^j$ , and  $D_{ict}^j/D_{ict}^{all}$  is the bank-specific proportion of each type of deposit in the total of deposits. In countries with a single reserve requirement the equation simplifies to  $\tau_{ct}$ , while in the other countries each bank faces a different effective required reserve ratio. For instance, banks that rely more on demand deposits ( $j = dem$ ) will tend to have a higher effective reserve requirement in the Bahamas and El Salvador compared to their competitors with a longer-term maturity profile (see Table A1). While the weighting procedure helps improving the measurement of reserve requirements, it introduces variation on top of that stemming from policy decisions. To overcome this, we use sample averages of each bank's proportion of deposits. Where reserve requirements depend on the currency denomination, we use country averages because a breakdown is not available on the bank-level (see last column of Table A1).

Our first set of outcome variables  $y_{it}$  is composed of two comprehensive measures of liquid assets, one comprises highly liquid, reserve-like assets and the other consists of securities investments. The former is composed of cash, interbank deposits and non-interest-earning balances with central banks, and the latter includes securities investments (government bonds, corporate bonds and stocks). Our second set of outcome variables relates to the banks' loan portfolio, one is the stock of outstanding loans and the other is non-performing loans. All variables are expressed as ratios, the liquid asset indicators are in percent of deposits, loans are in percent of assets and non-performing loans are in percent of total loans.

The main explanatory variables are the regulatory reserve ratio and the central bank policy rate. Higher regulatory requirements should be associated with higher eligible reserve holdings. It is less clear whether banks increase their other liquid asset holdings and whether they tighten lending conditions. Given that tighter requirements imply costs in terms of foregone revenue, banks will have incentives to restore their margins by shifting to higher-yielding assets, reducing deposit rates and increasing loan rates. The overall effect depends on the financial market development, loan market conditions and the substitutability of deposits and central bank credit.<sup>15</sup> When the adjustment in deposit rates is constrained, the cost effect arising from higher reserve requirements may incentivize banks to choose riskier assets in search-for-yield, which would lead to riskier loans books and higher loan defaults (Glocker, 2021). Higher policy rates increase the opportunity costs of holding less-remunerated reserves and other liquid assets compared to what a bank could earn on the credit market (Poole, 1968). Accordingly, one would observe an inverse relationship with liquidity holdings. Given that higher policy rates increase other interest rates in the economy, they increase banks' marginal cost of funds and thus banks would tighten credit conditions. Higher loan rates increase in turn the risk of borrowers being unable to pay back their loans to which banks would respond by cutting down on lending. This may also reduce credit demand for consumption and investment by households and firms.

The first set of control variables relates to the external macro-financial environment. We consider the nominal exchange rate, net capital inflows and international reserves. It is not clear how these indicators affect banks' liquidity holdings and loan portfolio. For instance, in the case of Jamaica it was noted that sharp depreciations coincided with a fall in excess reserves and thus in liquid assets (Anderson-Reid, 2011). On the other hand one might find the opposite if banks start demanding more precautionary liquidity and reduce lending as implied by higher exchange rate risk. Higher capital inflows create deposits, increase reserve requirements and ease lending conditions. International reserves capture the ability of a central bank to act as lender of last resort in foreign-currency and banks should thus demand more liquidity for precautionary purposes and reduce lending when they are low (Worrell et al., 2003; Worrell et al., 2012; Deléchat et al., 2012).

Next we include a number of bank-specific control variables, all of which are lagged by one year. The first set relates to bank size and capitalization. Larger and well-capitalized banks have better access to capital markets and thus they should hold less precautionary liquidity. They might be more exposed to financial markets and being less involved in the lending business compared to smaller banks. The second set is intended to measure banks' liquidity risks. We include the volatility of the cash-to-deposit ratio and exposure to short-term deposits (Agénor et al., 2004; Anderson-Reid, 2011). Banks tend to demand more liquidity and supply less loans when the banking environment is risky to protect themselves from costly and unexpected deposit withdrawals and rollover problems.

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<sup>15</sup> If deposits and central bank credit are imperfect substitutes, higher reserve requirements will not be fully accommodated by increases in borrowing from the central bank. Banks will attempt to restore interest margins and shift activities from lower- to higher-yielding assets. If deposit supply is relatively inelastic (e.g. because of switching costs) or banks have market power on the deposit market, the cost of higher reserve requirements would be passed on to depositors in the form of lower deposit rates (Tovar et al., 2012; Agénor et al., 2018). If, on the other hand, loan demand is relatively inelastic, some of the cost would be passed on to borrowers in the form of higher lending rates (Montoro and Moreno, 2011). In less competitive and underdeveloped financial markets, banks will most likely respond by adjusting both lending and deposits rates (Brei and Moreno, 2019).

The final set of control variables is composed of macroeconomic factors. We include inflation, real GDP growth and its volatility, public debt and exposure to tropical storms. Higher inflation should be associated with lower excess reserves and higher lending because the costs of holding low-yielding liquid assets are higher, but this is not necessarily the case, since it may also lead to higher uncertainty about collateral values, particularly in markets with adverse selection problems (Agénor and Anaouyi, 2010). While higher economic growth should be associated with better lending opportunities and lower loan defaults, it is less clear how banks adjust their liquidity holdings. Higher economic volatility should be associated with higher liquidity holdings, less lending and higher credit risks. Finally, we include the debt-to-GDP ratio to control for the fiscal stance of governments and the exposure to damaging tropical storms to control for both liquidity and credit risk associated with them (Noel et al., 2021; Brei et al. (2024)).

Apart from the above-mentioned motives, one should note that banks' asset portfolios also depend on their risk attitudes and business models. Depending on their liquidity preference, banks target specific and permanent liquidity ratios that act as a buffer over minimal requirements to avoid the risk of non-compliance and costly penalties. While banks' risk attitudes cannot be measured directly and are in part covered by the different motives for liquid asset holdings, by including bank-fixed effects, we control for any time-invariant differences in banks' preference for liquidity. Moreover, any liquidity holdings that are due to shocks that affect all banks in the region are controlled for by year-fixed effects.

## Results

We estimate the regressions separately for the two country groupings, small island economies versus continental economies, given that the policy transmission may differ. For each dependent variable, we start with a parsimonious specification and add subsequently more explanatory variables. This procedure allows us examining whether the results on the transmission channels are stable across the different specifications or whether there are issues related to omitted variable bias or multicollinearity. The results for each of our four outcome variables are reported in Tables 5-8, with precise definitions and summary statistics of the regression variables being reported in Tables 3 and 4. In what follows, we will focus our discussion on the final specification with the full set of control variables shown in column (iv) for the small island economies and in column (viii) for the other countries in each table.

### Reserve assets

Bank holdings of highly liquid, reserve-like assets (including cash, interbank and non-interest bearing central bank deposits) increase significantly and instantaneously in response to increases in the required reserve ratio (Table 5). The results indicate that banks instantaneously increase reserve holdings when central banks tighten reserve requirements. For banks with reserves in excess of the regulatory minimum this means that they chose to keep their buffer, rather than keeping reserve holdings constant and reducing their buffer. The impact coefficients are very similar for the two country groupings. For instance, when considering the small island economies, banks change their holdings of highly liquid assets nearly by one-to-one (by 0.91 percentage points (p.p.) for each 1 p.p. change in the required reserve ratio). Relative to an average reserve ratio of 15.3 percent of deposits, the impact is not only statistically but also economically meaningful. The pass-through in Central America and the continental Caribbean countries is somewhat lower (0.85 p.p.). The lagged required reserve ratio is insignificant indicating that all adjustment is made in the year of the policy change.

While the coefficients of the interest rate are throughout negative and insignificant, there is some evidence that banks from the continental region lower their reserve holdings in response to higher policy rates. This could be an indication of banks shifting to higher yielding assets in response to higher opportunity costs.

Some control variables appear to have significant effects. While in the small island economies, banks size and GDP volatility are negatively related to changes in highly liquid asset holdings, a heightened vulnerability to damaging tropical storms is positively related to banks' reserve assets. In the continental countries, there is evidence that currency depreciation, import cover, capitalization, economic growth and volatility are negatively related to banks' reserve assets. While each of these results might be interesting in itself, it is difficult to draw precise conclusions. Based on specific country experiences, a negative relation between currency depreciation and reserve holdings has been observed in Jamaica (Anderson-Reid, 2011). Regarding the bank-specific controls, larger and better capitalized banks may hold less reserve assets compared to smaller banks due to their better access to external funding markets and higher shock absorbing capacity. A better capital position may as well comfort banks and markets, and allow them to operate with less lower-yielding reserve assets.

#### Liquid assets (securities holdings excluding reserve assets)

Banks' holdings of other liquid assets are affected by changes in reserve requirements with a one year lag (Table 6). While banks from the small island economies reduce their liquid asset holdings by 0.73 p.p. for each 1 p.p. increase in the required reserve ratio, banks from the continental region increase them by 1.25 p.p. Given our previous results on an instantaneous pass-through to reserve asset holdings, these findings indicate that initially banks do not rebalance their liquid asset portfolio from securities investments to more liquid assets that are qualified reserve assets. The increase in reserve assets must have had been financed differently, which could be done by a combination of new deposit inflows, revenues from the banking business, or repayments and cuts in lending. After one year, banks' liquid asset holdings adjust. The decline observed in the small island economies could be a sign of sluggish rebalancing of liquid assets (that needed some time to be sold) to reserve assets, suggesting that liquidity buffers fall. In contrast, the increase observed in the other region would indicate that banks reestablish their liquidity buffers in the year after the change in regulatory reserves.

Changes in policy rates have some effect on liquid asset holdings of banks. While in the small island economies banks tend to decrease them instantaneously when policy rates raise, in the other country grouping there is evidence that banks increase them with a one year lag. The first result on the inverse relationship is in line with the argument that higher policy rates increase the opportunity costs of liquid asset holdings, presumably inducing banks to shift resources to the higher-yielding lending business.

Exchange rate depreciation is associated with higher liquid asset holdings in the small island economies. This could be related to increased demand for precautionary liquidity or due to positive valuation effects stemming from foreign securities holdings. Higher capital inflows, higher volatility in GDP growth and the cash-to-deposit ratio, and higher GDP growth are all associated with lower liquid asset holdings in Central America, while banks with higher exposure to short-term deposits hold more of them. While one would think that precautionary liquidity holdings should be higher when volatilities are higher, it could be that banks shy away from financial market investments in such environments. In the small island economies, better capitalized and larger banks hold significantly less liquid assets in the form of bonds and stocks. As before, this could be due to their better access to external funds implied by their size and

loss-absorbing capacity allowing them to operate with less precautionary liquidity holdings and to invest more resources into the profitable lending business. Banks from the small island economies increase liquid asset holdings with higher volatility in the cash-to-deposit ratio, which is in line with Maynard and Moore (2006) and Anderson-Reid (2011) for Barbados and Jamaica, respectively. Finally, currency depreciation and higher import cover are associated with higher securities holdings.

#### Bank lending

The next set of regressions focuses on the impact on bank lending (Table 7). As with securities holdings, banks adjust lending sluggishly with a one year lag in response to changes in required reserve ratios. In both regions, banks cut down on lending when reserve requirements raise. This robust finding across all specifications is in line with a number of studies highlighting the usefulness of reserve requirements in mitigating credit cycles (Montoro and Moreno, 2011; Izquierdo et al., 2013; Cordella et al., 2014; Federico et al., 2014; Glocker and Towbin, 2015). The sluggish response is somewhat expected given that it takes time until existing loans mature and the stock of outstanding loans falls. The impact is more pronounced in the continental country grouping where the loan-to-asset ratio declines by 0.52 p.p. for each 1 p.p. increase in required reserves. In the small island economies, the impact is still economically meaningful with a 0.31 p.p. reduction in the loan ratio for each 1 p.p. increase in required reserves. In the continental countries we thus find a rebalancing of the asset portfolio from lending to securities holdings one year after the policy tightening. Overall, our results highlight the effectiveness of central bank policies based on adjustments in required reserve ratios in mitigating credit cycles, even in banking sectors plagued by excess liquidity.

Changes in policy rates do not have a significant impact on bank lending, once controlling for changes in reserve requirements, macroeconomic and bank-specific factors. Across all specifications, the impact coefficients are insignificant. This could be due to the high levels of excess liquidity in the banking sectors where banks might not have incentives to change lending standards and the remuneration of deposits in response to changes in the policy rate and the concomitant change in funding costs. As argued in Agénor and Aynaoui (2010), if excess liquidity is sufficiently high, banks may not be willing to tighten credit standards in an attempt to keep up the demand for the profitable lending business relative to lower-yielding liquid assets. It has also be argued that, given the open nature of the considered economies, banks may shift away from domestic funding and avoid higher costs of borrowing at home by borrowing from abroad more cheaply (Worrell et al., 2012). Overall, the results are challenging and point to a greater effectiveness of central bank policies based on reserve requirements compared to those centered on policy rates in influencing the credit cycle.

There are some other significant results concerning the control variables. In the small island economies, higher capital inflows are associated with lower loan ratios, while larger banks tend to operate with higher loan exposures. The former result might point to some form of crowding out effect where foreign capital inflows substitute for domestic bank lending. The finding on large banks might be explained by their greater capacity in reacting to changes in credit market conditions compared to smaller banks, in line with the bank lending literature (Kashyap and Stein, 1995; Kishan and Opiela, 2000). In the continental region, there is evidence of a positive impact of GDP growth and its volatility on bank lending.

#### Non-performing loans

The last set of regressions focuses on the impact on credit risks (Table 8). While there is no significant impact of both reserve requirements and policy rates in the continental region, in

the small island economies we find evidence that increases in reserve requirements are followed by increases in the share of non-performing loans (NPL) one year after the policy change. For each 1 p.p. increase in the required reserve ratio, banks' non-performing loan ratios increase by 0.12 p.p. one year thereafter. The impact is economically meaningful if one considers that an increase in the reserve requirement by one standard deviation (8 p.p., see Table 4) is associated with an increase of 0.9 p.p. in the non-performing loan ratio (compared to an average NPL ratio of 6.8 percent of loans, see Table 2). Higher problem loans could be due to a search for yield effect induced by tighter reserve requirements. By reducing banks' profit margins, banks might have incentives to shift to riskier loan portfolios with higher expected returns thereby compensating the reduction in profit margins implied by higher non-remunerated reserve holdings. Higher problem loans one year after the policy tightening might also be linked to adverse selection problems in which borrowers with profitable investment projects exit the market, because loan rates have reached unsustainable levels, leaving banks with the most risky market segment. Such a relationship between reserve requirements and bank stability has been found in other studies such as in Elys et al. (2019), Dassatti Camors et al. (2019) and Jiminéz et al. (2017).<sup>16</sup>

Across all specifications, we do not find evidence that changes in policy rates affect credit risks, which is similar to our previous finding for bank lending (Table 7). Concerning the control variables, higher import cover and inflation are associated with higher credit risks in the small island economies, while higher growth and vulnerability to damaging tropical storms are associated with lower NPL ratios. The latter result might seem counterintuitive, but it could be explained by banks' higher risk aversion in hurricane-prone areas implying that they operate with less risky loan books. In the continental region, higher volatility of GDP and higher inflation are associated with lower credit risks. While this might seem to be at odds with expectations, again it could be a supply side phenomenon according to which banks shy away from risky lending in such environments.

### Excess liquidity and foreign banks

Next we investigate whether the impact differs across banks. First, we check if banks with very high levels of liquid assets on their balance sheets respond differently compared to banks on the other spectrum. We identify banks with excess liquidity for each region separately using a bank-specific indicator that is equal to one when a bank's liquid asset ratio (securities holdings excluding reserve assets) is in the top decile of its distribution. The identification on the bank-level is important because excess liquidity might not be a system-wide phenomenon, but rather unevenly distributed across banks.<sup>17</sup> It is not clear how banks with extremely liquid asset portfolios respond to changes in central bank policies. It might afford them with a higher flexibility in responding to changes in the policy stance compared to banks that are closer to the regulatory minimum. For instance, in response to a tighter policy environment, they might

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<sup>16</sup> In his theoretical contribution, Glocker (2021) highlights that such risk-shifting effects are most pronounced when central banks control deposit or savings rates, because tighter reserve requirements represent for banks a cost so that they would have incentives to lower deposit rates (Agénor et al., 2015; Brei and Moreno, 2019). However, when banks reach the lower bound, i.e. the minimum savings rate, they seek other possibilities to restore their profit margin in a search-for-yield by either switching to riskier loans with higher expected returns or by increasing loan rates. Both effects can have detrimental effects on bank stability.

<sup>17</sup> For instance, in the case of Suriname it has been noted that, even though banks are highly liquid due to high reserve requirements, excess reserves are skewed towards the larger systemic banks while the others face liquidity constraints (IMF, 2023).

take advantage of tighter credit market conditions and increase lending in a search for yield. As argued before, the greater the degree of excess liquidity, the more banks may be willing to weaken the procedures that they normally use for checking the creditworthiness of potential borrowers in an attempt to restore profit margins.

The baseline regressions are modified to include interactions terms between the indicator variable and the policy variables:

$$\begin{aligned} \Delta y_{ict} = & \alpha + \beta^\tau \Delta \tau_{ict} + \beta^{\tau,EL} \Delta \tau_{ict} \cdot EL_{ict} + \beta^{\tau'} \Delta \tau_{ict-1} + \beta^{\tau',EL} \Delta \tau_{ict-1} \cdot EL_{ict-1} \\ & + \beta^i \Delta i_{ict} + \beta^{i,EL} \Delta i_{ict} \cdot EL_{ict} + \beta^{i'} \Delta i_{ict-1} + \beta^{i',EL} \Delta i_{ict-1} \cdot EL_{ict-1} \\ & + \gamma X_{it} + \delta EL_{ict} + \vartheta_t + \vartheta_i + \varepsilon_{it} \end{aligned}$$

where  $EL_{ict}$  is the bank-specific indicator for banks with excess liquidity. With this non-linear specification, the initial impact of reserve requirements on our outcome variables is now given by:

$$\frac{\partial \Delta y_{ict}}{\partial \Delta \tau_{ict}} = \beta^\tau + \beta^{\tau,EL} EL_{ict}$$

Therefore, if the two coefficients are significant, then the impact for banks with low levels of liquidity is equal to  $\beta^\tau$  (since  $EL_{ict} = 0$ ) and that for banks with high levels of liquidity is  $\beta^\tau + \beta^{\tau,EL}$ , since  $EL_{ict} = 1$ . The results are reported in Table 9.

We will focus our discussion on the lending business as we are interested in the effectiveness of central bank policies in mitigating credit cycles. In both regions, there is a negative response of banking lending to tighter reserve requirements. While there is no differential response in the continental countries, in the small island economies banks with highly liquid balance sheets initially decrease lending in response to tighter reserve requirements. For each 1 p.p. increase in the required reserve ratio, highly liquid banks decrease lending by 0.78 p.p. in the same year. One year later, this pattern reverses. More specifically, while lending slows down at banks with lower level of liquid assets (by -0.46 p.p.), those with very high levels of liquidity increase lending after one year by 0.54 p.p. (-0.46+1.00) for each 1 p.p. increase in reserve requirements. Taken together, our results still point to the effectiveness of reserve requirements in mitigating credit cycles, but the impact on banks with excess liquidity in the small island economies reverses after one year. It could be that they take advantage of tighter credit market conditions by increasing lending, possibly in a search for yield. There is no evidence of heterogeneous effects when considering credit risks in the small island economies, as opposed to their peers from the continental countries where in the initial period credit risks seem to be higher at banks with very high liquid asset holdings and lower at the other banks. In terms of policy rate changes, there are again very few significant effects on banks' loan ratios.

Next, we estimate a similar model but include interactions terms for foreign banks. We thus replace our indicator variable  $EL_{ict}$  with an indicator variable  $F_{ict}$  that is equal to one if bank is in majority owned by a foreign bank and zero if it is domestically owned. Foreign banks represent important players in the banking systems, i.e. 44 out of our 116 banks are subsidiaries of foreign banks (see Table 2).<sup>18</sup> It is not clear whether foreign banks respond differently to changes in the policy stance compared to domestic banks. They might have an advantage by the access to internal funds stemming from their parent bank, they might serve a different (wealthier) clientele, and be more involved into lending to businesses particularly to those

<sup>18</sup> While foreign banks represent 22% of the market share in the small island economies, in the other region they account for 12% (in terms of total assets).

involved in international trade. The results of this experiment are reported in Table 10. Our main results on tighter reserve requirements hold for the two types of banks and in both regions, bank lending slows down after one year at all banks. In the small island economies, it appears that foreign banks slow down lending after one year in response to higher policy rates, which stand in contrast to domestic banks. In the other region, there is heterogeneous adjustment in the response of securities holdings to policy rate changes after one year and in problem loans in the initial period. Overall, reserve requirements thus appear to be effective in mitigating credit cycles independent of bank ownership.

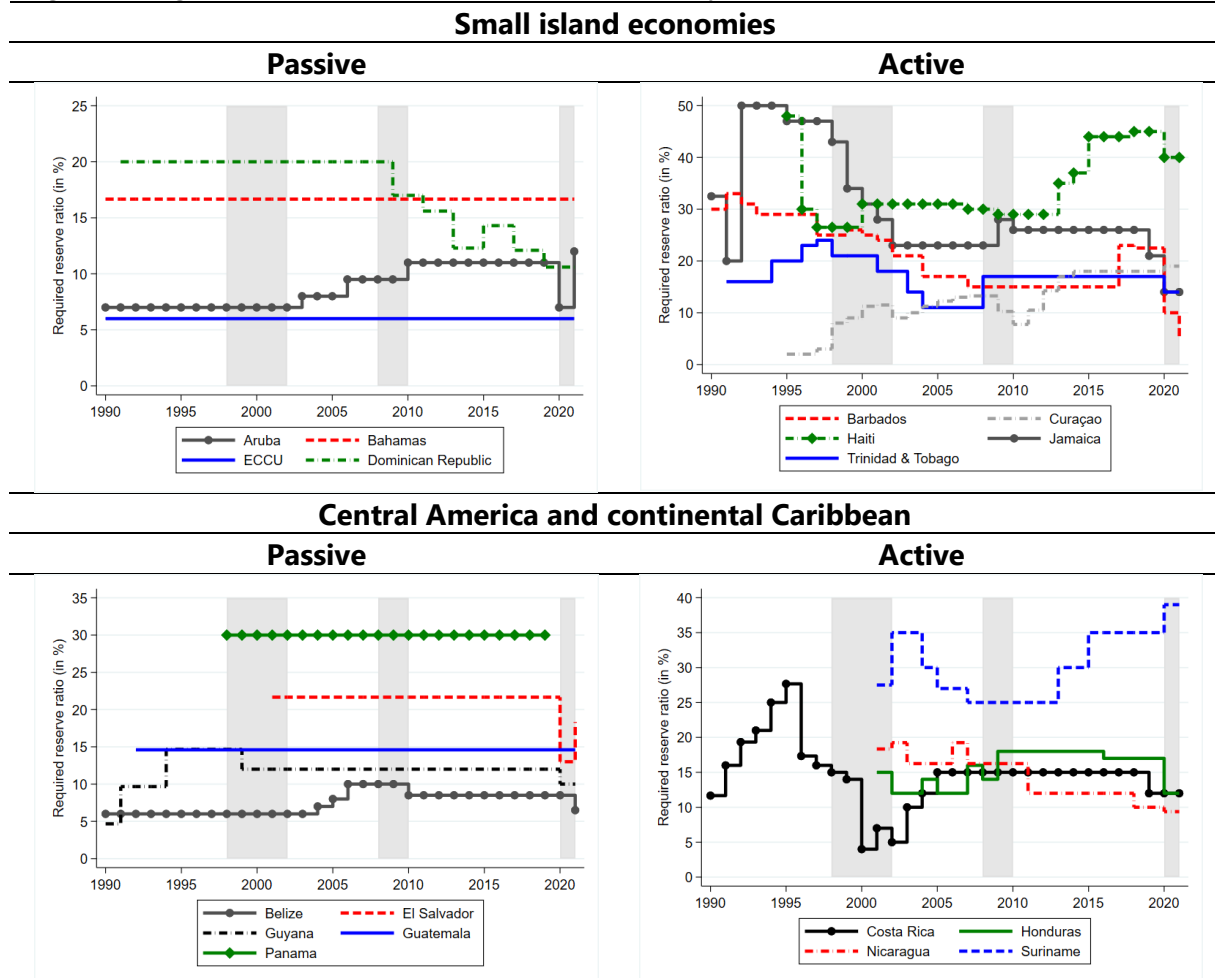
## Conclusions

The present investigated how two major central bank policy instruments, namely policy rates and reserve requirements, affected banks in the Caribbean and Central America. As we developed in detail, central banks tend to use these two instruments to conduct monetary and countercyclical policies with the aim to promote stable economic conditions that promote growth. Central banks from the region face challenges that are very different compared to those of their peers in the advanced and emerging market economies. Their economic systems are characterized by small size, partial dollarization, managed exchange rates and high dependence on imports. The unpredictable external environment coupled with shallow financial markets and oligopolistic banking sectors with high levels of excess liquidity pose challenges to central banks and they have to use a mix of direct and indirect policy tools to accomplish their objectives. Here we focused on two of them.

Using detailed information on reserve requirements and policy rates along with data on bank financial statements, we find that increases in reserve requirements have been associated with higher reserve asset holdings and reductions in bank lending. While the impact on reserve holdings occurs in the same year of the policy change, it takes one year for bank lending to slow down. From this perspective, changes in reserve requirements represent an effective countercyclical policy tool even in banking systems with excess liquidity. For the small island economies, the results give rise to some caution, as tighter reserve requirements have been associated with increased credit risks after one year. As we argue and in line with the theoretical predictions by Glocker (2021), this could be due to a search for yield effect of tighter reserve requirements according to which banks shift liquid assets to riskier loan portfolios with higher expected returns in an attempt to compensate for the reduction in their profit margins. A potential solution for central banks to this risk-shifting problem is to operate with countercyclical capital requirements given that higher capital requirements imply that there is more at stake for banks and thus they would internalize the impact of riskier lending.

Another important result of our study is that changes in policy rates exert little impact on banks in terms of their holdings of reserve assets and securities, and in terms of their lending activities. This points to a limited effectiveness of monetary policy based on interest rates - a finding that merits further exploration in future research.

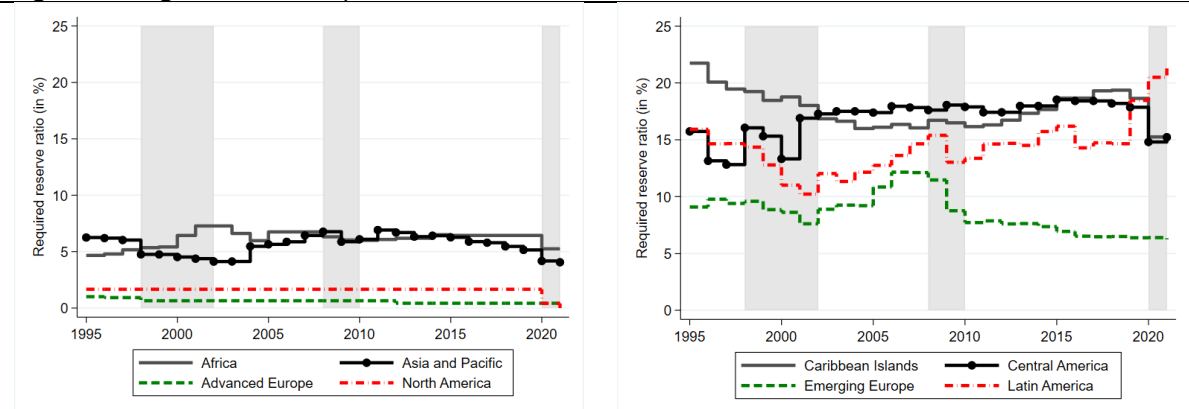
Figure 1: Legal reserve requirements for local currency exposures



Note: The figures show end-of-year regulatory reserve ratios (RRR). 'Passive' indicates countries in which reserve requirements tend to be stable and 'active' are those where they change quite frequently. In countries where RRR differ for demand, savings and time deposits, simple averages are shown. The shaded areas show periods of economic stress in the region (1998-2002, 2008-2010 and 2020-2021). More details on reserve requirement policy frameworks can be found in Table 1 and Table A1 in the Appendix.

Sources: Central banks; Federico et al. (2014). Authors calculations.

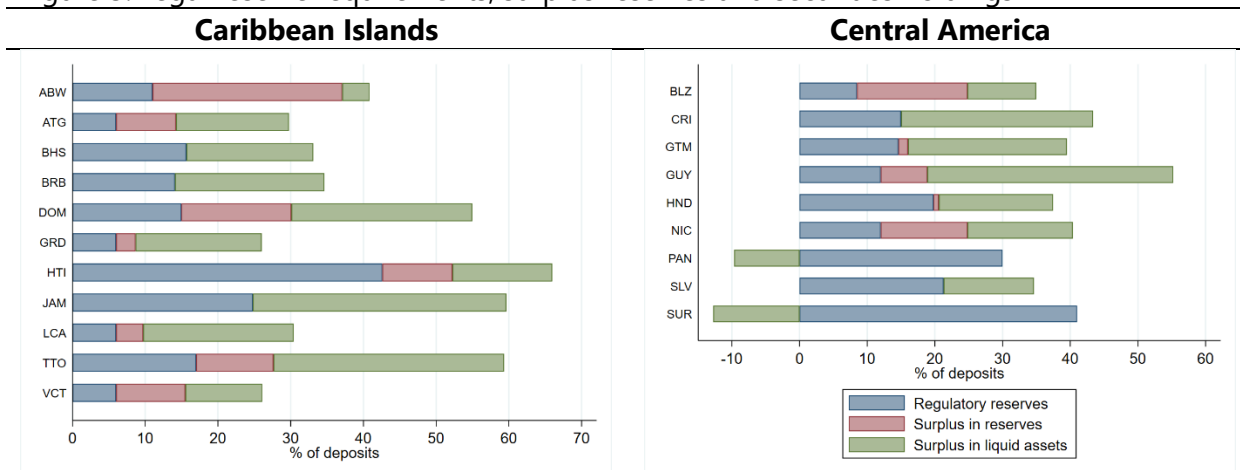
Figure 2: Legal reserve requirements around the world



Note: The figures show regional averages of regulatory reserve requirements. Region definitions are based on the IMF classification. Number of countries depend on data availability: 4 from Africa, 13 from Asia and Pacific, 9 from Advanced Europe, 13 from Emerging Europe, 9 from Latin America and 2 from North America. Caribbean Islands and Central America (including Belize, Guayana and Suriname) are composed of our sample of 20 countries.

Source: Central banks; Federico et al. (2014). Authors' calculations.

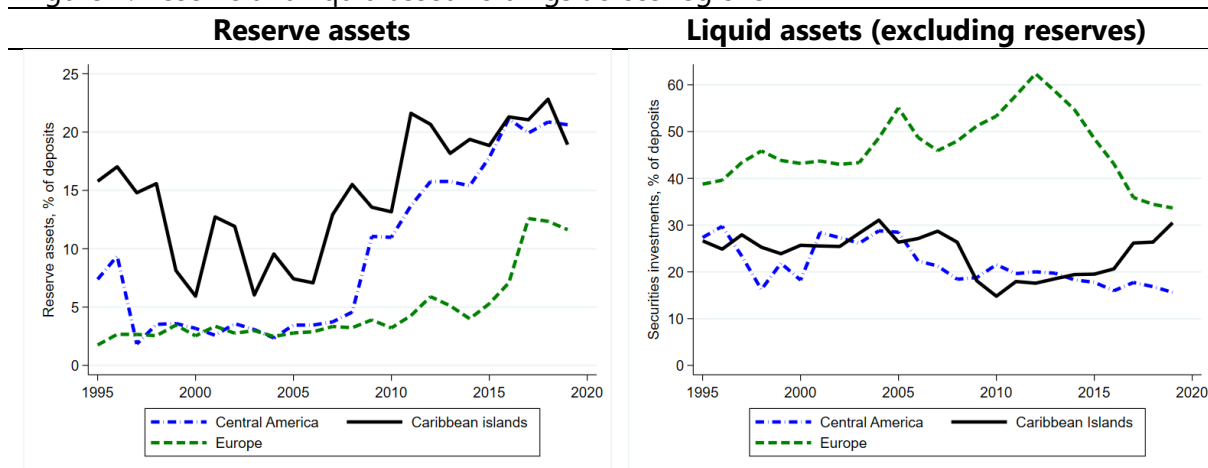
Figure 3: Legal reserve requirements, surplus reserves and securities holdings



Note: The figures show a decomposition of bank liquid asset holdings in percent of deposits (country medians for 2010-19). 'Regulatory reserves' are required reserve holdings (regulatory reserve ratio (RRR) weighted by bank-specific exposures; if RRRs vary across local and foreign currency deposits, it was assumed that banks hold the country average.) 'Surplus in reserves' is the difference between banks' holdings of reserve assets (cash and non-interest-earning balances with central banks) and the required regulatory reserves. 'Surplus in liquid assets' is the difference between liquid asset holdings (securities investments and reserve assets) and reserve assets. Negative values indicate that the regulatory reserve ratio was higher than total liquidity holdings. Central America includes Belize, Guayana and Suriname.

Sources: Fitch; Central banks; Federico et al. (2014). Authors calculations.

Figure 4: Reserve and liquid asset holdings across regions



Note: The figures show annual regional medians of reserve assets (cash and non-interest-earning balances with central banks) and securities investments (trading securities, derivatives, available for sale and held to maturity securities, at-equity investments, loans and advances to banks and other securities). Central America includes Belize, Guayana and Suriname. Europe includes the banks covered in Brei et al. (2023) from 18 European countries. Source: Fitch; Brei et al. (2023). Authors' calculations.

Table 1: Legal reserve and liquidity requirements in Central America and the Caribbean

	Minimum RR	RR type	Compliance assets	Eligible liabilities	Remuneration	Penalty	Uses
Aruba	Reserve requirement	single	n. a.	Deposits	n. a.	n. a.	n. a.
Bahamas	Cash and liquidity RR	maturity	Cash, CB balances and gov. securities	Deposits (incl. interbank and OLFIs)	n. a.	Twice annual discount rate per day of breach	Monetary policy
Barbados	Cash and liquidity RR	currency	Cash, CB deposits and gov. securities prior to 2021	Deposits	n. a.	Fine and rate fixed by central bank	Monetary policy
Dom. Republic	Reserve requirement	currency	Cash and central bank deposits	Deposits, fin. certificates, mortgage insurance exp.	FX reserves at Feds OR – 2%	n. a.	Monetary policy
Haiti	Reserve requirement	currency + bank type	Cash and gov. securities	Deposits and other liabilities	n. a.	n. a.	Monetary and prudential policy
Jamaica	Cash and liquidity RR	currency	Cash and gov. securities	Local liabilities and FX deposits	n. a.	Fixed (150.000 JM\$) + daily amount (5000\$)	Monetary and prudential policy
ECCU	Reserve requirement	single	EC\$ cash holdings and central bank deposits	Deposits (excl. interbank)	Non-interest-bearing	Penalty rate <5 p.p. over discount rate	Monetary policy
Trinidad and Tobago	Primary (cash) requirement	single	Cash reserve account at CB	Deposits	Non-interest earning	Fixed rate of 1/10% per day on deficiency	Monetary policy
Belize	Cash and reserve requirement		Cash, CB deposits, gov. bonds (since 2010)	Deposits	n. a.	n. a.	Monetary policy
Costa Rica	Reserve requirement	single	Deposits at CB account (same currency as exp.)	Deposits (excl. interbank)	n. a.	discount rate on deficiency	Monetary policy
El Salvador	Cash and liquidity RR	maturity	Deposits at CB and CB securities	Deposits	n. a.	n. a.	Prudential policy
Guatemala	Reserve requirement	single	Cash and deposits at CB account (same currency)	Deposits	0.6%	n. a.	Monetary policy
Guyana	Reserve requirement	single	n. a.	All liabilities	n. a.	n. a.	Monetary and prudential policy
Honduras	Cash and liquidity RR	currency	Cash, deposits at CB and gov. Bonds	Deposits, savings stamps	Parity at 1/2 of policy rate	Fixed by CB, depend on currency	Monetary policy
Nicaragua	Cash and liquidity RR	single	Cash or CB securities	Deposits	n. a.	Based on interbank rate (> 1%)	Monetary policy
Panama	Liquidity RR	single	Short-term Assets, mat. <186 days	Deposits (excl. funds from parents), mat.<186 days	n. a.	n. a.	Prudential policy
Suriname	Reserve requirement	currency	Cash, bank deposits, and gov. securities.	Deposits	Non remunerated	Fixed amount	Monetary policy

Note: 'RR' denotes reserve requirements and 'CB' central bank. Some numbers might be outdated. 'n. a.' denotes not available.

Sources: Central banks; Deléchat et al. 2012; Jordan et al. 2012.

Table 2: Characteristics of the database

	No. of banks	Foreign banks	Assets	Assets/GDP	RR type	Average RR, LC	Average RR, FX	Reserve assets	Liquid assets (incl. reserves)	Cash-deposit ratio	Term deposits	Demand deposits	Equity	Loans	NPLs	Interest rate on loans
	No. of entities		Mil. USD	in %		% of deposits				Std. dev.	in % of assets			in % of loans		in %
Small island economies																
Antigua and Barbuda	1	0	474	28.1	s	6	6	11.1	26.9	3.1	60.7	19.1	16.3	60.5	8.3	9.4
Aruba	2	1	2117	77.6	s	11	11	25.3	37.0	2.2	38.8	40.6	10.6	64.7	15.1	8.7
Bahamas	6	1	8303	63.1	m	17	17	11.1	28.3	2.1	68.4	10.9	13.8	69.7	6.1	8.9
Barbados	4	4	12677	272.2	c	21	2	14.8	42.8	3.3	57.8	18.5	11.8	58.1	6.6	10.8
Dominican Republic	7	2	19420	21.8	c	12	20	28.6	48.5	3.5	48.2	6.9	10.2	57.3	2.0	17.5
Grenada	2	1	806	66.4	s	6	6	7.3	30.9	0.5	62.0	23.9	9.8	57.7	4.6	9.7
Haiti	4	0	3218	19.6	c	31	34	47.5	66.4	3.3	53.0	29.1	7.8	34.0	0.9	15.5
Jamaica	7	4	8054	50.9	c	26	23	13.4	62.3	2.3	44.9	15.0	12.6	38.1	4.1	28.8
Saint Lucia	2	0	1140	53.8	s	6	6	9.1	31.2	1.8	73.9	10.4	12.5	63.4	15.9	8.9
St Vincent & Grenadines	1	0	417	50.6	s	6	6	15.1	26.1	2.1	51.0	24.2	11.6	63.6	6.4	8.5
Trinidad and Tobago	4	2	18333	84.7	s	17	17	22.0	51.8	2.8	44.1	19.8	12.2	47.1	4.3	13.5
Sum*/mean	40*	15*	74960*	71.7		14.5	13.4	18.7	41.1	2.5	54.8	19.8	11.7	55.8	6.8	12.7
Central America and continental Caribbean																
Belize	2	1	1242	78.6	s	8.5	8.5	23.4	27.5	2.4	63.7	20.1	11.4	69.1	2.9	13.6
Costa Rica	11	2	50601	79.0	c	15	15	12.2	41.9	1.3	43.5	19.5	11.6	69.1	2.3	15.3
El Salvador	10	5	18180	67.6	m	22	22	17.8	34.6	1.5	53.1	16.2	10.6	67.8	2.4	10.3
Guatemala	11	5	43888	57.0	s	15	15	14.9	41.3	1.9	44.6	29.6	8.9	54.5	1.7	12.8
Guyana	5	3	2180	42.1	s	12	12	13.0	51.0	1.1	68.6	16.9	11.3	40.0	12.9	16.2
Honduras	12	7	21255	85.3	c	17	24	16.6	34.5	2.0	51.7	11.6	10.3	67.3	1.7	14.6
Nicaragua	7	2	6381	50.6	s	16	16	22.0	40.8	2.8	52.6	16.3	10.0	58.5	2.1	17.1
Panama	15	4	109458	163.4	s	30	30	2.0	21.2	0.4	60.3	11.4	9.7	63.4	1.4	9.1
Suriname	3	0	1623	48.9	c	30	50	18.5	26.2	3.1	46.7	38.2	7.1	50.4	2.1	12.8
Sum*/mean	76*	29*	254808*	74.7		18.3	21.3	15.6	35.5	1.8	53.9	20.0	10.1	60.0	3.3	13.5

Note: The table reports simple averages for the period 1995-2019. 'RR type' indicates the type of reserve requirement at end-2019: 's' are single reserve requirements, 'm' reserve requirements that vary by maturity, 'c' reserve requirements that vary by currency. 'Average RR, LC (FC)' denotes average reserve requirement rates in local (foreign) currency. 'NPLs' denotes non-performing loans.

Sources: Central banks; Fitch; World Bank Development Indicators. Authors' calculations.

Table 3: Variable definitions

Variable	Definition
<b>Outcome variables</b>	
Reserve holdings	Cash and due from banks, in percent of deposits. Includes cash and non-interest-earning balances with central banks (in percent of total deposits)
Liquid assets	Trading securities, derivatives, available for sale and held to maturity securities, at-equity investments, loans and advances to banks and other securities (in percent of total deposits)
Loans	Consumer, corporate, commercial and mortgage loans, (in percent of assets)
Non-performing loans	Non-performing loans (in percent loans)
<b>Central bank policy variables</b>	
Reserve requirement rate	Regulatory reserve requirement rate, weighted by maturity and currency composition, where applicable
Policy rate	Central bank discount rate, where available, if not monetary policy-related interest rate or deposit rate (per annum)
<b>External macroeconomic factors</b>	
Exchange rate	Official exchange rate, local currency per USD, period average
Net financial account	Net financial account, in percent of GDP
International reserves	Official reserves, in months of imports
<b>Idiosyncratic factors</b>	
Equity	Total equity, in percent of assets
Size	Logarithm of total assets
<b>Precautionary factors</b>	
Volatility, GDP	Standard deviation of real GDP growth, 3-year rolling window
Volatility, cash-to-deposit ratio	Standard deviation of the cash-to-deposit ratio, 3-year rolling window
Short-term deposits	Demand deposits, in percent of assets
<b>Domestic macroeconomic factors</b>	
Inflation	Annual inflation, GDP deflator
GDP growth	Annual real GDP growth
Government debt	In percent of GDP
Damaging storms	Cumulative number of damaging tropical storms
Note: This table provides variable definitions. Sources: Central banks; Fitch; World Bank Development Indicators; IMF-IFS database; Brei et al. (2024).	

Table 4: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Small island economies					
Δ Reserve holdings	528	-0.07	8.00	-61.98	31.41
Δ Liquid assets	528	0.53	17.22	-159.93	171.15
Δ Loans	528	-0.11	5.52	-47.15	16.85
Δ NPLs	452	-0.03	3.17	-26.22	16.73
Δ RR rate	528	-0.28	1.93	-11.90	7.60
Δ Policy rate	528	-0.25	1.80	-10.00	10.00
Δ FX rate	528	1.81	7.98	-3.46	168.07
Δ Financial account	528	0.25	6.02	-22.29	18.59
International reserves	528	3.76	2.16	0.52	13.35
Equity (t-1)	528	11.91	4.21	-2.05	30.46
Size (t-1)	528	20.22	1.25	16.67	23.20
Volatility, GDP (t)	528	2.47	2.14	0.07	15.36
Volatility, cash-deposit ratio (t-1)	528	4.30	5.62	0.02	47.55
Short-term deposits (t-1)	528	18.72	11.60	1.30	62.83
Inflation	528	5.18	7.53	-27.63	91.38
GDP growth	528	2.09	3.49	-11.96	14.44
Gov. debt	528	59.91	33.37	13.47	159.13
Damaging storms	528	6.91	6.03	0.00	23.00
Central America and continental Caribbean					
Δ Reserve holdings	1101	0.57	7.10	-65.42	59.21
Δ Liquid assets	1101	-0.58	10.54	-123.39	111.94
Δ Loans	1101	0.35	5.09	-29.21	29.56
Δ NPLs	903	-0.07	4.32	-72.66	68.91
Δ RR rate, weighted	1101	-0.02	1.22	-5.90	7.75
Δ Policy rate	1101	-0.24	1.93	-16.26	12.87
Δ FX rate	1101	2.95	11.11	-47.64	46.53
Δ Financial account	1101	-0.15	13.51	-180.69	185.62
International reserves	1101	3.10	1.38	0.70	7.41
Equity (t-1)	1101	12.67	11.10	3.43	95.40
Size (t-1)	1101	20.53	1.34	17.12	23.85
Volatility, GDP	1101	1.92	2.34	0.08	22.28
Volatility, cash-deposit ratio (t-1)	1101	3.12	4.96	0.01	49.53
Short-term deposits (t-1)	1101	19.22	13.45	0.13	78.69
Inflation	1101	4.88	8.13	-5.61	174.86
GDP growth	1101	3.93	2.65	-4.92	11.98
Gov. debt	1101	42.67	18.97	14.65	236.16
Damaging storms	1101	3.11	3.95	0.00	12.00

Note: This table provides summary statistics for the regression variables.

Table 5: Reserve holdings, reserve requirements and policy rates

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	Small island economies				Central America and continental Caribbean			
	Y = $\Delta$ Reserve holdings							
$\Delta$ RR rate (t)	<b>0.999***</b> <b>(0.164)</b>	<b>1.001***</b> <b>(0.162)</b>	<b>0.976***</b> <b>(0.161)</b>	<b>0.907***</b> <b>(0.153)</b>	<b>0.741**</b> <b>(0.275)</b>	<b>0.776**</b> <b>(0.319)</b>	<b>0.889**</b> <b>(0.366)</b>	<b>0.850**</b> <b>(0.345)</b>
$\Delta$ RR rate (t-1)	0.095 (0.187)	0.110 (0.166)	0.080 (0.152)	0.023 (0.112)	-0.120 (0.204)	-0.049 (0.216)	0.101 (0.249)	0.045 (0.222)
$\Delta$ Policy rate (t)	-0.112 (0.184)	-0.137 (0.192)	-0.150 (0.207)	-0.216 (0.176)	-0.203 (0.133)	-0.221 (0.141)	-0.253 (0.140)	<b>-0.331**</b> <b>(0.134)</b>
$\Delta$ Policy rate (t-1)	0.017 (0.213)	0.010 (0.199)	0.017 (0.228)	0.051 (0.257)	0.024 (0.129)	0.015 (0.087)	-0.019 (0.071)	-0.038 (0.072)
$\Delta$ FX rate (t)		-0.017 (0.025)	0.001 (0.017)	-0.010 (0.012)		<b>-0.052**</b> <b>(0.018)</b>	<b>-0.054**</b> <b>(0.018)</b>	<b>-0.047**</b> <b>(0.017)</b>
$\Delta$ Net capital inflows (t)		<b>0.071***</b> <b>(0.015)</b>	<b>0.065***</b> <b>(0.015)</b>	0.039 (0.030)		0.0144 (0.079)	0.015 (0.088)	-0.012 (0.094)
International reserves (t)		-0.098 (0.250)	0.200 (0.287)	0.082 (0.325)		<b>-0.845*</b> <b>(0.400)</b>	<b>-1.048**</b> <b>(0.399)</b>	<b>-0.964**</b> <b>(0.394)</b>
Equity (t-1)			-0.137 (0.108)	-0.163 (0.104)			<b>-0.151**</b> <b>(0.051)</b>	<b>-0.149**</b> <b>(0.057)</b>
Size (t-1)			<b>-2.496***</b> <b>(0.452)</b>	<b>-2.575***</b> <b>(0.515)</b>			-0.519 (0.716)	-0.836 (0.615)
Volatility, GDP (t)			<b>-0.548**</b> <b>(0.229)</b>	<b>-0.576**</b> <b>(0.229)</b>			<b>-0.183*</b> <b>(0.092)</b>	<b>-0.173*</b> <b>(0.084)</b>
Volatility, cash-deposit (t-1)			-0.159 (0.142)	-0.154 (0.147)			0.208 (0.181)	0.210 (0.181)
Short-term deposits (t-1)			-0.018 (0.050)	-0.011 (0.053)			-0.070 (0.052)	-0.060 (0.050)
Inflation (t)				0.087 (0.076)				0.0106 (0.013)
GDP growth (t)				0.030 (0.187)				<b>-0.394**</b> <b>(0.144)</b>
Gov. debt (t)				-0.033 (0.031)				0.0120 (0.021)
Damaging storms				<b>0.345**</b> <b>(0.148)</b>				-0.062 (0.155)
Obs.	528	528	528	528	1101	1101	1101	1101
No. of banks	40	40	40	40	76	76	76	76
R2, within	0.133	0.135	0.160	0.169	0.038	0.046	0.064	0.071

Note: The sample period is 1994-2019. The regressions are estimated with bank-fixed effects. Standard errors are clustered by country. A constant and time fixed effects are included but not reported. (\*\*\*, \*\*, \*) indicate significance on the 1%, 5%, and 10% level.

Table 6: Liquid assets, reserve requirements and policy rates

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	Small island economies				Central America and continental Caribbean			
	Y = $\Delta$ Liquid assets (securities holdings excluding reserve assets)							
$\Delta$ RR rate (t)	-0.389 (0.272)	-0.403 (0.274)	<b>-0.272*</b> <b>(0.126)</b>	-0.175 (0.136)	0.352 (0.262)	0.346 (0.257)	0.270 (0.156)	0.178 (0.148)
$\Delta$ RR rate (t-1)	<b>-1.022*</b> <b>(0.519)</b>	<b>-0.979*</b> <b>(0.540)</b>	<b>-0.777*</b> <b>(0.419)</b>	<b>-0.731*</b> <b>(0.401)</b>	<b>1.405**</b> <b>(0.508)</b>	<b>1.373**</b> <b>(0.506)</b>	<b>1.319**</b> <b>(0.433)</b>	<b>1.258**</b> <b>(0.426)</b>
$\Delta$ Policy rate (t)	<b>-0.558**</b> <b>(0.186)</b>	<b>-0.577**</b> <b>(0.191)</b>	<b>-0.594*</b> <b>(0.267)</b>	<b>-0.517*</b> <b>(0.271)</b>	0.292 (0.241)	0.329 (0.260)	0.354 (0.224)	0.294 (0.236)
$\Delta$ Policy rate (t-1)	-0.536 (0.320)	<b>-0.594*</b> <b>(0.326)</b>	-0.668 (0.443)	-0.730 (0.428)	0.484 (0.278)	0.505 (0.272)	<b>0.539*</b> <b>(0.278)</b>	<b>0.541*</b> <b>(0.270)</b>
$\Delta$ FX rate (t)		0.0141 (0.034)	0.041 (0.023)	<b>0.051**</b> <b>(0.023)</b>		0.039 (0.025)	0.026 (0.022)	0.025 (0.020)
$\Delta$ Net capital inflows (t)		0.022 (0.049)	0.021 (0.046)	0.060 (0.050)		-0.060 (0.038)	<b>-0.096*</b> <b>(0.042)</b>	<b>-0.108**</b> <b>(0.042)</b>
International reserves (t)		0.989 (1.015)	1.319 (0.783)	<b>1.364*</b> <b>(0.684)</b>		0.907* (0.411)	0.693 (0.578)	0.779 (0.502)
Equity (t-1)			<b>-1.009*</b> <b>(0.508)</b>	<b>-0.972*</b> <b>(0.513)</b>			0.159 (0.484)	0.151 (0.481)
Size (t-1)			<b>-11.92**</b> <b>(4.393)</b>	<b>-11.85**</b> <b>(4.363)</b>			-0.233 (1.032)	-0.344 (1.091)
Volatility, GDP (t)			<b>-0.519*</b> <b>(0.257)</b>	-0.480 (0.266)			<b>-0.597***</b> <b>(0.167)</b>	<b>-0.587**</b> <b>(0.179)</b>
Volatility, cash-deposit (t-1)			<b>0.486**</b> <b>(0.201)</b>	<b>0.483**</b> <b>(0.205)</b>			<b>-0.176*</b> <b>(0.093)</b>	<b>-0.190*</b> <b>(0.091)</b>
Short-term deposits (t-1)			0.047 (0.080)	0.0360 (0.089)			<b>0.111**</b> <b>(0.044)</b>	<b>0.117**</b> <b>(0.044)</b>
Inflation (t)				-0.127 (0.074)				0.022 (0.027)
GDP growth (t)				-0.018 (0.211)				<b>-0.370*</b> <b>(0.196)</b>
Gov. debt (t)				0.019 (0.046)				-0.043 (0.028)
Damaging storms				-0.403 (0.345)				0.250 (0.158)
Obs.	528	528	528	528	1101	1101	1101	1101
No. of banks	40	40	40	40	76	76	76	76
R2, within	0.0821	0.0853	0.152	0.154	0.0840	0.0875	0.102	0.107

Note: The sample period is 1994-2019. The regressions are estimated with bank-fixed effects. Standard errors are clustered by country. A constant and time fixed effects are included but not reported. (\*\*\*, \*\*, \*) indicate significance on the 1%, 5%, and 10% level.

Table 7: Bank lending, reserve requirements and policy rates

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	Small island economies				Central America and continental Caribbean			
	Y = $\Delta$ Bank loans							
$\Delta$ RR rate (t)	0.092 (0.265)	0.090 (0.274)	0.080 (0.256)	0.049 (0.252)	-0.218 (0.159)	-0.224 (0.157)	-0.240 (0.147)	-0.154 (0.139)
$\Delta$ RR rate (t-1)	<b>-0.261**</b> <b>(0.098)</b>	<b>-0.282**</b> <b>(0.103)</b>	<b>-0.296**</b> <b>(0.100)</b>	<b>-0.307***</b> <b>(0.090)</b>	<b>-0.584***</b> <b>(0.106)</b>	<b>-0.583***</b> <b>(0.129)</b>	<b>-0.615***</b> <b>(0.096)</b>	<b>-0.521***</b> <b>(0.074)</b>
$\Delta$ Policy rate (t)	-0.077 (0.122)	-0.046 (0.147)	-0.045 (0.146)	-0.055 (0.138)	-0.132 (0.117)	-0.144 (0.110)	-0.140 (0.096)	-0.040 (0.068)
$\Delta$ Policy rate (t-1)	0.132 (0.137)	0.146 (0.125)	0.162 (0.128)	0.207 (0.150)	-0.110 (0.073)	-0.123 (0.084)	-0.121 (0.083)	-0.102 (0.092)
$\Delta$ FX rate (t)		0.021 (0.022)	0.016 (0.018)	0.011 (0.016)		0.010 (0.008)	0.013 (0.008)	0.010 (0.008)
$\Delta$ Net capital inflows (t)		<b>-0.086*</b> <b>(0.046)</b>	<b>-0.084*</b> <b>(0.044)</b>	<b>-0.096*</b> <b>(0.047)</b>		-0.056 (0.033)	-0.044 (0.029)	-0.017 (0.031)
International reserves (t)		0.016 (0.395)	-0.079 (0.343)	-0.076 (0.335)		0.010 (0.264)	0.177 (0.278)	0.159 (0.316)
Equity (t-1)			0.247 (0.169)	0.227 (0.169)			-0.056 (0.079)	-0.053 (0.075)
Size (t-1)			<b>2.206***</b> <b>(0.476)</b>	<b>2.258***</b> <b>(0.604)</b>			0.357 (0.415)	0.653 (0.437)
Volatility, GDP (t)			0.072 (0.160)	0.053 (0.158)			<b>0.278**</b> <b>(0.115)</b>	<b>0.263**</b> <b>(0.106)</b>
Volatility, cash-deposit (t-1)			-0.048 (0.039)	-0.043 (0.037)			0.013 (0.062)	0.019 (0.056)
Short-term deposits (t-1)			0.032 (0.022)	0.041 (0.028)			0.0022 (0.017)	-0.011 (0.017)
Inflation (t)				0.031 (0.021)				-0.015 (0.012)
GDP growth (t)				0.088 (0.121)				<b>0.462**</b> <b>(0.187)</b>
Gov. debt (t)				-0.003 (0.016)				-0.004 (0.024)
Damaging storms				0.148 (0.171)				-0.208 (0.155)
Obs.	528	528	528	528	1101	1101	1101	1101
No. of banks	40	40	40	40	76	76	76	76
R2, within	0.100	0.108	0.133	0.137	0.126	0.129	0.136	0.159

Note: The sample period is 1994-2019. The regressions are estimated with bank-fixed effects. Standard errors are clustered by country. A constant and time fixed effects are included but not reported. (\*\*\*, \*\*, \*) indicate significance on the 1%, 5%, and 10% level.

Table 8: Credit risk, reserve requirements and policy rates

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	Small island economies				Central America and continental Caribbean			
	Y = $\Delta$ Non-performing loans							
$\Delta$ RR rate (t)	0.045 (0.026)	<b>0.042*</b> <b>(0.022)</b>	0.029 (0.028)	0.012 (0.034)	-0.342 (0.189)	<b>-0.362*</b> <b>(0.189)</b>	-0.357 (0.198)	-0.341 (0.218)
$\Delta$ RR rate (t-1)	<b>0.152***</b> <b>(0.044)</b>	<b>0.155**</b> <b>(0.053)</b>	<b>0.126*</b> <b>(0.062)</b>	<b>0.116*</b> <b>(0.055)</b>	0.291 (0.206)	0.265 (0.190)	0.278 (0.187)	0.275 (0.198)
$\Delta$ Policy rate (t)	0.022 (0.069)	0.029 (0.069)	0.066 (0.089)	0.009 (0.075)	-0.041 (0.113)	-0.059 (0.114)	-0.078 (0.123)	-0.066 (0.097)
$\Delta$ Policy rate (t-1)	0.055 (0.084)	0.037 (0.095)	0.039 (0.126)	0.009 (0.078)	0.075 (0.130)	0.063 (0.131)	0.055 (0.139)	0.061 (0.134)
$\Delta$ FX rate (t)		0.012 (0.015)	0.011 (0.013)	0.012 (0.012)		0.012 (0.008)	0.013 (0.009)	0.0150 (0.010)
$\Delta$ Net capital inflows (t)		-0.015 (0.018)	-0.029 (0.020)	-0.027 (0.017)		-0.003 (0.027)	-0.012 (0.021)	-0.001 (0.035)
International reserves (t)		<b>0.306**</b> <b>(0.098)</b>	<b>0.444***</b> <b>(0.078)</b>	<b>0.318**</b> <b>(0.135)</b>		0.023 (0.187)	-0.118 (0.211)	-0.141 (0.181)
Equity (t-1)			0.084 (0.086)	0.126 (0.073)			0.021 (0.049)	0.015 (0.050)
Size (t-1)			-0.781 (1.631)	-1.059 (1.326)			<b>0.680*</b> <b>(0.315)</b>	0.629 (0.350)
Volatility, GDP (t)			-0.115 (0.179)	-0.094 (0.152)			<b>-0.132**</b> <b>(0.043)</b>	<b>-0.112***</b> <b>(0.031)</b>
Volatility, cash-deposit (t-1)			-0.003 (0.028)	-0.017 (0.031)			-0.014 (0.019)	-0.010 (0.020)
Short-term deposits (t-1)			-0.044 (0.057)	-0.070 (0.049)			-0.001 (0.019)	-0.001 (0.022)
Inflation (t)				<b>0.041***</b> <b>(0.013)</b>				<b>-0.035***</b> <b>(0.005)</b>
GDP growth (t)				<b>-0.135*</b> <b>(0.063)</b>				-0.033 (0.057)
Gov. debt (t)				-0.024 (0.022)				-0.001 (0.009)
Damaging storms				<b>-0.274**</b> <b>(0.108)</b>				-0.047 (0.154)
Obs.	452	452	452	452	903	903	903	903
No. of banks	39	39	39	39	72	72	72	72
R2, within	0.151	0.161	0.183	0.221	0.124	0.124	0.128	0.132

Note: The sample period is 1994-2019. The regressions are estimated with bank-fixed effects. Standard errors are clustered by country. A constant and time fixed effects are included but not reported. (\*\*\*, \*\*, \*) indicate significance on the 1%, 5%, and 10% level.

Table 9: Reserve requirements, policy rates and excess liquidity

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	Small island economies				Central America and continental Caribbean			
	Y=ΔRes.	Y=ΔSec.	Y=ΔL	Y=ΔNPL	Y=ΔRes.	Y=ΔSec.	Y=ΔL	Y=ΔNPL
ΔRR rate (t)	<b>0.902***</b> <b>(0.246)</b>	<b>-0.334**</b> <b>(0.127)</b>	0.269 (0.193)	-0.003 (0.035)	<b>1.077*</b> <b>(0.575)</b>	0.348 (0.274)	-0.027 (0.140)	<b>-0.902**</b> <b>(0.266)</b>
ΔRR rate (t)*High EL(t)	-0.547 (0.760)	0.026 (0.398)	<b>-0.778**</b> <b>(0.278)</b>	-0.028 (0.169)	-0.603 (0.594)	-0.556 (0.639)	-0.285 (0.311)	<b>1.369**</b> <b>(0.418)</b>
ΔRR rate (t-1)	0.0921 (0.147)	-0.700 (0.500)	<b>-0.457***</b> <b>(0.089)</b>	<b>0.120*</b> <b>(0.060)</b>	0.082 (0.284)	<b>1.191**</b> <b>(0.421)</b>	<b>-0.570***</b> <b>(0.065)</b>	0.367 (0.222)
ΔRR rate (t-1)*High EL(t-1)	-0.960 (1.194)	-0.438 (1.366)	<b>1.002***</b> <b>(0.313)</b>	-0.102 (0.183)	-0.892 (1.543)	0.709 (0.421)	1.047 (0.575)	<b>-0.885**</b> <b>(0.332)</b>
ΔPolicy rate (t)	<b>-0.262*</b> <b>(0.143)</b>	<b>-0.559*</b> <b>(0.259)</b>	-0.044 (0.138)	-0.002 (0.081)	-0.320 (0.197)	0.226 (0.335)	-0.017 (0.073)	-0.028 (0.100)
ΔPolicy rate (t)*High EL(t)	2.016 (2.224)	1.307 (1.652)	-0.419 (0.551)	0.403 (0.677)	0.119 (0.355)	0.228 (0.581)	-0.085 (0.220)	<b>-0.186***</b> <b>(0.039)</b>
ΔPolicy rate (t-1)	0.031 (0.188)	<b>-0.908**</b> <b>(0.373)</b>	<b>0.276*</b> <b>(0.150)</b>	0.001 (0.079)	0.039 (0.071)	0.473 (0.271)	-0.100 (0.095)	0.0860 (0.148)
ΔPolicy rate (t-1)*High EL(t-1)	0.615 (1.549)	<b>4.133**</b> <b>(1.494)</b>	-1.200 (0.741)	0.294 (0.239)	-2.025 (2.247)	1.856** (0.534)	-0.084 (0.443)	-0.240 (0.592)
Obs.	528	528	528	452	1101	1101	1101	903
No. of banks	40	40	40	39	76	76	76	72
R2, within	0.177	0.162	0.162	0.223	0.0852	0.112	0.163	0.167

Note: The sample period is 1994-2019. The regressions are based on the full specification including all control variables (not reported). 'High EL' is a dummy variable equal to one if a bank has a liquid asset ratio (excluding reserves) in the last decile of the distribution. Standard errors are clustered by country. (\*\*\*, \*\*, \*) indicate significance on the 1%, 5%, and 10% level.

Table 10: Reserve requirements, policy rates and foreign banks

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	Small island economies				Central America and continental Caribbean			
	Y= $\Delta$ Res.	Y= $\Delta$ Sec.	Y= $\Delta$ L	Y= $\Delta$ NPL	Y= $\Delta$ Res.	Y= $\Delta$ Sec.	Y= $\Delta$ L	Y= $\Delta$ NPL
$\Delta$ RR rate (t)	<b>1.175**</b> <b>(0.408)</b>	0.159 (0.401)	0.138 (0.421)	0.027 (0.040)	<b>1.091*</b> <b>(0.503)</b>	0.453 (0.279)	-0.066 (0.143)	<b>-0.859**</b> <b>(0.299)</b>
$\Delta$ RR rate (t)*Foreign(t)	-0.700 (1.044)	-0.655 (0.914)	-0.288 (0.402)	-0.044 (0.080)	-0.719 (0.519)	-0.940 (0.637)	-0.226 (0.316)	<b>1.212**</b> <b>(0.408)</b>
$\Delta$ RR rate (t-1)	0.099 (0.127)	-1.080 (0.891)	<b>-0.335***</b> <b>(0.091)</b>	<b>0.135**</b> <b>(0.049)</b>	0.111 (0.121)	<b>1.656**</b> <b>(0.456)</b>	<b>-0.559***</b> <b>(0.095)</b>	0.489 (0.275)
$\Delta$ RR rate (t-1)*Foreign(t-1)	-0.563 (0.413)	1.438 (1.641)	0.045 (0.228)	-0.038 (0.063)	-0.248 (0.548)	<b>-1.161**</b> <b>(0.425)</b>	0.094 (0.142)	-0.436 (0.282)
$\Delta$ Policy rate (t)	-0.309 (0.271)	-1.347 (0.936)	0.072 (0.249)	0.023 (0.040)	<b>-0.341*</b> <b>(0.172)</b>	0.334 (0.299)	-0.023 (0.078)	-0.021 (0.114)
$\Delta$ Policy rate (t)*Foreign(t)	0.046 (0.548)	2.102 (1.544)	-0.183 (0.502)	0.002 (0.156)	0.118 (0.316)	0.032 (0.445)	-0.064 (0.221)	-0.203 (0.118)
$\Delta$ Policy rate (t-1)	-0.201 (0.174)	-1.446 (1.026)	<b>0.535*</b> <b>(0.265)</b>	0.151 (0.150)	-0.046 (0.117)	0.839 (0.480)	-0.128 (0.103)	0.090 (0.177)
$\Delta$ Policy rate (t-1)*Foreign(t-1)	<b>0.678***</b> <b>(0.203)</b>	1.455 (0.937)	<b>-0.825***</b> <b>(0.188)</b>	<b>-0.360**</b> <b>(0.147)</b>	0.029 (0.257)	-0.784 (0.661)	0.064 (0.133)	-0.015 (0.125)
Obs.	528	528	528	452	1101	1101	1101	903
No. of banks	40	40	40	39	76	76	76	72
R <sup>2</sup> , within	0.182	0.173	0.157	0.231	0.074	0.116	0.160	0.167

Note: The sample period is 1994-2019. The regressions are based on the full specification including all control variables (not reported). 'Foreign' is a dummy variable equal to one if a bank is majority-owned by a foreign parent company. Standard errors are clustered by country. (\*\*\*, \*\*, \*) indicate significance on the 1%, 5%, and 10% level.

## Appendix

Table A1: Reserve requirements regulation in the Caribbean and Central America

	Type 2019	Type change	RR demand	RR savings	RR-FX demand	RR-FX savings	RR max.	RR-FX max.	RR min.	RR-FX min.	Demand	Sav. & term	FX
			in % of deposits				annual change				in % of deposits		
Small island economies													
Aruba	s		9.6	9.6	9.6	9.6	5	5	-4	-4	43.1	56.9	
Bahamas	m		20	15	20	15	0	0	0	0	17.1	82.9	
Barbados	c	s/2005	17.0	17.0	2.9	2.9	8	0	-12.5	-2	26.6	73.4	7.0
Dominican Republic	c	s/2001	15.9	15.9	18.8	18.8	2	5	-3.3	-10	16.7	83.3	30.0
ECCU	s		6	6	6	6	0	0	0	0	23.7	76.3	
Haiti	c		34.9	34.9	37.8	37.8	7	10	-5	0	38.4	61.6	60.0
Jamaica	c	s/2008	23.9	23.9	25.2	25.2	5	3	-7	-5	25.0	75.0	40.0
Trinidad & Tobago	s		15.8	15.8	15.8	15.8	6	6	-4	-4	39.2	60.8	
Mean			17.5	16.9	16.7	16.1	4.1	3.6	-4.3	-3.1	28.7	71.3	
Central America and continental Caribbean													
Belize	s		8.1	8.1	8.1	8.1	2	2	-2	-2	25.5	74.5	
Costa Rica	c	cm/199	12.9	12.9	13.4	13.4	5	7	-10	0	32.0	68.0	41.0
El Salvador	m		24.4	19.6	24.4	19.6	5.3	5.3	-8.7	-8.7	24.3	75.7	
Guatemala	s		14.6	14.6	14.6	14.6	0	0	0	0	44.1	55.9	
Guyana	s	m/1998	11.8	11.8	11.8	11.8	0	0	-2	-2	19.0	81.0	
Honduras	c		15.5	15.5	31.1	31.1	4	2	-5	-15.5	25.0	75.0	30.0
Nicaragua	c	s/2019	14.2	14.2	14.2	14.2	3	3	-4.3	-4.3	23.9	76.1	73.0
Panama	s		30	30	30	30	0	0	0	0	19.4	80.6	
Suriname	c	s/2000	30.7	30.7	40.5	40.5	7.5	10.8	-5	0	43.9	56.1	55.0
Mean			18.0	17.5	20.9	20.4	3.0	3.3	-4.1	-3.6	28.6	71.4	

Note: The table reports simple averages for the period 1990-2019. 'Type, 2019' indicates the type of reserve requirement at end-2019 ('s' indicates single reserve requirements (RR) for all deposits, 'm' RR that vary with maturity of deposits, 'c' RR that differ for foreign currency deposits, and 'cm' RR that vary across maturity and currency. 'Type, change' indicates the previous type of reserve requirement with the year of change, if applicable. 'RR' and 'RR-FX' denote reserve requirement rates in local and foreign currency. 'Av. RR, max (min)' indicates the maximum (minimum) annual change in the average reserve requirement. 'Demand', 'savings & term' and 'FX' are country averages of the respective deposit shares in percent of deposits (FX deposit shares are estimates based on central bank reports or similar). Sources: Central banks; Federico et al. (2014); Deléchat et al. (2012). Authors' calculations.

## Box 1: Monetary policy frameworks

### Small island economies

**Aruba:** The Centrale Bank van Aruba has a fixed exchange regime and there are several instruments available for the effective execution of its monetary policy. One of its most important instruments is the reserve requirement, which is used to either mop up from or inject liquidity into the banking sector to ultimately promote financial stability. (<https://www.cbaruba.org/about-us-main-functions-and-activities>)

**The Bahamas:** The main instruments of monetary policy in The Bahamas are reserve requirements, changes in the central bank discount rate and selective credit controls, supplemented by moral suasion. Over the years, the central bank has relied on interest rate controls in combination with moral suasion and other policies to manage financial sector liquidity. The central bank affects interest rates by varying its discount rate, which is used mainly to signal changes in monetary policy. For the most part, interest rate policy reflects changing responses to bank liquidity and domestic credit conditions. (<https://www.centralbankbahamas.com/objectives>)

**Barbados:** Barbados has a fixed exchange rate regime and historically the central bank has adopted a number of monetary policy instruments. These include moral suasion, changes in the discount rate, required reserve ratios, open market operations (OMOs), and minimum savings deposit rate. Since 2013, the central bank shifted towards a market-based determination of policy rates (3-month T-bill rate plus a spread), for details see Worrell et al. (2012).

**Dominican Republic:** Historically, monetary policy focused on managing base money mainly via (primary market) OMOs, with adoption of continuous inflation targeting since 2005. The central bank gives high importance to the exchange rate as a nominal anchor. It uses a monetary policy rate as reference rate with maturity of one day. To affect the level of interbank rates, the central bank performs daily auctions of central bank bills or overnight repurchase agreements (Repos), with yields equivalent to the policy rate  $\pm$  50 basis points. (Central Bank of the Dominican Republic, Informe de Política Monetaria, 2021). Since 2010 some secondary trading in central bank and government paper, clear interest rate corridor from restructured standing facilities (loan vs deposit rates), and a formal policy rate are in place (Cobham, 2022).

**ECCU:** Given the small size and openness of the economies of the member countries, the central bank has sought to pursue the objective of price stability through the maintenance of a fixed exchange rate with the US dollar. Its ability to execute its responsibility to regulate the availability of money and credit is constrained by the underdeveloped nature of the financial markets. This inhibits the ability of the central bank to influence the level of interest rates and thereby the availability of money and credit through market means. In principle, interest rates in the currency union are set at the discretion of the commercial banks, except that the central bank regulates the minimum rate payable on savings deposits. (<https://www.eccb-centralbank.org/monetary-policy>)

**Haiti:** Since 2012, the central bank aims for low inflation and exchange rate stability mainly via reserve requirements, backed up by OMOs (auctions of central bank bills), policy rates as signals, and periodic forex interventions, see Cobham (2022) and <https://www.brh.ht/politique-monetaire/>.

**Jamaica:** The main monetary policy instrument used by the central bank is the policy rate. The policy rate is the interest rate that the central bank pays on balances in the current accounts of deposit-taking institutions at the Bank of Jamaica. In addition to this rate, the central bank uses a variety of other monetary policy tools to meet its inflation target. It also conducts OMO and makes occasional adjustments to the reserve requirement ratios while managing the foreign exchange market in the context of operating a flexible exchange rate regime. (<https://boj.org.jm/core-functions/monetary-policy/monetary-policy-instruments/>)

**Trinidad and Tobago:** The central bank employs a range of direct and indirect instruments to conduct monetary policy. The indirect or market based instruments largely comprise OMO and the use of a policy rate, the repo rate, while the direct instruments mainly involve the use of statutory reserve requirements. From time to time, the central bank also employs special facilities to absorb excess liquidity from the financial system. (<https://www.central-bank.org.tt/core-functions/monetary-policy>)

### Central America and continental Caribbean

**Belize :** To accomplish its monetary policy objective, the central bank of Belize uses a mix of direct and indirect policy tools to influence the supply and demand of money. Indirect policy tools are used more widely than direct tools. Indirect tools such as reserve requirements and open market operations seek to alter liquidity conditions. While the use of reserve requirements has been the traditional monetary tool of choice, more recently, the central bank shifted towards the use of OMO to manage liquidity in the financial system and to signal its policy stance. Direct policy tools are used to establish limits on interest rates, credit and lending. These include direct credit

controls, direct interest rate controls and direct lending to banks as lender of last resort (rarely used). (<https://www.centralbank.org.bz/home/core-functions/monetary-policy/monetary-policy-tools>)

**Costa Rica:** Since 2006, Costa Rica has transitioned from a crawling peg regime to a managed float as part of the move toward an inflation-targeting regime (Cubero et al., 2018). The central bank uses a policy rate as a reference in guiding the cost of one day operations in the interbank market. The central bank gives high importance to the exchange rate as a nominal anchor and intervenes in the FX market to preserve the stability of the currency. With the interest rate as policy instrument, all foreign exchange interventions are sterilized through daily liquidity auctions. Over the period 2005-2020, the legal reserve requirement was at the maximum level allowed by law before being reduced to combat the impact of the Covid-19 pandemic. Forex and secondary government securities markets are underdeveloped.

**El Salvador:** Since 2001, full dollarization with explicit aim of lowering interest rates and raising growth. US dollar is the legal tender. Reserve requirements replaced by remunerated liquidity requirements, deposit insurance fund and lender of last resort facility rare being used, some ongoing OMOs and central bank liabilities not assumed by government are in place (Cobham, 2022).

**Guatemala:** The central bank has adopted an inflation-targeting framework in 2005. The major monetary policy instrument is the policy rate in a context of underdeveloped securities markets, weak monetary policy transmission mechanism and high monetary growth. FX market interventions are constrained and there is an intervention rule to limit exchange rate volatility (Medina Cas et al., 2011; Cobham, 2022).

**Guyana:** The Bank of Guyana utilizes two instruments in the conduct of monetary policy. These are reserve requirements and OMOs on Treasury bills. Monetary policy focuses on broad money growth. (<https://bankofguyana.org.gy/bog/regulatory-framework/monetary-policy>)

**Honduras:** The central bank is moving towards a more flexible exchange rate regime anchored on price stability and the management of international reserves (IMF, 2021). It uses OMOs, changes in policy rates and reserve requirements for monetary policy. To reduce the fragmentation between central bank and treasury instruments, the central bank introduced a 28-day reverse repo with government securities to manage liquidity (IMF, 2021a; Cobham, 2022).

**Nicaragua:** Nicaragua has a crawling peg. The central bank uses a monetary reference rate with an interest rate corridor. In response to the Covid-19 pandemic, the central bank stabilized the financial sector by introducing repos, reducing reserve requirements, phasing-in regulatory provisioning, and by adopting a new scheme of daily monetary operations to ensure access by banks to daily liquidity from the central bank (IMF, 2020). Monetary policy uses OMOs but remains focused on quantities and less on interest rates, notably reserve targets, and on exchange rate crawl, within a highly dollarized economy (Cobham, 2022).

**Panama:** Panama is a fully dollarized economy and does not have its own currency or central bank. There are liquidity regulations in place to ensure adequate levels of liquidity to cover the external financial obligations of the government and banking sector. Statutory liquidity requirements were introduced in 2009 ("the legal liquidity index") with a minimum of 30 percent (IMF, 2021b).

**Suriname:** The central bank operates under a reserve money targeting framework. The exchange rate is market-determined and the central bank only intervenes to address disorderly market conditions. The reserve requirement for deposits in local currency was introduced in 2001 and that for deposits in foreign currency (US dollar and euro) was introduced in 2003. The central bank conducts OMOs to control local currency liquidity in the banking system (wholesale auctions of term deposits and since 2022 direct issuances of central bank certificates), see IMF (2023). Changes in reserve requirements are used to complement monetary policies based on interest rates along with moral suasion and caps on credit growth.

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