

Liquidity Regulation and the Transmission of Lending Shocks Across Borders

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Abstract

We investigate how liquidity regulation affects the transmission of negative *wholesale* funding shocks from the largest OECD global banks to the lending of their foreign subsidiaries across 98 countries. Controlling for adverse *solvency* shocks, which we argue is very important for identification, we find that, surprisingly, liquidity regulation exacerbates the transmission of adverse wholesale shocks. These findings suggest that liquidity regulation has a destabilizing effect for the host market. The effect is driven primarily by countries with floating exchange rate regimes and less so by countries with currency boards and other exchange rate management arrangements, such as dollarization. The results from our global study provide important lessons for Bulgaria in its transition from a currency board to a euro area membership.

Keywords: Global banks, liquidity regulation, wholesale shocks, exchange rate regimes, transmission, internal capital markets

JEL: G01, G21, G28

1. Introduction

The global financial crisis added a new impetus to banking regulation around the globe. At their core, most of these regulatory efforts were targeted towards stemming contagion across markets via the internal capital markets of global banks. Despite the increased regulatory attention, the knowledge of the inner workings of the operations and drivers of cross-border flows in these internal markets is still insufficient. Such knowledge becomes even more crucial in attempting to predict and prevent transmission of negative shocks across borders. The current paper aims to answer the question of whether liquidity regulation can mitigate or exacerbate the transmission of negative shocks across borders through the subsidiary operations of multinational banks.

The importance of global banks for host markets around the globe and in transition economies cannot be overstated. Aside from the direct links due to the foreign ownership of the largest local banks, multinational banks redistribute a large portion of foreign direct investments (FDIs),¹ which constitutes an indirect connection between

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¹ Ivanov et al. (2018) establish that one fifth of foreign direct investments in Bulgaria run through the banking sector.

international financial and business cycles and local business cycles. Global banks use their internal capital markets for optimal resource allocation and diversification within the conglomerate (see, e.g., Cetorelli and Goldberg, 2012a,b). However, a number of recent studies show that internal capital markets may transmit shocks from parents to their foreign subsidiaries, and thus they may threaten the stability of foreign banking systems and real economies (see, e.g., Radev, 2021 and Barth and Radev, 2022).

In the current work, we analyze how liquidity regulation around the globe affects the transmission of shocks from parents to subsidiaries via the internal capital markets of global banks. Following Radev (2021) and Barth and Radev (2022), we define two types of idiosyncratic shocks at the parent level – solvency and wholesale shocks² and control for the macroeconomic environment across all our main specifications. Since both types of shocks may be correlated, to disentangle the effect of liquidity regulation, which usually transpires through funding channels, we also need to control for solvency shocks. We base our regression analysis and conclusions on a hand-collected dataset of liquidity regulations in over 90 countries around the world and discuss exchange rate regimes as a possible driver of our findings.

Our results suggest that in order to analyze whether negative wholesale funding shocks are systematically related to a reduction in subsidiary lending and to study the full magnitude of the effect, we should also control for negative solvency shocks to parent banks. Second, using a unique hand-collected dataset of liquidity reforms in our sample of countries, we find that

stricter liquidity rules do not affect subsidiary lending growth in normal times but appear to aggravate the impact of wholesale shocks on foreign subsidiaries: If a host country has imposed stricter liquidity regulation, a parent wholesale shock decreases lending growth by 6.8 to 6.9 percentage points, while the liquidity regulation in the *home country of the parent* does not affect the transmission of shocks. Therefore, the main finding of the paper is that stricter host-country liquidity rules impede lending growth in the host market in times of a parent distress. A possible explanation for this finding could be that parents prefer not to violate the liquidity requirements imposed by the regulators in the host country and therefore the only way to withdraw funds from their subsidiaries is by cutting lending, as previously shown by Van den End and Kruidhof (2013) and De Nicolo et al. (2012). Investigating exchange rate arrangements as possible drivers of our results, we find that after a shock to the parent, host-country liquidity regulation reduces lending mainly in countries with floating exchange rate regimes. We also find very strong negative effect of parent-country liquidity regulation on host countries with currency boards, but primarily in tranquil periods. Interestingly, there is virtually no effect of foreign and domestic liquidity regulation for subsidiary jurisdictions with dollarization.

Our paper speaks to the literature on the bank lending channel and the paths of transmission of lending supply shocks through internal capital markets. And more specifically: Whether internal capital markets within multinational banks play a role in credit supply (Houston and James, 1998; De Haas and van Lelyveld, 2003, 2010; Holod and Peek,

² To identify the shocks, we follow the methodology of DeYoung et al. (2017) and Radev (2021). For more details, see Online Appendix A.1.

2010; Cetorelli and Goldberg, 2012a,b; Radev, 2021; Barth and Radev, 2022). Schnabl (2012) documents that global banks transfer negative liquidity shocks abroad, leading to a drop in lending in the host markets. De Haan and van den End (2013) find that after a liquidity shock to their Dutch parent, foreign branches and subsidiaries reduce their lending by more than their domestic counterparts. Radev (2021) finds that while solvency shocks to parents are more important than wholesale shocks, the transmission of the latter still occurs, through parents that rely primarily on wholesale funding.

The main contribution of the paper is to the literature on how liquidity regulation affects the transmission of shocks across borders. Banerjee and Mio (2014) do not find a negative effect of tightened liquidity regulation on bank lending to the real economy for a set of U.K. banks. On the other hand, a number of studies (see, for instance, Van den End and Kruidhof, 2013 and De Nicolo et al., 2012) provide evidence that higher liquidity requirements increase lending interest rates, decrease loan volume and lead to inefficiency and reduction of welfare. Our own findings suggest that liquidity regulation has a destabilizing effect for the host market.

Our paper is also related to the general literature on the co-movement of international financial and business cycles through banking activities. Karamisheva et al. (2019) find that the financial cycle is synchronized with the business cycle in Bulgaria, meaning that a reduction in bank lending is correlated with a reduction in real economic activity. Relating to liquidity measures, in an investigation of the drivers of credit supply in Bulgaria, Peshev (2014) finds that locally operating banks with larger liquidity buffers manage to weather

better the global financial crisis and the following euro area sovereign debt crisis.

Our findings are also relevant for the literature that connects exchange rate regimes and financial and banking stability. Agenor et al. (2020) analyze the effect of foreign exchange interventions on financial stability in a model of managed float with financial frictions and imperfect capital mobility. The authors find that a sterilization policy may be expansionary through bank portfolios, which could increase volatility and financial risks. Our findings show that moving from managed to a fully floating exchange rate arrangement, for instance from a currency board or dollarization to a common currency like the euro, may increase the risks of transmission of negative shocks.

This remainder of this paper is organized as follows. Section 2 presents the institutional framework of the relationship between parents and subsidiaries. Section 3 presents our major hypothesis and empirical model and discusses the data. Section 4 reports the baseline empirical results and further findings and robustness checks. Section 5 concludes.

2. Institutional Details

2.1. Regulation of Foreign Affiliates

In this section, we outline the institutional details that govern foreign subsidiaries, including the legal distinction between subsidiaries and branches and how both types of ownership structures are regulated. Although we focus on foreign *subsidiaries* in this paper, the comparison between branches and subsidiaries is vital in understanding the institutional environment that a parent bank faces when it enters and operates in a foreign market.

There are a number of differences between subsidiaries and branches that banks take

into consideration when choosing an optimal organizational structure abroad. The most important difference is that subsidiaries are (fairly) independent legal entities incorporated in the host country, while branches are business units that are part of the parent bank and not legally independent. Subsidiaries are separate banks that are supervised in the host country. Considering financial reporting, most countries do not require branches of foreign parents to issue financial reports.³ This data unavailability effectively constrains the scope of our study to foreign subsidiaries.

There are various motives why a bank would choose to open a branch, instead of incorporating a subsidiary in a foreign country and vice versa. Maintaining a subsidiary is usually related to higher costs, i.e. maintaining capital and liquidity buffers and abiding to the rules of host country supervisors. The motives include also differences in taxation and economic and political risks between the home and the host jurisdictions (Cerutti et al., 2007).

There are also differences in the freedom of movement of cash flows between the parent and the affiliate. Theoretically, it is unrestricted under the centralized organizational form (i.e., for branches), while it may be very limited in the decentralized form (i.e., for subsidiaries). Overall, maintaining a branch network may allow for a liquidity and risk management at the group level, which would help the group in neutralizing idiosyncratic shocks in any part of the network. On the other hand, a subsidiary structure may allow the parent to contain losses in the event of a distress of a particular affiliate.

There are also different incentives, depending on the bank's business model:

Universal banking, investment banking or commercial banking. For an investment bank that focuses on maintaining contacts with corporate clients around the globe and has no retail banking business, a centralized branching system is more convenient. On the other hand, a commercial bank may find maintaining a foreign subsidiary more attractive if it would like to concentrate on retail banking. Maintaining a separate local business unit that has local expertise is particularly important in obtaining local funding or singling out profitable investments. It could also be held accountable for its performance and decisions. Furthermore, the subsidiary is considered a local bank in the host country and can take advantage of its deposit insurance schemes. We chose to concentrate on commercial banks to avoid taking into account these conflicting incentives stemming from a bank's business model.

2.2. Liquidity Regulation

The regulation of the liquidity management of banks and its impact on banking practices had been neglected before the global financial crisis, since the focus has been on capital regulation. Until that point, rules on liquidity levels were considered unnecessary if capital adequacy rules were already in place, as considerable substitution effects were conjectured to take place. After the default of Lehman Brothers, it was revealed that many banks had poor liquidity management practices, despite fulfilling their capital adequacy obligations. In 2009, the works on the new Basel III accord commenced, which strengthened and extended the regulation of capital and proposed a separate leverage ratio. In contrast to the capital rules, which

³ An important exception is the UK where branches are also required to issue financial statements (Saunders and Steffen, 2011).

extended a framework that already existed, no such standards pre-existed for liquidity regulation. The efforts resulted in the publication of BCBS (2010), which introduced the Liquidity Coverage Ratio (LCR) that aims to ensure that the bank holds enough high-quality liquid assets to withstand a stress period of 30 days.

Since the focus of the current policy discussions is whether the LCR is a viable liquidity management tool and since a number of countries have introduced similar ratios even before Basel III,⁴ we decided to focus specifically on that quantitative type of liquidity regulation. Our conjecture is that the liquidity rules in both the home and the host country matter for the transmission of shocks. The home country rules regarding the liquidity buffer affect the capacity of the parent bank to absorb idiosyncratic liquidity shocks before it transmits them to its subsidiaries. On the other hand, the liquidity requirements in the host country limit the size of cash flows that a parent is able to extract without precipitating actions by the host regulators.

3. Empirical Model and Data

3.1. Empirical Model and Identification Strategy

3.1.1. Theoretical Prediction

Our main testable hypothesis aims at analyzing the effect of liquidity regulation on the transmission of wholesale shocks. Liquidity buffers decrease the probability of fire sales, deleveraging, liquidity hoarding and restriction of credit – elements that lead to negative externalities due to their

effects on asset prices and the availability of funding (Van den End and Kruidhof, 2013). In addition, since the possibility of liquidity provision by central banks can lead to moral hazard problems (Farhi and Tirole, 2012), the relatively costly liquidity buffers can align the incentives of bank managers and increase the time before liquidity assistance is needed. Our main testable hypothesis, therefore, reads:

Hypothesis: *Subsidiaries in countries with regulatory minimum liquidity requirements are less affected by wholesale funding shocks to parents.*

3.1.2. General Model

In this paper, we investigate how the transmission of idiosyncratic shocks to a parent bank affects the lending of its foreign subsidiaries, depending on the strictness of the liquidity regulation in the home and host countries. To test the hypothesis outlined above, we follow Radev (2021) and estimate variations of the following model:

$$\begin{aligned} \text{growth (Loans)}_{i,j,k,t} = & \alpha_0 + \alpha_1 \cdot \text{SolvencyShock}_{j,t-1} \\ & + \alpha_2 \cdot \text{WholesaleShock}_{j,t-1} \\ & + \alpha_3 \cdot \text{Interactions}_{j,t-1} \\ & + \alpha_4 \cdot \text{BankControls}_{i,j,k,t-1} \\ & + \alpha_5 \cdot \text{MacroVariables}_{k,t} \\ & + \beta_t + \gamma_i + \epsilon_{i,j,k,t} \end{aligned}$$

where $\text{growth (Loans)}_{i,j,k,t}$ is the loan growth of subsidiary i of parent j in host country k at time t ; $\text{SolvencyShock}_{j,t-1}$ and $\text{WholesaleShock}_{j,t-1}$ are solvency and wholesale funding shocks on parent j at time $t-1$, respectively;⁵ $\text{Interactions}_{j,t-1}$ is a vector of interaction terms discussed later; $\text{BankControls}_{i,j,k,t}$ is a vector of individual bank-related indicators of subsidiary i of parent j

⁴ For instance, the Netherlands introduced its first liquidity requirement in 1977, and Luxembourg in 1993 (Bonner et al., 2014).

⁵ To identify the shocks, we follow the methodology of DeYoung et al. (2017) and Radev (2021). For more details, see Online Appendix A.1.

in country k at time $t-1$; $MacroControls_{k,t}$ is a vector of macroeconomic variables, related to host country k at time t ; β_t is a time fixed effect for period t ; γ_i is an entity fixed effect for subsidiary i .⁶ We define the solvency and liquidity shocks, respectively, as a large and unexpected decline in the capital of the parent bank (solvency shock), or a sudden dry-up in its wholesale funding (liquidity shock). We discuss the definition of shocks in more detail in Section A.1.

The bank variables control for individual bank idiosyncratic characteristics, related to the size, sources of funding, performance and financial health of the subsidiary. The variables that we use are: *size*, *profitability*, *riskiness*, *liquidity level*, *capitalization* and *internally generated funds*. To control for the local demand for credit, we also introduce macroeconomic variables. These include *GDP growth*, *change in unemployment rate* (Δ *unemployment rate*) and annual inflation. Throughout the paper, we lag the bank controls by one period and cluster the standard errors at the parent level. For further discussions on identification, please refer to Radev (2021).

3.2. Data

3.2.1. Dataset Construction

To construct our dataset, we start with annual bank balance sheet data from Bureau van Dijk's Bankscope for the period 1997-2012.⁷ We focus on the top 500 commercial banks in OECD countries and search manually for their foreign subsidiaries, and whether they themselves are subsidiaries of foreign banks. We end up with 84 OECD parents and 375 OECD and non-OECD. Table A2 in the

Online Appendix provides a list of the parent commercial banks, as well as the respective number of their foreign subsidiaries.⁸ Overall, the parent banks represent 27 OECD countries, while the subsidiaries are located in 98 countries (OECD and non-OECD combined). Figures A4 and A5 in the Online Appendix depict the geographical distribution of the subsidiaries and the parents in our sample, respectively. We hand-collect data about liquidity regulation and exchange rate arrangements around the world from the webpages of local banking authorities and the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. The final dataset for our regressions consists of 2745 annual observations at the subsidiary level and 870 matched parent-year observations. We convert the data from Bankscope from local currency to millions of U.S. Dollars.

3.2.2. Descriptive Statistics

Table 1 presents the descriptive statistics of some of the main variables in our regression analysis. In terms of loan growth, the mean in the sample of subsidiaries is over 4 percentage points higher than the mean loan growth rate in the sample of parents. At the same time, the volatility of subsidiary loan growth is two times higher than the volatility of parent loan growth. Foreign subsidiaries are smaller than their parents, but are more profitable, better capitalized and more liquid. Foreign subsidiaries also generate higher net income to total loans than their parents. Regarding the macroeconomic variables in the host countries over the sample period, the mean annual GDP growth is about 8

⁶ Table 2 defines all variables and the sources of the data.

⁷ For a more detailed description of the construction of our dataset and sample selection, see Radev (2021).

⁸ The full list of subsidiaries is available upon request.

percent, mean annual inflation is at 4%, while mean unemployment is held at below 9%.

The full set of regression variables and their descriptions is provided in Table 2.

Table 1. Descriptive Statistics. This table presents the descriptive statistics of the dependent variable and the bank control variables in our regression analysis. The sample comprises 375 foreign subsidiaries of 84 OECD parent banks in the period 1997-2012.

Note: Not all data for parents are available, therefore the number of observations for some of the variables below is lower than 870. These variables are not used in the regression analysis, as it is at the subsidiary level, and the averages are presented for the sake of approximate comparison only.

Variable		Parents	Subsidiaries
Loan Growth Rate	Mean	14.33%	18.46%
	Standard Deviation	24.25%	45.73%
	Observations	870	2745
Size	Mean	11.77	7.62
	Standard Deviation	1.49	1.93
	Observations	870	2745
Profitability (Profit/Total Earning Assets)	Mean	0.91%	1.57%
	Standard Deviation	1.27%	2.52%
	Observations	860	2745
Riskiness (LLP/Loans)	Mean	0.89%	1.39%
	Standard Deviation	1.11%	2.61%
	Observations	843	2745
Capitalization (Equity/Total Assets)	Mean	6.36%	12.50%
	Standard Deviation	3.03%	9.66%
	Observations	870	2745
Liquidity (Liquid Assets/Total Assets)	Mean	22.10%	28.16%
	Standard Deviation	12.96%	20.43%
	Observations	870	2745
Internally Generated Funds (Net Income _{<i>t</i>})/Loans _{<i>t</i>} -1)	Mean	1.80%	3.62%
	Standard Deviation	3.37%	7.84%
	Observations	860	2745
GDP Growth	Mean	-	8.04%
	Standard Deviation	-	11.73%
	Observations	-	2745
Inflation	Mean	-	4.23%
	Standard Deviation	-	5.02%
	Observations	-	2745
Unemployment	Mean	-	8.83%
	Standard Deviation	-	6.09%
	Observations	-	2745

Table 2. Regression Variables. This table presents a description of the regression variables and data sources. All relevant balance sheet variables are converted to U.S. dollars for an easier interpretation of the results.

Variable name	Description	Data source
Loan Growth Rate _{<i>i</i>}	Growth of total subsidiary loans	Bankscope
Size _{<i>i</i>}	Natural logarithm of total subsidiary assets	Bankscope
Profitability _{<i>i</i>}	Ratio of subsidiary profits to total earning assets	Bankscope
Riskiness _{<i>i</i>}	Ratio of subsidiary loan-loss provisions to total loans	Bankscope
Capitalization _{<i>i</i>}	Ratio of subsidiary equity to total assets	Bankscope
Liquidity _{<i>i</i>}	Ratio of subsidiary liquid assets (cash, trading securities and interbank lending of maturities less than three months) to total assets	Bankscope
Internally Generated Funds _{<i>i</i>}	Ratio of subsidiary net income at time <i>t</i> to total loans at time <i>t</i> -1	Bankscope
Liquidity_sub _{<i>k</i>}	Dummy variable that takes the value of 1 if a liquidity requirement apart from the general required reserves is officially instituted in <i>subsidiary</i> country <i>k</i> and 0 otherwise	World Bank's Bank Regulation and Supervision surveys, National authorities documentation, Survey among national authorities
Liquidity_par _{<i>i</i>}	Dummy variable that takes the value of 1 if a liquidity requirement apart from the general required reserves is officially instituted in <i>parent</i> country <i>l</i> and 0 otherwise	World Bank's Bank Regulation and Supervision surveys, National authorities documentation, Survey among national authorities
Floating _{<i>k</i>}	Dummy variable that takes the value of 1 if there is a <i>floating arrangement</i> in <i>subsidiary</i> country <i>k</i> and 0 otherwise	International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and own calculations
Currency Board _{<i>k</i>}	Dummy variable that takes the value of 1 if there is a <i>currency board arrangement</i> in <i>subsidiary</i> country <i>k</i> and 0 otherwise	International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and own calculations
Pegged _{<i>k</i>}	Dummy variable that takes the value of 1 if there is a <i>pegged arrangement</i> in <i>subsidiary</i> country <i>k</i> and 0 otherwise	International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and own calculations
Other Management _{<i>k</i>}	Dummy variable that takes the value of 1 if there is a <i>managed arrangement</i> that does not fit the other categories in <i>subsidiary</i> country <i>k</i> and 0 otherwise	International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and own calculations

Variable name	Description	Data source
Pegged and Management _k	Dummy variable that takes the value of 1 if there is a <i>pegged or other managed arrangement</i> in <i>subsidiary</i> country <i>k</i> and 0 otherwise	International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and own calculations
Dollarization _k	Dummy variable that takes the value of 1 if the currency of another country circulates as the sole legal tender (formal dollarization) in <i>subsidiary</i> country <i>k</i> and 0 otherwise	International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and own calculations
Gross Domestic Product Growth _k	Annual GDP growth in subsidiary country	Datastream, World Bank's World Development Indicators
Inflation _k	Annual inflation in subsidiary country	Datastream, World Bank's World Development Indicators
Unemployment _k	End-of-year unemployment in subsidiary country	Datastream, World Bank's World Development Indicators

4. Empirical Results

4.1. Liquidity Regulation and Shock Transmission

As mentioned in our introduction and hypothesis sections, the existing literature does not provide definitive evidence whether stricter liquidity rules are beneficial in preventing liquidity crises and in fostering lending growth. One major drawback of these studies is that they are focusing on the experience of a particular country (e.g., the U.K. in Banerjee and Mio (2014)) or the results are based on theoretical simulations (Van den End and Kruidhof (2013); De Nicolo et al. (2012) and Gai et al. (2011)). Overall, most studies fail to take into account the cross-sectional dimension of liquidity regulation. To our knowledge, Bonner et al. (2014) is the only study that investigates the effects of liquidity regulation in a large sample of 7000 banks in 24 OECD countries. However, the authors focus on the effect of liquidity regulation on parent bank liquidity holdings and not on the

transmission of liquidity shocks from parents to subsidiaries.

To address this omission in the literature, we collect a unique dataset of liquidity reforms in the 27 parent-bank countries in our sample, as well as in the 98 countries where our parent banks have subsidiaries. We start our search with the World Bank's Bank Regulation and Supervision surveys in 1998-2000, 2002, 2006, and 2011. We further complement our data with information from the competent national authorities and legal acts at the national level. We concentrate on requirements for liquidity buffers beyond the traditional required reserves (such as regulatory minimum ratio on liquid assets) that exist in almost all countries in our sample.⁹ 47 host countries had such rules in the beginning of our sample in 1997, and this number rose to 73 in 2012. Considering the parent home-country sample, 8 countries had such legislation in 1997, and 15 – in 2012.

After collecting the legal information, we introduce liquidity regulation dummy variables “Liquidity_sub_{*j*}” and “Liquidity_par_{*i*}” that

⁹ 90 countries had required reserves rules throughout the full sample period between 1997 and 2012.

take the value of 1 if a liquidity requirement apart from the general required reserves is officially instituted in a host country j or in a parent's country i at time $t-1$, respectively and 0 otherwise. In our regressions, we include the dummies and an interaction with the wholesale shocks. Since several countries strengthened and subsequently relaxed their liquidity requirements, our design allows for different countries (and, hence, parent and subsidiaries) to be either in the control or the treatment group at different points in time.

Table 3 presents the results from our analysis. Model (1) includes only solvency and wholesale funding shocks as per our definition and following Radev (2021). Overall, we find that negative solvency shocks are more dominant in affecting foreign subsidiary lending, compared to wholesale shocks. Therefore, in order to analyze whether negative wholesale funding shocks are systematically related to a reduction in subsidiary lending and to study the full magnitude of the effect of liquidity regulation, we should also control for negative solvency shocks to parent banks. Model (2) includes only the dummy for host country liquidity regulation with its interaction with the wholesale funding shock.¹⁰ Model (3) presents the results for home country liquidity regulation with its interaction with the wholesale funding shock, while Model (4) includes both dummies and both interaction terms. In Model (2), we observe a positive but statistically insignificant coefficient of the standalone liquidity dummy. The main coefficient of interest, the coefficient of the interaction term, is negative and statistically significant at the 5% level. These results suggest that liquidity regulation has limited beneficial effect on loan growth abroad in

times when no wholesale shock occurs, while it decreases lending in times of liquidity shocks. A plausible explanation for our results is suggested by Bonner et al. (2014), who find that liquidity regulation serves as a substitute for a bank's incentives for actual liquidity buffer holding based on fundamental bank characteristics. The results from regression models (3) and (4) show that home country regulation has no additional effect on the transmission of shocks. This is also in line with the descriptive findings in Bonner et al. (2014), where the presence of liquidity regulation is shown to have no effect on the aggregate liquidity in the banking sector of 24 OECD countries. As in our study, the authors find that domestic lending rates increase during tranquil time but decrease during a crisis. In our case, we find that host country liquidity regulation has an impact on the transmission of shocks *across borders*.

Our results suggest that the liquidity buffers that foreign subsidiaries are obliged to hold do not prevent the transmission of a parent wholesale shock to the host country's economy. A possible explanation for the transmission taking place despite the liquidity rules in the host country is that while parents prefer not to violate the liquidity thresholds in the foreign market, they withdraw funds from their subsidiaries by halting current and future subsidiary lending and using the proceeds from past subsidiary lending to cushion the shocks at the headquarters. Our findings are also somewhat at odds with the results of Van den End and Kruidhof (2013) and De Nicolo et al. (2012) who find that liquidity regulation leads to an overall decrease in lending growth, efficiency and welfare. We find this not to be the case in normal times. However,

¹⁰ In unreported regressions, we confirmed that the coefficient of the interaction between solvency shocks and liquidity regulation is insignificant. The results are available upon request.

we find evidence for a negative effect of liquidity regulation on subsidiary lending if a wholesale shock hits the parent, which can

have a disruptive effect for the economy of the host country.

Table 3. Liquidity Regulation and Shock Transmission. This table reports the results from the estimation of Equation 1 with interactions of parent shocks with liquidity regulation dummies at the subsidiary and parent bank levels. The sample comprises 368 foreign subsidiaries of 84 OECD parent banks in the period 1997-2012. The dependent variable is the growth rate of subsidiary loans. “Solvency Shock_{j,t-1}” and “Wholesale Shock_{j,t-1}” are dummy variables that take the value of 1 if a parent bank *j* is hit by a solvency and wholesale shock, respectively, and 0 otherwise. “Liquidity_subk” is at the host subsidiary country *k* level. “Liquidity_parl” is at the home parent country *l* level. The bank controls are at the subsidiary *i* level. They are lagged with one period. The “Macro Controls” vector contains GDP growth, inflation and unemployment in the host country *k* of the respective subsidiary. All variables are defined in Table 2 and in the main text. The bank fixed effects are at the subsidiary level. The numbers in parentheses are standard errors. All standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)
Solvency Shock _{j,t-1}	-0.0584** (0.026)	-0.0585** (0.025)	-0.0569** (0.026)	-0.0569** (0.026)
Wholesale Shock _{j,t-1}	0.0200 (0.028)	0.0571 (0.035)	0.0275 (0.029)	0.0609* (0.036)
Liquidity sub _{j,t-1}		0.0614 (0.039)		0.0618 (0.039)
Liquidity sub _{j,t-1} *Wholesale Shock _{j,t-1}		-0.0689* (0.038)		-0.0681* (0.038)
Liquidity par _{j,t-1}			-0.0204 (0.046)	-0.0249 (0.046)
Liquidity par _{j,t-1} *Wholesale Shock _{j,t-1}			-0.0221 (0.048)	-0.0128 (0.048)
Size _{j,t-1}	-0.2033*** (0.034)	-0.2056*** (0.034)	-0.2021*** (0.035)	-0.2042*** (0.035)
Profitability _{j,t-1}	-1.8226** (0.859)	-1.8350** (0.866)	-1.8120** (0.855)	-1.8274** (0.862)
Riskiness _{j,t-1}	-1.6472** (0.682)	-1.6448** (0.694)	-1.6484** (0.684)	-1.6471** (0.696)
Capitalization _{j,t-1}	0.3472 (0.309)	0.3347 (0.309)	0.3538 (0.312)	0.3398 (0.312)

	(1)	(2)	(3)	(4)
Liquidity _{j,t-1}	0.6937*** (0.129)	0.7025*** (0.130)	0.6979*** (0.129)	0.7072*** (0.131)
Internally Generated Funds _{j,t-1}	0.7438*** (0.278)	0.7516*** (0.283)	0.7360*** (0.277)	0.7435*** (0.281)
Subsidiary FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Macro Variables	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Observations	2745	2745	2745	2745
R-squared	0.233	0.234	0.233	0.234
Adjusted R-squared	0.225	0.226	0.225	0.226

4.2. Liquidity Regulation, Currency Arrangements and Shock Transmission

In this part, we delve deeper into the drivers of the results in the previous section. In particular, we investigate whether the intensity of shock transmission through liquidity regulation varies across different exchange rate regimes. Liquidity in the banking system is regulated for different purposes in the case of a currency board or other hard pegs, such as dollarization, and under softer pegs and floating exchange rate regimes. For instance, it may be the case that due to the tighter monitoring and control of financial stability under currency boards, additional liquidity rules as defined in our paper may have only marginal effect if any.

To this end, we hand-collect information about the exchange rate regimes in each host country for the period 1997-2012 from IMF's Annual Reports on Exchange Arrangements and Exchange Restrictions (AREAER). Then, we construct dummy variables for floating and pegged exchange rate regimes, and currency board and dollarization arrangements, and

split our regression sample into groups according to each definition.¹¹

Table 4 presents the results from the estimation. While the point estimates for the interaction of wholesale shocks with subsidiary liquidity regulation are usually negative and with a relatively large absolute value, the significance in Models (2) to (4) in the previous section are primarily driven by subsidiaries in countries with floating exchange rate regimes. Interestingly, in that case, parent country liquidity rules reduce foreign subsidiary lending in normal times and increase subsidiary lending when the parent suffers from a wholesale shock. That may be driven by excess liquidity influx from parent central banks to counteract idiosyncratic wholesale events that is then used for investment abroad. None of the hard- and soft-peg regimes yield a significant coefficient for this interaction, with the exception of the residual model with "Other Management" arrangements. Bank lending in host countries with currency boards and dollarizations is insensitive to wholesale shocks through their liquidity regulation, which may indicate that

¹¹ The variable definitions for each type of exchange rate arrangements are provided in Table 2.

standard liquidity regulation as we define it yields limited additional benefits in these cases. This comes as a no surprise, since hard-peg regimes usually have a comprehensive framework to maintain financial stability during systemic and idiosyncratic shocks.

Overall, we observe that floating exchange rate regimes drive the results in the previous section and that home-country regulation at the parent level tends to reduce foreign subsidiary lending when there are no wholesale shocks to the parent. Host country liquidity regulation improves lending growth in

non-shocked periods primarily through softer peg arrangements. We also find very strong negative effect of foreign liquidity regulation on host countries with currency boards, but primarily in tranquil periods. Interestingly, there is virtually no effect of foreign and domestic liquidity regulation for jurisdictions with dollarization. This is possibly due to the effects of other regulatory measures that make loan growth immune to currency fluctuations and foreign and domestic liquidity rules.

Table 4. Liquidity Regulation and Shock Transmission across Currency Arrangements. This table reports the results from the estimation of Equation 1 with interactions of parent shocks with liquidity regulation dummies at the subsidiary and parent bank levels. The sample comprises 368 foreign subsidiaries of 84 OECD parent banks in the period 1997-2012. The dependent variable is the growth rate of subsidiary loans. “Solvency Shock_j” and “Wholesale Shock_j” are dummy variables that take the value of 1 if a parent bank *j* is hit by a solvency and wholesale shock, respectively, and 0 otherwise. “Liquidity_subk” is at the host subsidiary country *k* level. “Liquidity_parl” is at the home parent country *l* level. The bank controls are at the subsidiary *i* level. They are lagged with one period. The “Macro Controls” vector contains GDP growth, inflation and unemployment in the host country *k* of the respective subsidiary. All variables are defined in Table 2 and in the main text. The bank fixed effects are at the subsidiary level. The numbers in parentheses are standard errors. All standard errors are clustered at the parent level. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	Floating (1)	Currency Board (2)	Pegged (3)	Other Management (4)	Pegged and Mngmt (5)	Dollarization (6)
Solvency Shock _{j,t-1}	0.0003 (0.044)	-0.0465 (0.081)	0.0085 (0.067)	-0.0066 (0.063)	-0.0204 (0.053)	-0.0022 (0.126)
Wholesale Shock _{j,t-1}	0.0443 (0.043)	-0.0312 (0.082)	0.0191 (0.056)	0.0481 (0.065)	0.0685 (0.054)	-0.0388 (0.093)
Liquidity sub _{j,t-1}	0.0862 (0.065)	0.0787 (0.121)	0.2790 (0.173)	0.2837** (0.140)	0.2488** (0.118)	0.1444 (0.145)
Liquidity sub _{j,t-1} * Wholesale Shock _{j,t-1}	-0.1414** (0.054)	-0.0122 (0.086)	-0.0240 (0.059)	-0.0818 (0.100)	-0.0788 (0.072)	0.1721 (0.204)
Liquidity par _{j,t-1}	-0.1376*** (0.049)	-0.1607** (0.070)	-0.0689 (0.072)	-0.1883** (0.084)	-0.1817** (0.077)	-0.0985 (0.099)

	Floating (1)	Currency Board (2)	Pegged (3)	Other Management (4)	Pegged and Mngmt (5)	Dollarization (6)
Liquidity par $_{j,t-1}^*$	0.1126*	0.1099	0.0005	0.1978**	0.0595	0.0271
Wholesale Shock $_{j,t-1}$	(0.058)	(0.102)	(0.085)	(0.085)	(0.065)	(0.114)
Subsidiary FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Macro Variables	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	747	347	306	362	473	237
R-squared	0.453	0.469	0.434	0.521	0.481	0.427
Adjusted R-squared	0.430	0.420	0.375	0.479	0.447	0.346

4.3. Robustness

In unreported regressions, we perform a battery of robustness checks to verify the validity of our results.¹² First, we include lags of the dependent variable as control variables to account for possible dynamic dependence and cannot find significant coefficients of these variables. Second, we show that the results are not driven by the global financial crisis of 2008-2009. Third, we check whether the size of parent liquidity buffers reduces the transmission of wholesale shock and we find evidence that parent banks usually tend to protect their foreign subsidiaries before transmitting by using up their own liquidity buffers first.

5. Conclusion

The operations of global banks tend to improve financial and economic conditions in developing countries. However, in times of distress in any part of the banking conglomerate, contagion can be transferred across borders through the global bank's internal capital market. One of the policies that can prevent the transmission of adverse shocks is to secure that local banking

subsidiaries have sufficient liquidity at their disposal at any given time. This paper investigates empirically how liquidity regulation affects the transmission of negative shocks across borders through the internal capital markets of global banks.

Liquidity regulation is primarily targeted at preventing or alleviating liquidity shocks to banking operations. However, bank lending can be affected by many types of shocks, most notably solvency shocks. Therefore, in order to analyze whether and how liquidity regulation affects the transmission of negative funding shocks to foreign subsidiary lending, we also control for negative solvency shocks to parent banks. Our findings confirm that solvency shocks to parents generally have larger standalone effect on subsidiary lending than wholesale shocks and therefore, it is crucial to control for the former when analyzing the latter. Transmission of wholesale shock occurs in host countries with stricter liquidity regulation. Therefore, our main finding is that, on average, host country liquidity regulation tends to exacerbate the negative effect of parent wholesale shocks on the lending of their foreign subsidiaries. We further

¹² The results are available upon request.

investigate how exchange rate arrangements around the globe affect the transmission through local liquidity regulation and find that our main effect is driven primarily by countries with a floating exchange rate, and much less so by other managed arrangements, such as currency boards and dollarization. Our conjecture is that the additional safeguards of financial stability in the latter cases reduce the negative externalities of stringent liquidity rules on bank lending.

These results have important policy implications and add to our understanding of the transmission of wholesale shocks across borders. The recent focus of banking regulation on requiring banks to hold sufficient buffers against adverse shocks has proven to be effective in reducing cross-border contagion. However, the liquidity rules currently in place globally aggravate the transmission of shocks across borders and further efforts are needed to find a more effective global regulatory framework.

Regarding our finding that the results are driven by floating exchange rate, we should issue a caution to countries such as Bulgaria that strive to switch from a successful currency board arrangement to a floating arrangement by joining the euro area. More research is needed on identifying the financial stability safeguards that should be preserved and expanded upon with such a fundamental switch in monetary and economic policy.

As the Bulgarian banking system is mostly foreign-owned by OECD parents, this paper and our related research on global banking also provide guidance to Bulgarian supervisors on the active channels of transmission of idiosyncratic and systemic shocks. Future research may expand the time frame and scope of the study to cover important international initiatives like the

Vienna Initiative 1.0 and 2.0, Basel III and the Bank Recovery and Restructuring Directive, as well as important international political events, such as Brexit and the War in Ukraine.

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A. Online Appendix

A.1 Estimation of Solvency and Wholesale Shocks (Radev, 2021)

In estimating the solvency and wholesale funding shocks to parents, we adopt and extend the methodology by DeYoung et al. (2017) and Radev (2021). To this end, we use a partial capital adjustment model to estimate the banks' internal capital ratio targets in order to identify the parent solvency shocks. Following this model, every bank has a target capital ratio that is a function of observable characteristics:

$$K_{i,t}^* = \beta \cdot X_{i,t-1},$$

with $K_{i,t}$ being the bank i 's capital ratio in period t , while $X_{i,t-1}$ is a vector of observable determinants of the capital ratio, such as parent size, average return on assets, whether the bank is public and whether it is a global systemically important bank. β is a vector of coefficients.

In extreme situations, banks may deviate from their target capital ratios, which results in costly capital adjustments. During this adjustment process, banks close a constant proportion λ of the gap between their actual capital K and K^* in each time period:

$$K_{i,t} - K_{i,t-1} = \lambda \cdot (K_{i,t}^* - K_{i,t-1}) + \epsilon_{i,t},$$

where λ is the aforementioned adjustment speed. A value of $0 < \lambda < 1$ reflects the partial

adjustment towards K^* between $t-1$ and t . Substituting for the respective values in both equations and rearranging leads to:

$$K_{i,t} = \lambda\beta \cdot X_{i,t-1} + (1 - \lambda) \cdot K_{i,t-1} + \epsilon_{i,t}.$$

Recovering $\hat{\lambda}$ from $(\widehat{1 - \lambda})$ and subsequently $\hat{\beta}$ from $(\widehat{\lambda\beta})$, we calculate the target ratio

$K_{i,t}^*$ for bank i in period t . Since the equation contains a lagged dependent variable, DeYoung et al. (2017) suggest using the dynamic generalized method of moments by Blundell and Bond (1998).

To identify exogenous shocks, we follow DeYoung et al. (2017) and set a number of conditions, such as a decrease in the equity capital ratio ($\Delta K_{i,t-1}$) of a bank that is already below its target capital ratio $GAPCAP_{i,t-2} = K_{i,t-2}^* - K_{i,t-2} > 0$ that leads to an *unexpected* even larger deviation from its internal target (assuming that the goal of the bank is to return to its target ratio as soon as possible – already in the subsequent period). We also require a drop in equity by at least 5%. As banks usually expect profits in the next year in their annual forecasts, a year-on-year drop in equity in the unconsolidated parent reports by 5% represents a substantial undershooting of these forecasts.

$$\text{Solvency Shock} = \begin{cases} 1, & \text{if } K_{[t,t-2]} < K_{[t,t-2]}^* \text{ and } \Delta K_{[t,t-1]}^* < 0 \\ & \text{and } \Delta GAPCAP_{[t,t-1]} > 0 \text{ and } g_{[equity,t-1]} < -0.05 \\ 0, & \text{otherwise} \end{cases}$$

We extend the methodology of DeYoung et al. (2017) to applications for wholesale funding by analogously assuming that the bank targets a specific wholesale funding to

total liabilities ratio WF^* . We substitute WF and WF^* for K and K^* in the procedure above and set the following conditions for wholesale funding shocks:

$$\text{Wholesale Shock} = \begin{cases} 1, & \text{if } WF_{[i,t-2]} < WF_{[i,t-2]}^* \text{ and } \Delta WF_{[i,t-1]}^* < 0 \\ & \text{and } \Delta GAPWF_{[i,t-1]} > 0 \text{ and } g(\text{wholesale funding}_{t-1}) < -0.05 \\ 0, & \text{otherwise} \end{cases}$$

The results for the respective estimations are summarized in Table A1. Model (1) presents the estimated coefficients used to derive the solvency shocks, while Model (2) presents the coefficients used to identify the wholesale funding shocks. We observe a quicker adjustment to capital targets than for wholesale funding targets. We use the full data set of parent-year observations that we have at our disposal, which leads to a higher observations count than in Table 1.

Figures A1 and A2 present the number of the respective shocks for each year in our sample. Panel a) of Figure A1 (Figure A2) shows the solvency (wholesale funding) shocks per year in the *parent* sample. In total, there are 101 (174) solvency (wholesale funding) shocks in the parent dataset in the sample period. Panel b) presents the solvency (wholesale funding) shocks per year that are relevant for the sample of 375 subsidiaries after merging both datasets. Since a parent usually has more than one subsidiary, this results in a total of 323 (577) parent solvency (wholesale funding) shocks in our merged dataset. An important conclusion from observing the figures is that the shocks identified using our definitions are well-spread throughout the period and do not cluster exclusively around the global financial crisis of 2008-2009. In our robustness checks section, we show that our main results are not affected if we exclude these years.

Table A1. Partial adjustment model for capital and wholesale funding. Parameters for a partial adjustment model estimated for an unbalanced panel for global parent banks between 1997 and 2002. Model (1) presents the estimated coefficients used to derive the solvency shocks, while Model (2) presents the coefficients used to identify the wholesale funding shocks. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. Source: Radev (2021)

	(1)	(2)
Capitalization	0.6944*** (0.071)	
Wholesale Funding Ratio		0.7798*** (0.035)
Size	0.0023*** (0.001)	0.0080*** (0.002)
ROAA	-0.0013 (0.001)	0.0046* (0.003)
GSIB	-0.0120 (0.008)	-0.0023 (0.012)
Public	-0.0021 (0.008)	0.0137 (0.016)
Observations	1830	1830
λ	0.3056	0.2201
Average Targets	0.0733	0.4465

The correlation between the solvency and wholesale shocks is 0.18 in the parent sample and 0.12 in the subsidiary sample, which means that the shocks are fairly uncorrelated and banks are usually not hit by both shocks simultaneously. This could be seen in Figure A3, where we present the number of simultaneous solvency and wholesale shocks in our parent and subsidiary samples. Panel a) shows the simultaneous shocks per year in the *parent* sample. There are 40 simultaneous

shocks in the parent dataset in the sample period. Panel b) presents the simultaneous shocks per year that are relevant for the

sample of 375 subsidiaries after merging both datasets. In total, we have 110 simultaneous shocks in our subsidiary sample.

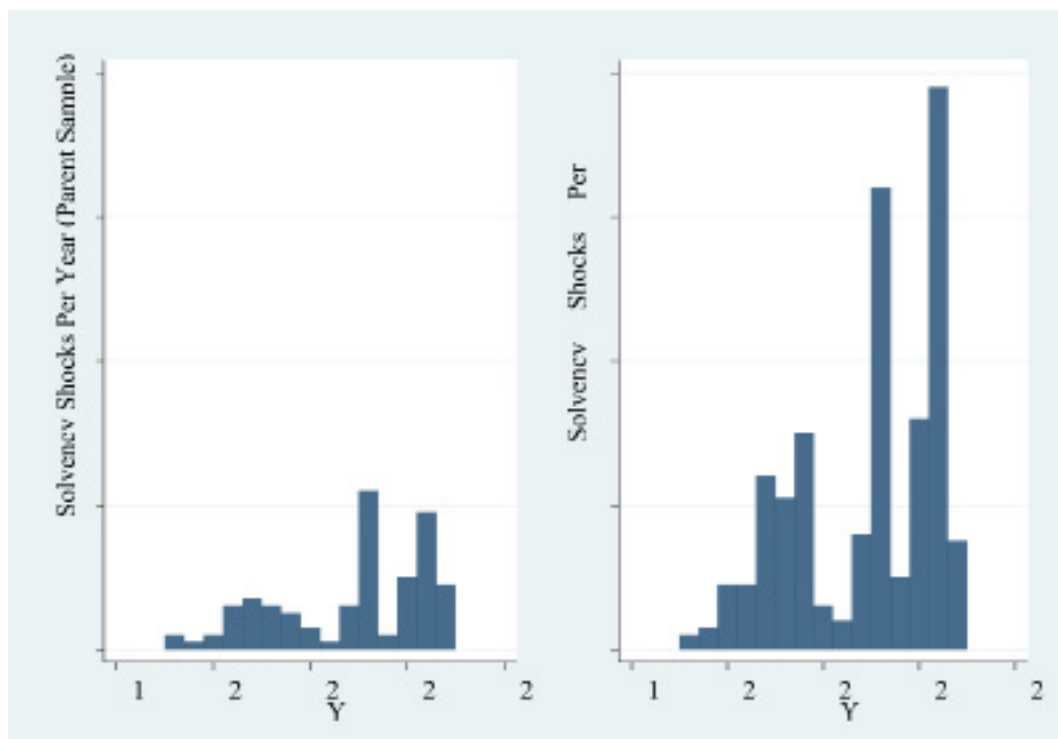


Figure A1. Number of Solvency Shocks Per Year. This figure presents the number of solvency shocks that transfer from the 84 OECD parent banks to the 375 subsidiary banks in our sample between 1997 and 2012. Panel a) presents the solvency shocks per year in the parent sample. In total, there are 101 solvency shocks in the parent dataset in the sample period. Panel b) presents the solvency shocks per year that are relevant for the sample of 375 subsidiaries after merging both datasets. Since a parent usually has more than one subsidiary, this results in a total of 323 parent solvency shocks in our merged dataset. Source: Radev (2021)

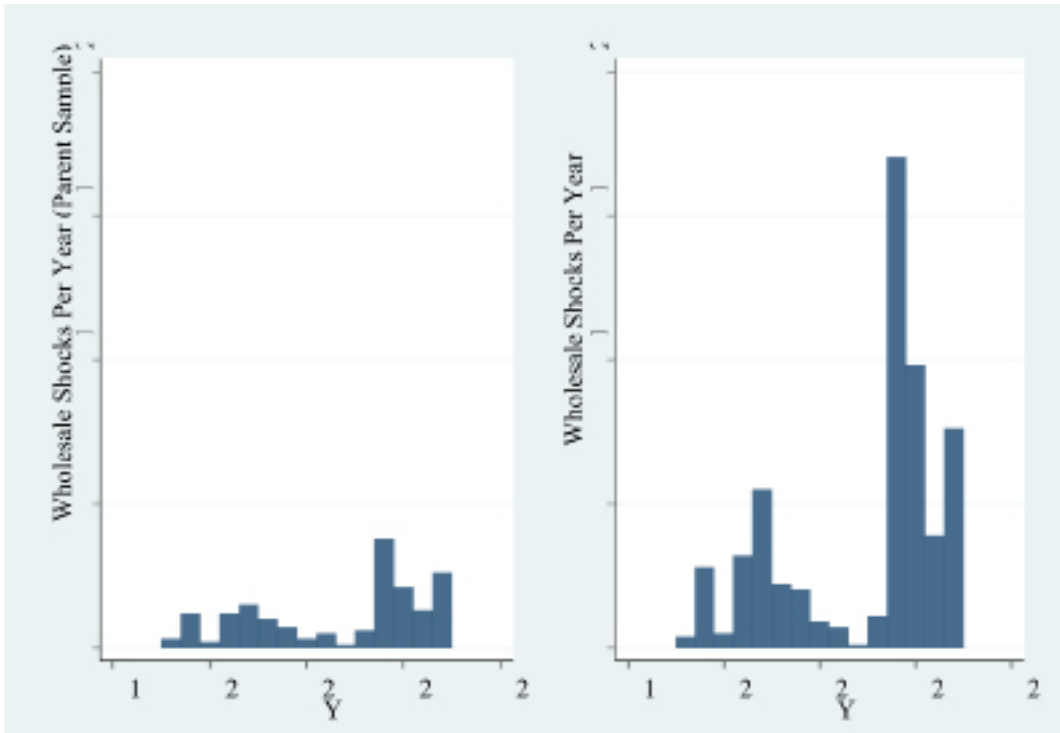


Figure A2. Number of Wholesale Shocks Per Year. This figure presents the number of wholesale shocks that transfer from the 84 OECD parent banks to the 375 subsidiary banks in our sample between 1997 and 2012. Panel a) presents the wholesale shocks per year in the parent sample.

In total, there are 174 wholesale shocks in the parent dataset in the sample period. Panel b) presents the wholesale shocks per year that are relevant for the sample of 375 subsidiaries after merging both datasets. Since a parent usually has more than one subsidiary, this results in a total of 577 parent wholesale shocks in our merged dataset. Source: Radev (2021)

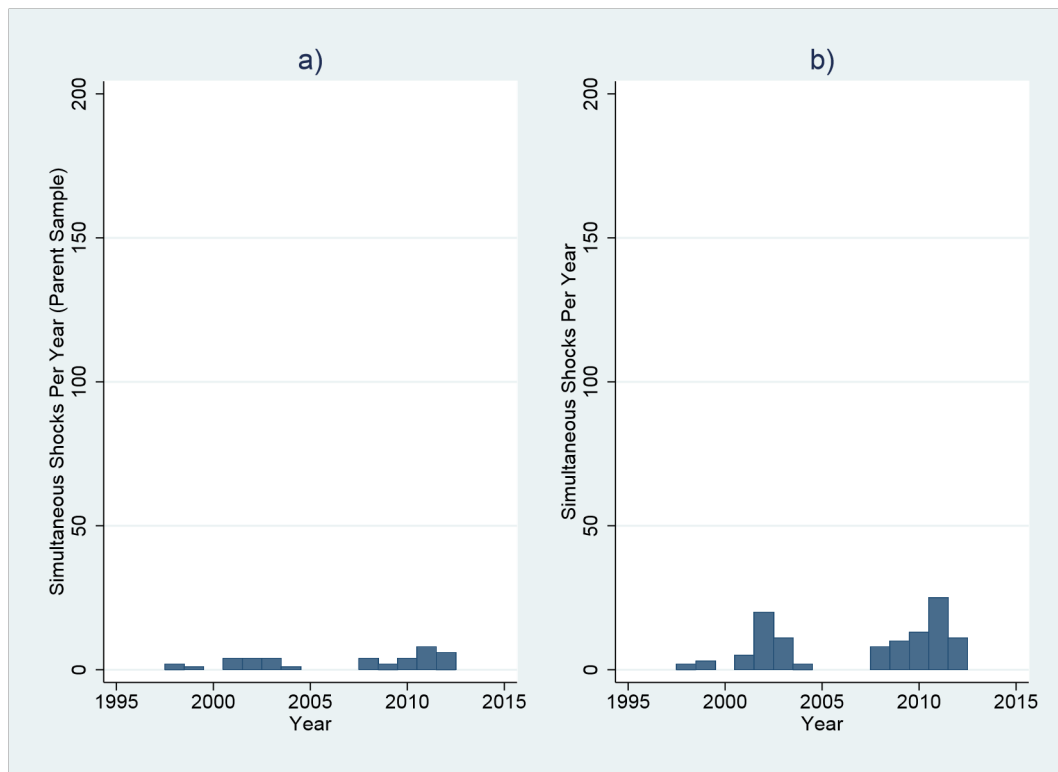


Figure A3: Number of Simultaneous Solvency and Wholesale Shocks Per Year. This figure presents the number of simultaneous solvency and wholesale shocks that transfer from the 84 OECD parent banks to the 375 subsidiary banks in our sample between 1997 and 2012. Panel a) presents the simultaneous shocks per year in the parent sample. In total, there are 40 simultaneous shocks in the parent dataset in the sample period. Panel b) presents the simultaneous shocks per year that are relevant for the sample of 375 subsidiaries after merging both datasets. Since a parent usually has more than one subsidiary, this results in a total of 110 simultaneous parent shocks in our merged dataset. Source: Radev (2021)

A.2. Figures

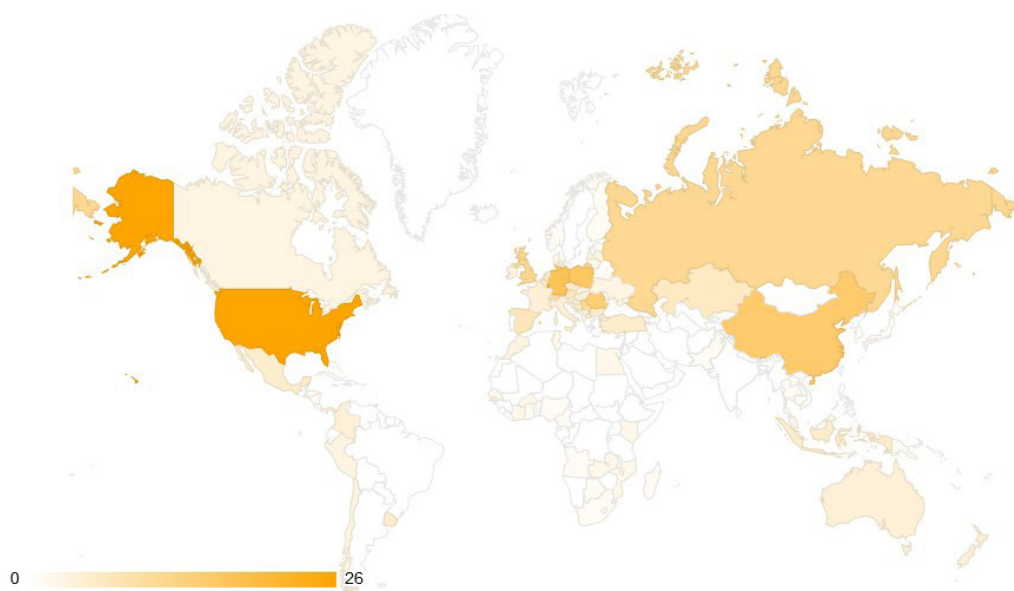


Figure A4. Geographical Distribution of Subsidiaries. This figure presents the geographical distribution of the 375 subsidiaries of the 84 OECD parent banks in our sample. Source: Radev (2021)

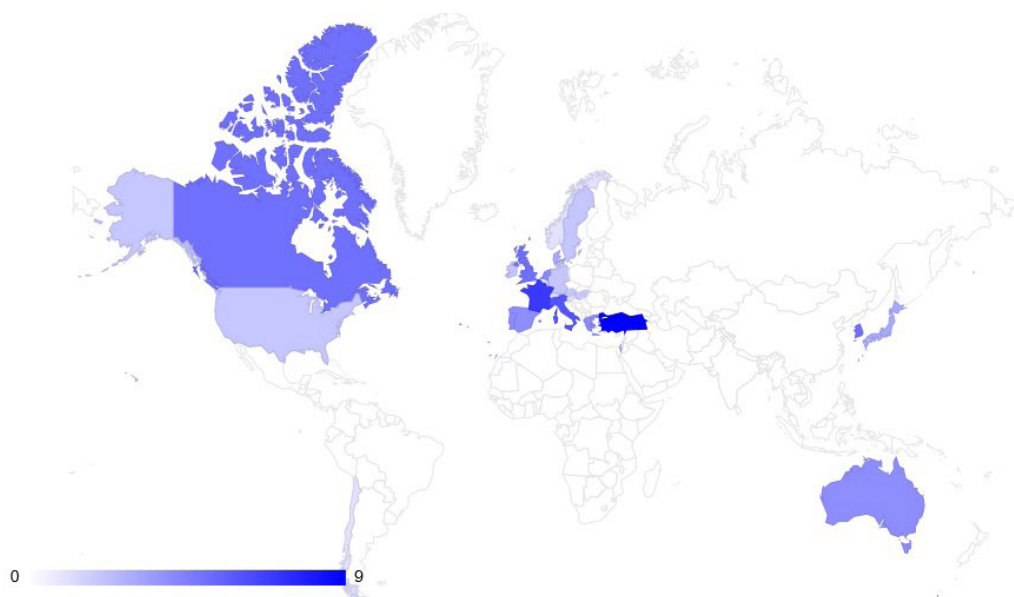


Figure A5. Geographical Distribution of Parents. This figure presents the geographical distribution of the 84 OECD parent banks in our sample. Source: Radev (2021)

A.3 Tables

Table A2. Parents and Subsidiaries. This table presents the 84 parent commercial banks in our sample and the overall number of subsidiaries per bank. Source: Radev (2021)

	Parent Name	Parent Country	# Subs
1	ABN AMRO Bank NV	NETHERLANDS	2
2	Akbank T.A.S.	TURKEY	1
3	Allied Irish Banks plc	IRELAND	1
4	Alpha Bank AE	GREECE	5
5	Australia and New Zealand Banking Group	AUSTRALIA	6
6	Banca Mediolanum SpA	ITALY	1
7	Banca Monte dei Paschi di Siena SpA	ITALY	2
8	Banco Bilbao Vizcaya Argentaria SA	SPAIN	7
9	Banco Comercial Portugues, SA-Millennium bcp	PORTUGAL	3
10	Banco de Sabadell SA	SPAIN	2
11	Banco Desio - Banco di Desio e della Brianza SpA	ITALY	1
12	Banco Espirito Santo SA	SPAIN	2
13	Banco Santander SA	SPAIN	18
14	BANIF - Banco Internacional do Funchal, SA	PORTUGAL	1
15	Bank für Arbeit und Wirtschaft und Österreichische Postsparkasse Aktiengesellschaft-BAWAG PSK Group	AUSTRIA	1
16	Bank Hapoalim BM	ISRAEL	2
17	Bank Leumi Le Israel BM	ISRAEL	5
18	Bank of Montreal-Banque de Montreal	CANADA	2
19	Bank of Nova Scotia (The) - SCOTIABANK	CANADA	13
20	Bank of Tokyo - Mitsubishi UFJ Ltd (The)-Kabushiki Kaisha Mitsubishi Tokyo UFJ Ginko	JAPAN	1
21	Bankia, SA	SPAIN	1
22	Banque Fédérative du Crédit Mutuel	FRANCE	1
23	Banque Internationale à Luxembourg SA	LUXEMBOURG	1
24	Barclays Bank Plc	UNITED KINGDOM	7
25	BNP Paribas	FRANCE	25
26	Caixa Geral de Depositos	PORTUGAL	5
27	Canadian Imperial Bank of Commerce CIBC	CANADA	4
28	Citibank NA	UNITED STATES OF AMERICA	10
29	Commerzbank AG	GERMANY	6
30	Commonwealth Bank of Australia	AUSTRALIA	1
31	CorpBanca	CHILE	3
32	Credit Agricole Corporate and Investment Bank-Credit Agricole CIB	FRANCE	1

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	Parent Name	Parent Country	# Subs
33	Credit Europe Bank N.V.	NETHERLANDS	2
34	Credito Emiliano SpA-CREDEM	ITALY	1
35	Danske Bank A/S	NORWAY	3
36	Denizbank A.S.	TURKEY	1
37	Deutsche Bank AG	GERMANY	18
38	Dexia Crédit Local SA	FRANCE	2
39	DNB Bank ASA	NORWAY	5
40	East West Bank	UNITED STATES OF AMERICA	1
41	Eurobank Ergasias SA	GREECE	3
42	First International Bank of Israel	ISRAEL	2
43	Hana Bank	REPUBLIC OF KOREA	1
44	HSBC Bank plc	UNITED KINGDOM	5
45	Industrial Bank of Korea	REPUBLIC OF KOREA	1
46	ING Bank NV	NETHERLANDS	6
47	Intesa Sanpaolo	ITALY	10
48	Investec Bank Plc	UNITED KINGDOM	1
49	Israel Discount Bank Ltd.	ISRAEL	2
50	Jyske Bank A/S	DENMARK	1
51	KB Kookmin Bank	REPUBLIC OF KOREA	2
52	KBC Bank NV	BELGIUM	5
53	Korea Exchange Bank	REPUBLIC OF KOREA	4
54	Mizuho Bank Ltd	JAPAN	6
55	MKB Bank Zrt	HUNGARY	1
56	National Australia Bank Limited	AUSTRALIA	2
57	National Bank of Greece SA	GREECE	6
58	Natixis	FRANCE	2
59	NLB dd-Nova Ljubljanska Banka d.d.	SLOVENIA	5
60	Nordea Bank Danmark Group-Nordea Bank Danmark A/S	DENMARK	1
61	OTP Bank Plc	HUNGARY	5
62	Piraeus Bank SA	GREECE	6
63	Raiffeisen Bank International AG	AUSTRIA	7
64	RCI Banque	FRANCE	1
65	Royal Bank of Canada RBC	CANADA	10
66	Royal Bank of Scotland NV (The)-RBS NV	NETHERLANDS	6
67	Shinhan Bank	REPUBLIC OF KOREA	7
68	Skandinaviska Enskilda Banken AB	SWEDEN	6
69	Société Générale	FRANCE	26

Parent Name		Parent Country	# Subs
70	Standard Chartered Bank	UNITED KINGDOM	8
71	Sumitomo Mitsui Banking Corporation	JAPAN	2
72	Svenska Handelsbanken	SWEDEN	2
73	T.C. Ziraat Bankasi A.S.	TURKEY	2
74	Toronto Dominion Bank	CANADA	3
75	Turk Ekonomi Bankasi A.S.	TURKEY	1
76	Turkiye Garanti Bankasi A.S.	TURKEY	2
77	Turkiye Halk Bankasi A.S.	TURKEY	1
78	Turkiye is Bankasi A.S. - ISBANK	TURKEY	2
79	Turkiye Vakiflar Bankasi TAO	TURKEY	1
80	UBS AG	SWITZERLAND	5
81	UniCredit SpA	ITALY	24
82	Westpac Banking Corporation	AUSTRALIA	3
83	Woori Bank	REPUBLIC OF KOREA	3
84	Yapi Ve Kredi Bankasi A.S.	TURKEY	2
		Total	375

Table A3. Parents and Subsidiaries. This table presents the distribution of the 375 subsidiaries across countries. For a graphical representation, see Figure A4. Source: Radev (2021)

	Subsidiary Country	Number of Subsidiaries	OECD Member		Subsidiary Country	Number of Subsidiaries	OECD Member
1	ALBANIA	3	No	50	LATVIA	3	Yes
2	ANDORRA	1	No	51	LITHUANIA	2	Yes
3	ANGOLA	1	No	52	LUXEMBOURG	24	Yes
4	ARUBA	1	No	53	MACAO	2	No
5	AUSTRALIA	4	Yes	54	MACEDONIA (FYROM)	5	No
6	AUSTRIA	6	Yes	55	MADAGASCAR	1	No
7	BAHAMAS	3	No	56	MALAYSIA	2	No
8	BARBADOS	2	No	57	MALTA	3	No
9	BELARUS	1	No	58	MEXICO	5	Yes
10	BELGIUM	6	Yes	59	MONTENEGRO	3	No
11	BELIZE	1	No	60	MOROCCO	3	No
12	BOSNIA AND HERZEGOVINA	6	No	61	MOZAMBIQUE	2	No
13	BOTSWANA	1	No	62	NETHERLANDS	5	Yes
14	BULGARIA	5	No	63	NEW ZEALAND	4	Yes
15	BURKINA FASO	2	No	64	NICARAGUA	1	No
16	CAMBODIA	1	No	65	NIGERIA	1	No

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	Subsidiary Country	Number of Subsidiaries	OECD Member		Subsidiary Country	Number of Subsidiaries	OECD Member
17	CAMEROON	1	No	66	NORWAY	1	Yes
18	CANADA	3	Yes	67	PAKISTAN	1	No
19	CAPE VERDE	3	No	68	PANAMA	3	No
20	CHILE	3	Yes	69	PAPUA NEW GUINEA	1	No
21	CHINA	15	No	70	PERU	3	No
22	COLOMBIA	4	No	71	POLAND	16	Yes
23	COTE D'IVOIRE	2	No	72	PORTUGAL	1	Yes
24	CROATIA	4	No	73	REPUBLIC OF KOREA	1	Yes
25	CURACAO	1	No	74	REPUBLIC OF MOLDOVA	1	No
26	CYPRUS	3	No	75	ROMANIA	14	No
27	CZECH REPUBLIC	5	Yes	76	RUSSIAN FEDERATION	11	No
28	DENMARK	2	Yes	77	SAMOA	2	No
29	EGYPT	2	No	78	SENEGAL	2	No
30	EL SALVADOR	1	No	79	SERBIA	10	No
31	ESTONIA	1	Yes	80	SEYCHELLES	1	No
32	FINLAND	1	Yes	81	SINGAPORE	1	No
33	FRANCE	4	Yes	82	SLOVAKIA	3	Yes
34	GEORGIA	1	No	83	SLOVENIA	4	Yes
35	GERMANY	17	Yes	84	SOUTH AFRICA	1	No
36	GHANA	1	No	85	SPAIN	7	Yes
37	GRENADA	1	No	86	SWITZERLAND	9	Yes
38	HAITI	1	No	87	THAILAND	1	No
39	HONDURAS	1	No	88	TONGA	1	No
40	HONG KONG	4	No	89	TRINIDAD AND TOBAGO	4	No
41	HUNGARY	4	Yes	90	TUNISIA	2	No
42	INDONESIA	5	No	91	TURKEY	5	Yes
43	IRELAND	3	Yes	92	UKRAINE	3	No
44	ITALY	4	Yes	93	UNITED KINGDOM	11	Yes
45	JAMAICA	3	No	94	UNITED STATES OF AMERICA	26	Yes
46	JAPAN	1	Yes	95	URUGUAY	5	No
47	KAZAKHSTAN	6	No	96	VANUATU	1	No
48	KENYA	2	No	97	VIET NAM	1	No
49	KYRGYZSTAN	1	No	98	ZAMBIA	2	No
					Total:	375	