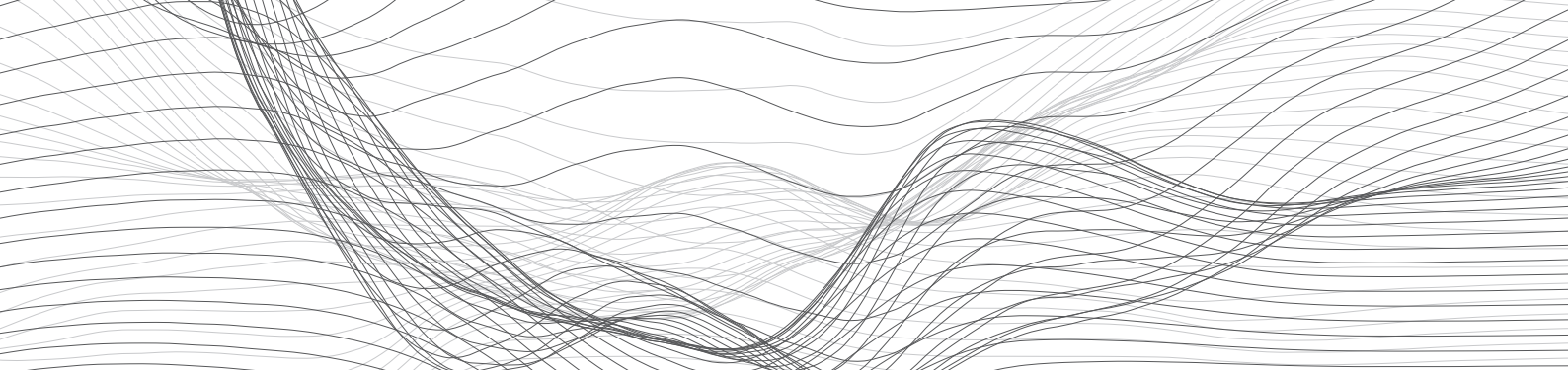

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International Monetary Policy Transmission through Banks in Small Open Economies

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Abstract

This paper studies the international transmission of monetary policy through banks in small open economies using the examples of Switzerland and Canada. We assess the inward transmission of foreign monetary policy for Switzerland and the outward transmission of domestic monetary policy for Canada. In both country cases, we focus on the international bank lending and the international portfolio channel, which make opposing predictions about how monetary policy transmits internationally through banks. Our results on the inward transmission of foreign monetary policy through banks in Switzerland are consistent with a role for the international portfolio channel, but we find no evidence for the traditional international bank lending channel. The results on the outward transmission of domestic monetary policy in Canada suggest that foreign lending by Canadian banks is affected through both channels, which work as predicted and largely balance each other.

Key Words: international banking, monetary policy, inward transmission, outward transmission, small open economies, Switzerland, Canada

JEL Classification: G21, E5, F21, F32

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1 Introduction

This paper studies the international transmission of monetary policy through banks in small open economies.[1] We first use Switzerland as an example to study the impact of foreign monetary policy on lending by Swiss banks in the domestic economy—the so called 'inward transmission' of monetary policy. We then rely on Canada to study the impact of domestic monetary policy on lending by Canadian banks abroad—correspondingly referred to as the 'outward transmission' of monetary policy.

Switzerland and Canada are appealing cases to study the international transmission of monetary policy, as they are typical examples of small open economies. This implies that the exogeneity assumptions in our empirical analysis are more likely to hold, as the impact of domestic economic conditions (including domestic monetary policy) on the foreign economy is negligible. For the analysis of inward transmission of foreign monetary policy, this is helpful as foreign monetary policy can appropriately be treated as exogenous. Similarly, it is helpful for the analysis of outward transmission of domestic monetary policy as the latter will not affect lending by foreign banks abroad. This distinguishes our work from papers that focus on the analysis of large open economies.

When investigating the international transmission of monetary policy through banks, we focus on two distinct sets of frictions. The first set is related to frictions in banks' funding. When monetary policy is tightened, banks' depository base shrinks. Due to frictions in funding markets, banks may not be able to (costlessly) substitute those lost deposits with other sources of funding, and, as a result, have to cut their supply of loans (see Bernanke and Blinder [1988], Kashyap and Stein [1994]). Banks' difficulty to attract funding may also be due to the negative effect of a monetary tightening on a bank's net worth (see Gambacorta and Mistrulli [2004], Gambacorta and Shin [2016]). The frictions related to banks' own ability to attract funding are summarized under the commonly known term 'bank lending channel.' The transmission of monetary policy along the 'international bank lending channel' is qualitatively identical to its domestic counterpart, since a tightening of domestic monetary policy raises banks' funding costs and thus affects negatively both their domestic and foreign lending activities. The second set of frictions is related to the borrower side: because of informational frictions, in particular information asymmetry about borrower quality, bank borrowers' terms of credit depend on their net worth. In the domestic context, the transmission of monetary policy through borrower frictions is subsumed under the notion of the 'balance sheet channel' (see Bernanke and Gertler [1995]).

[1] The notion of a "small open economy" highlights the fact that an economy is a price taker in international financial and goods markets and is characterized by a particularly strong international exposure through financial and trade linkages.

As our analysis centers on the supply side effects of the balance sheet channel, and thus concerns the banks' portfolio choice, we follow Correa et al. [2015] and use the notion 'international portfolio channel.' According to the international portfolio channel, monetary policy has opposite effects on domestic and foreign lending activities. A tightening of domestic monetary policy reduces the net worth of domestic borrowers, prompting global banks to substitute away from risky domestic lending to safer foreign lending. The aggregate effect of contractionary monetary policy on foreign lending is positive rather than negative.

Thus, for the international transmission of monetary policy, the international bank lending channel and the international portfolio channel point in opposite directions.[2] It is worth noting that the two channels can be simultaneously at play; hence, an insignificant aggregate effect could mean that the two channels balance each other out.

Similarly, our identification strategy for both the in- and outward transmission of monetary policy relies on the strength of financial frictions that banks and borrowers face, proxied by the heterogeneity of banks' balance sheet characteristics. Specifically, we test whether banks with different characteristics respond differently to changes in monetary policy and whether these variations are consistent with the theoretical predictions associated with the international bank lending channel and the international portfolio channel respectively. Regarding inward transmission, the strength of the bank lending channel is expected to be affected by the share of foreign deposits, whereas the share of foreign assets affects the strength of the portfolio channel. To assess the outward transmission channel, we rely on a different set of balance sheet characteristics that measure the relevant frictions. The strength of the bank lending channel is expected to be affected by the reliance on short-term deposits, liquid assets, internal capital markets, bank size and capital base. As for the portfolio channel, we test whether banks substitute risky domestic lending to safer foreign lending depending on their reliance on risky C&I loans or securities.

Our results on inward transmission of foreign monetary policy through banks in Switzerland are consistent with a role for the international portfolio channel. However, we find no evidence for the international bank lending channel. We attribute this to the large share of foreign wholesale deposits, for which the standard bank lending channel theory does not apply. The results on the outward transmission of domestic monetary policy suggest that foreign lending by Canadian banks is affected by Canadian monetary policy through both channels, which work as predicted and largely balance each other. Quantitatively, for both, outward and inward transmission, the effect on bank lending appears to be limited.

[2]Unless otherwise noted, we refer to the international versions of the channels in the remainder of the paper.

Our paper is part of the 2016-2017 International Banking Research Network (IBRN) project that aims to provide comparable cross-country evidence on the international transmission of monetary policy. To this end, a number of individual country teams work on the topic in parallel, using their distinct, confidential bank-level data but a common methodological approach and comparable data across countries and time. Our paper sheds light on the international bank lending and international portfolio channel from the perspective of small open economies and relates to two different streams of literature. One strand of the literature studies the role of the international bank lending channel in response to the global transmission of US monetary policy but focuses particularly on large economies, such as the US. Correa and Murry [2009] use detailed information on US banks' foreign claims to identify changes in the supply of cross-border funds due to changes in the US monetary policy stance. Their study provides evidence that during a US monetary tightening, US banks significantly reduce their holdings of cross-border claims on foreign residents, supporting the existence of an international bank lending channel, with the result being stronger for banks with foreign offices. Subsequently, Cetorelli and Goldberg [2012] examine the response of global banks to liquidity shocks and find that having global operations insulates domestic banks from changes in domestic monetary policy as they can resort to internal capital markets. More recently, Temesvary et al. [2015] assess how US monetary policy affects foreign lending of US-resident banks, investigating both cross-border claims and claims by affiliates abroad. Finally, Correa et al. [2015] examine a large sample of lender-borrower country pairs over a prolonged time period. They find that monetary policy tightening increases foreign lending, but because they use cross-country data, they cannot provide an analysis of transmission channels as detailed as we do in this study.[3]

Another strand of the literature shows that foreign monetary policy affects small open economies through the exchange rate and foreign income channels, while monetary policy of small open economies has itself little effect on foreign economic conditions (e.g., Galí and Monacelli [2005], Leitemo and Söderstrom [2005], Faia and Monacelli [2008], and De Paoli [2009]). However, this literature does not consider the role of the banks and their domestic as well as foreign lending activities.

Our paper is organized into five sections and proceeds as follows. Section 2 provides an overview of the economies and banking systems in Switzerland and Canada, highlights their common features and discusses their main differences. Section 3 analyses the inward transmission of foreign monetary policy to Switzerland and Section 4 examines the outward transmission of domestic monetary policy in Canada. Finally, Section 5 concludes.

[3]Relatedly, Avdjiev et al. [2017] find that banking systems that were better capitalized prior to the global financial crisis experienced smaller increases in sensitivities to US monetary policy later on.

2 Banking Systems in Switzerland and Canada—Common Features and Notable Differences

This section discusses common features and notable differences between the Swiss and the Canadian economy, with a particular focus on their banking systems. Both common features and differences have an immediate bearing on our empirical approach and thus on the contribution of our paper to the literature.

We start by highlighting the common features of the two economies and provide a rationale why they are suitable for our empirical analysis:

- Both economies are typical examples of small open economies. The size aspect of the small open economy definition is illustrated by placing the two countries in relation to their size-wise most important neighbours. While Switzerland had a GDP of 0.7 trillion USD in 2015, the euro area's GDP amounted to 11.6 trillion USD during the same year, which is more than 17 times as much.[4] Similarly, while Canada's GDP was equal to 1.60 trillion USD in 2015, the GDP of the US amounted to 18.0 trillion USD during the same period, which is more than 11 times as much. The openness aspect of the small open economy can be demonstrated by focusing on quantitative de facto measures of openness. In 2015, the sum of merchandise exports and imports in relation to domestic GDP amounted to 57% for Switzerland and to 54% for Canada, which is almost three times the US number of 21%. Furthermore, the sum of capital in- and outflows, calculated as the sum of direct investment, portfolio investment and other investments, relative to domestic GDP amounted to 43% for Switzerland and to 23% for Canada, which is a multiple of the 4% figure for the US during this period. These asymmetries indicate that economic conditions in the US and the euro area can be treated as exogenous to Swiss and Canadian monetary policy.

- Both Switzerland and Canada are highly developed economies and have been very stable over the last two decades. Based on data from the World Economic Outlook database for 2015, the high level of development is demonstrated by a GDP per capita of approximately 49.000 current international dollars in Switzerland and 38.000 current international dollars in Canada. Working with a set of highly developed economies ensures that the financial

[4] All figures in this paragraph are obtained from the IFS statistics of the IMF and refer to 2015.

frictions observed in our empirical analysis are indeed those that actually matter, in a similar way to the large (open) economy. At the same time, a high level of economic and financial development ensures that our estimates are not affected by other confounding factors that would appear in less developed countries, such as a weak quality of institutions or the presence of political risks, which are potentially correlated with the financial frictions of interest. In addition, the stability of the two economies is demonstrated by an average annual real GDP growth rate over the period between 2000 and 2015 that amounts to 1.9% in Switzerland and 2.2% in Canada (both with a standard deviation of 1.7%). Relatedly, domestic bank lending was not negatively affected by the recent financial crisis in either of the economies and has continued to grow. Nominal growth of domestic credit from 2007-2015 amounted to 3.8% in Switzerland and to 3.4% in Canada.[5]

There are also important differences between the two financial systems that affect the structure of our empirical analysis:

- The Canadian banking system is highly concentrated and largely dominated by six domestically owned Canadian banks[6] of which we include four in the empirical analysis. Among the federally chartered commercial banks, trust and loan companies, and foreign bank branches, Canada's six largest banks hold approximately 90 per cent of all assets in the banking system. The Swiss banking system features a substantially larger number of banks with diverse business models. Regarding domestic lending, domestic retail banks hold the largest market share, followed by the two global systemically important banks (G-SIBs).[7]

- With the exception of the two G-SIBs, banks headquartered in Switzerland are not very active in lending abroad, either in terms of direct lending or lending through their foreign affiliates (see Tables 1 and 2).[8] This is different in Canada, where a significant share of the lending operations is conducted abroad.

In light of these two observations, we select Switzerland to study the inward transmission of monetary policy and Canada to assess the outward transmission. Our decision is mainly based on the fact that the inward transmission approach is estimated more precisely if the number of domestic banks is substantial and thus the number of country-bank-time observations is large (as is the case in Switzerland). In addition, the results of the outward transmission approach are

[5] Both numbers refer to borrowing of the non-financial sector only.

[6] These banks are the Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, National Bank of Canada, Royal Bank of Canada, and the Toronto Dominion Bank.

[7] These banks are UBS and Credit Suisse.

[8] All figures and tables of the paper are located in Appendix A.

more meaningful if domestic banks conduct a significant part of their lending operations abroad (as is the case in Canada). If this was not the case, the potential impact of monetary policy on bank lending abroad might suffer from a low external validity.

3 Inward Transmission of Monetary Policy – Evidence from Switzerland

3.1 Methodology

3.1.1 Data

Swiss Bank-Level Data

Bank-level data are taken from the Swiss National Bank (SNB) Monthly Banking Statistics, the Bank for International Settlements (BIS) Locational Banking Statistics and Supervisory Reportings. These data are collected by the SNB. The bank-level data are confidential and can only be accessed at the SNB. In some cases, we complement these data with information from public quarterly reports of banks (see Appendix B for details on the balance sheet variables).

The data cover the time period from 2000Q1 to 2015Q4 on a quarterly basis. Since we focus on international transmission through domestic banks, we exclude foreign banks. Furthermore, since we focus on the impact on domestic lending, we also exclude domestic wealth management banks. As can be seen from Tables 1 and 2, for both excluded groups of banks, domestic lending to non-banks accounts only for a small part of their balance sheets and their market share is small. Including these banks may thus distort the results. The remaining domestic banks cover 95% of domestic lending in 2015. Of these about 71% are included in our sample (for the others no BIS Locational Statistics are collected). There were no significant mergers in the sample considered. We use the following bank-level data for our regression analysis (the specifications are discussed in Section 3.1.2).

Dependent variable:[9] Our dependent variable is the growth rate of total domestic loans (i.e., the sum of domestic mortgage loans and other loans to non-banks) computed as the change in logs. These data are at the level of the domestically consolidated parent, i.e., excluding foreign subsidiaries. To reduce sensitivity to outliers, we exclude observations where the value of the dependent variable (log change of loans) lies above the 99 percentile or below the 1 percentile of the sample distribution.

[9]Source: SNB Monthly Banking Statistics, Form MONA-M011 loans.

Channels of international monetary policy transmission: The main channel variables concern exposures towards and funding from the United States (US), the euro area and the United Kingdom (UK). For these variables we rely on the BIS Locational Statistics, which provide data on international financial assets and liabilities of bank offices resident in Switzerland, excluding the positions of their foreign affiliates. International assets (claims) cover liquid assets, loans and debt instruments. International liabilities cover deposits. In some specifications, we further distinguish international assets and deposits by the bank and the non-bank sector. The following points are noteworthy (see Table 3):

- The euro area is the most important counterparty on average, both in terms of total liabilities and total assets. Positions vis-a-vis the US and the UK are substantially smaller. Links to Japan are negligibly small (less than 0.1% of the balance sheet). For this reason, unlike in the common IBRN specification, transmission of Japanese monetary policy is not further considered in this study.

- The composition of assets and liabilities differs across jurisdictions. For the US and the UK, the largest share of assets and liabilities are positions vis--vis foreign banks. For the euro area, there are also substantial non-bank positions.

- On average, bilateral foreign asset and liability positions are relatively small. Means are generally larger than medians, pointing to a right-skewed distribution. This is due to the fact that the two G-SIBs have large international activities, while international exposures of the retail banks are limited (see also Tables 1 and 2). This implies that the potential for international monetary policy transmission through Swiss banks' lending decisions might be limited as there may be little overlap between those banks that are a priori expected to be exposed to foreign monetary policy (through their large international activity) and banks for which the main variable of interest—domestic lending—is important.

Bank controls:[10] As balance sheet controls we use the percentage of a bank's portfolio of assets that is liquid (Liquid Asset Ratio), the percentage of a bank's balance sheet financed with core deposits (Deposit Ratio), the bank's total capital to asset ratio (Total Capital Ratio)[11] and the log of a bank's total assets (Log Total Assets). These data are at the level of the domestically consolidated parent, i.e., excluding foreign subsidiaries. Since most of the banks in our sample

[10]Because of data constraints we are not able to include the net intragroup funding position used in other country studies as additional control.

[11]Since definitions of Risk-Weighted Assets (RWA) have changed, we use total assets in the denominator of the Total Capital Ratio.

do not have material foreign subsidiaries, the data for the domestically consolidated parent are close to those of the globally consolidated parent. An exception are the two G-SIBs. To account for their foreign subsidiaries, we rely on the quarterly reports of the two banks collected by Bloomberg.

Foreign Monetary Policy

We consider foreign monetary policy in the most important currency areas, i.e., the US, the euro area, and the UK. To measure monetary policy, we rely on the common measures used by all teams in the IBRN project. Specifically, we measure conventional monetary policy in the respective jurisdiction with the first difference in the short-term policy rate (Figure 1). To capture unconventional policy at the zero lower bound, we use the difference of the central bank balance sheet over GDP (Figure 2). Finally, we control for the entire Zero Lower Bound period with a dummy.[12] As cyclical variables we use output and credit gaps and the volatility in financial markets (measured by the VIX index).[13] These data are also common to all IBRN specifications.

3.1.2 Empirical Approach

Empirical Specification

Our baseline analysis relies on two main specifications: the first specification is designed to measure the aggregate effect of foreign monetary policy changes (conventional or unconventional) on domestic lending growth.

$$\begin{aligned}\Delta Y_{b,t} &= \alpha_0 + \sum_{k=0}^{K}(\alpha_{1,k}^{ctry}\Delta MP_{t-k}^{ctry} + \alpha_{2,k}^{ctry}\Delta QE_{t-k}^{ctry}\cdot ZLB_t^{ctry}) + \alpha_3^{ctry}ZLB_t^{ctry} \\ &\quad +\alpha_4^{ctry}Z_{t-1}^{ctry} + \alpha_5 X_{b,t-1} + \alpha_6^{domestic}Z_{t-1}^{domestic} + \alpha_7^{domestic}\Delta MP_{t-1}^{domestic} \\ &\quad +\alpha_8 VIX_{t-1} + f_b + \varepsilon_{b,t} \qquad (1)\end{aligned}$$

The second specification is designed to measure how the effect of foreign monetary policy varies across banks. This is particularly useful to determine the channels of transmission.

$$\begin{aligned}\Delta Y_{b,t} &= \alpha_0 + \sum_{k=0}^{K}(\alpha_{1,k}^{ctry}\Delta MP_{t-k}^{ctry} + \alpha_{2,k}^{ctry}\Delta QE_{t-k}^{ctry}\cdot ZLB_t^{ctry})\cdot channel_{b,t-4}^{ctry} \\ &\quad +\alpha_3^{ctry}ZLB_t^{ctry}\cdot channel_{b,t-4}^{ctry} + \alpha_4 X_{t-1} + \alpha_4^{ctry}channel_{b,t-4}^{ctry} + f_t + \varepsilon_{b,t} \qquad (2)\end{aligned}$$

[12] In the IBRN project these are defined as follows: US: 2008q4-2015q4, euro area: 2013q4- 2015q4, UK: 2009q1-2015q4.

[13] VIX corresponds to the volatility index from the Chicago Board Options Exchange (CBOE).

In both cases the dependent variable is the log change in domestic lending.

To analyze the effects of monetary policy, we include the contemporaneous change of conventional (ΔMP^{ctry}_{t-k}) and unconventional foreign monetary policy (ΔQE^{ctry}_{t-k}) as well as three lags ($K = 3$). Our main interest is the sum of the effect of foreign monetary policy over four quarters, i.e., $\sum_{k=0}^{K} \alpha^{ctry}_{1,k}$ and $\sum_{k=0}^{K} \alpha^{ctry}_{2,k}$.[14]

We are interested in the effect of foreign monetary policy on the supply of credit. In small open economies, foreign monetary policy can be considered as exogenous to domestic conditions. However, foreign monetary policy may affect credit demand through its effect on general macroeconomic and financial conditions. To control for demand effects, we include in the first specification the foreign and domestic output gap and credit gap as demand controls, summarized in the vectors Z^{ctry}_{t-1} and $Z^{domestic}_{t-1}$. We also control for domestic monetary policy ($\Delta MP^{domestic}_{t-k}$) and the volatility in financial markets (VIX index VIX_{t-1}). In the second specification, we control for demand effects by introducing time fixed effects. Time fixed effects absorb all variables that do not display cross-sectional variation. Therefore, we can no longer identify the effects that foreign monetary policy has on lending growth and rather focus on the variation of the effect across different banks by interacting foreign monetary policy with bank-specific channel variables. These channel variables will be discussed in detail below. To control for bank characteristics, we add bank fixed effects and the standard set of bank controls mentioned before (Total Capital Ratio, Liquid Assets Ratio, Deposit Ratio, log Total Assets.)

We start from a parsimonious specification and analyse the effects of monetary policy changes in the US, the euro area, and the UK separately. We assess the robustness of these findings with a specification that includes all measures jointly (as specified for the meta-analysis in the IBRN project).

Transmission Channels

The international bank lending channel poses that banks that rely more on funding from a specific jurisdiction should have lower domestic lending growth when monetary policy in that specific foreign jurisdiction contracts. Due to various frictions, banks may not be able to compensate for the reduction in foreign deposits and hence face higher funding costs. To test for this effect, we interact foreign monetary policy measures with deposits from the corresponding

[14] In slight deviation from the IBRN specification, we interact the unconventional monetary policy variable with the Zero Lower Bound (ZLB) dummy and thereby impose the restriction that the central bank balance sheet did not have a separate effect on lending before the zero lower bound. This restriction derives from the fact that the central banks did not consider the size of the balance sheet as a separate instrument before introducing unconventional monetary policy: the size of the balance sheet adjusted endogenously to the policy rate decision. Using a separate ZLB dummy we also allow for a structural break at the zero lower bound.

jurisdiction (as a share of the banks' total assets). We would expect the corresponding coefficient to have a negative sign.

The international portfolio channel predicts that net worth and credit worthiness of foreign borrowers decline as a result of a foreign monetary policy tightening, triggering a reshuffling of lending towards domestic borrowers. This effect should be larger for banks with larger positions of foreign assets. To test for this effect, we interact foreign monetary policy measures with banks' assets towards the corresponding jurisdiction (as a share of the banks' total assets). We would expect the corresponding coefficient to have a positive sign.

3.2 Results

3.2.1 Baseline Specifications

No channel specification: We start by analyzing the effect of foreign monetary policy on domestic credit growth, accounting for demand factors with controls for the business and the financial cycle (equation 1). Results are shown in Table 4. The no channel specification tests whether there is evidence for an aggregate impact of international monetary policy on domestic lending by the average bank, without specifying the exact channel of transmission, but controlling for credit demand factors. Depending on which transmission channel dominates, the overall impact could in principle be positive, negative or zero. On the one hand, if the international bank lending channel dominates, we would expect that foreign monetary policy leads to a contraction of domestic lending, because the costs of foreign funding increase. On the other hand, if the international portfolio channel dominates, we would expect that foreign monetary policy has a positive effect on domestic lending, as foreign borrowers become more risky and banks turn away from foreign to domestic borrowers. If both channels are at work, they may offset each other to some extent.

Across specifications, we find that contractionary monetary policy (conventional or unconventional) leads to an expansion of domestic credit or has no statistically significant effect. For the specification that analyzes the effect of US monetary policy, we find a statistically significant positive effect of conventional contractionary monetary policy: a 100 basis points increase in the Federal Reserve's policy rate is associated with a 0.5% increase in domestic lending to the non-bank sector.[15] There is no evidence for a statistically significant effect of unconventional US monetary policy. For the euro area we find a statistically significant positive effect of unconventional monetary policy: a contraction of the ECB's balance sheet by one percent

[15]Note that contractionary monetary policy is an increase of the policy rate for conventional policy and a decrease of central bank assets over GDP for unconventional policy.

of euro area GDP is associated with an increase in lending by 0.4%. The ECB's conventional monetary policy has no statistically significant effect on credit growth in Switzerland. For UK monetary policy, we find that neither conventional nor unconventional monetary policy have a significant effect on domestic credit growth. Although not the main interest of the study, it is reassuring to note that the domestic monetary policy control has a negative effect on domestic lending growth, as expected. In response to domestic monetary policy, the domestic portfolio channel and the domestic bank lending channel work in the same direction.[16]

Overall, our results do not seem to provide evidence for a dominant role of the international bank lending channel. The results, however, may be compatible with a dominant role of the international portfolio channel or a combination of the international portfolio channel and the international bank lending channel. Given this preliminary evidence on the overall effect of monetary policy, the following sections try to identify the channel through which foreign monetary policy is transmitted more precisely, exploiting heterogeneities across banks.

International bank lending channel (transmission via foreign deposits): We now turn to the specification with time fixed effects (Equation 2), focusing on the relative variation across banks with different characteristics.

We start with a discussion of the effects of conventional monetary policy. Overall, the results (see Table 5) are not in line with the international bank lending channel. In response to a foreign interest rate tightening, banks with high levels of foreign deposits tend to display higher lending growth than banks with low levels of foreign deposits. The positive coefficient is the opposite of what is predicted by the international bank lending channel. The effect is statistically significant in two out of three specifications (UK and US monetary policy). In the third specification (ECB's monetary policy) there is no statistically significant variation across banks. Regarding unconventional monetary policy, there is no evidence that the transmission of unconventional monetary policy varies across banks, as the results are mostly insignificant.

One explanation for our finding about the effects of foreign conventional monetary policy is that a substantial share of international deposits from domestic banks in Switzerland are deposits from foreign banks. The traditional bank lending channel theory, however, is not necessarily valid for deposits from other banks (wholesale deposits). It relies on the assumption that retail deposits are a special source of funding because they: a) are subject to reserve requirements and b) are a low-cost funding source as they provide liquidity services and are protected by deposit insurance. These assumptions are generally not valid for wholesale deposits. In fact, recent

[16]The effects of foreign monetary policy and domestic monetary policy are not directly comparable, as per IBRN guidance the domestic monetary policy control enters with only one lag.

research shows that in response to a monetary policy tightening, funding tends to shift away from retail deposits to wholesale deposits (see Drechsler et al. [2017]). A measure capturing mainly the share of wholesale deposits is therefore not necessarily suitable for measuring the strength of the bank lending channel.

Splitting deposits into bank and non-bank deposits supports the notion that the effects are different for the two categories of international liabilities.[17] For deposits from banks interacted with conventional foreign monetary policy, the coefficient remains positive and statistically significant in two out of three specification. For deposits from non-banks, however, the coefficient is either statistically insignificant (US, euro area) or negative (UK).[18] The positive coefficient on deposits from banks interacted with foreign interest rate policy is consistent with a story where domestic banks receive more funding from foreign banks. This could be due to the fact that loans to borrowers abroad become more risky due to the monetary tightening, prompting foreign banks to shift lending out of the country. This in turn increases available funds for domestic banks, which increases domestic lending. The effect should be stronger for banks that receive more foreign bank funding and could be interpreted as an indirect portfolio channel working through foreign banks' asset reallocation towards domestic banks.

Regarding unconventional monetary policy, there is no evidence that the transmission of unconventional monetary policy varies across banks. Results are mostly insignificant if we interact the unconventional monetary policy measure with total deposits. If we distinguish between deposits from banks and non-banks, most of the results are insignificant again and do not have the predicted sign.

International portfolio channel (transmission via foreign assets): We start with a discussion of the international transmission of conventional foreign monetary policy. Overall, our results are consistent with a role for the portfolio channel (see Table 6). In response to a contraction of conventional foreign monetary policy in a given jurisdiction, banks with a large share of foreign assets (in the respective jurisdiction) relative to their balance sheet tend to increase their lending by more than banks with a small share. We find a statistically significant positive effect in two out of three specifications (US and UK). The quantitative importance of these effects is, however, limited. For example, a change in a bank's share of US assets on their balance sheet equivalent to the difference between the 75^{th} and 25^{th} percentile in our sample increases the effect on lending growth by about 0.10%. For the UK, we obtain an estimate of

[17] Our data do not allow for a split between wholesale and retail deposits. Foreign deposits by non-banks may not only include retail deposits but also wholesale deposits, e.g., from non-bank financial firms.

[18] The large coefficient for the UK should be interpreted with caution, as the share of deposits from non-banks is very small.

similar magnitude. Compared to the aggregate effect of foreign monetary policy on domestic lending over four quarters for an average bank of 0.5% for the US, this is much smaller. It is also much smaller compared to the mean and standard deviation of year on year lending growth in our sample (mean: 4.5%, standard deviation 15%, q4 on q4 growth rates).

In analogy to the specification with foreign liabilities, we now interact foreign conventional monetary policy measures separately with foreign non-bank assets and foreign bank assets. A priori, the international portfolio channel could work through both asset categories. For one, domestic banks could relocate directly away from foreign non-bank borrowers, as their credit worthiness declines. For another, there could be an indirect effect, as foreign banks demand less funding from domestic banks, since lending has become less attractive in their home market. Our results indicate that both non-bank assets and bank assets may play a role. In the US, the coefficient on the interaction of conventional foreign monetary policy with non-bank assets is statistically significant, whereas the interactions with bank assets are not. In the UK, the reverse is the case. For the euro area, the coefficients are statistically insignificant in both cases.

Regarding unconventional monetary policy, we again find no evidence that its international transmission varies across banks in a consistent manner. The interaction terms with unconventional foreign monetary policy are insignificant in most cases. In some cases, they also have a sign opposite to what would be predicted by the portfolio channel. For example, for banks with a higher exposure to the US banks, contractionary unconventional monetary policy of the Federal Reserve leads to lower lending growth.

3.2.2 Extensions

As an extension, we run several additional specifications. First, we interact foreign monetary policy with international claims or deposits in specific foreign currencies (US dollar, Euro, British pound) rather than vis-à-vis specific jurisdiction (US, euro area, UK).[19] This may be particularly relevant to study the funding frictions associated with the bank lending channel. Monetary policy of a specific central bank directly influences funding costs in the respective currency globally, but does not necessarily affect returns on international claims its residents hold in other currencies. Results are shown in Table 7. To save space, we present them in a more compact form and report only the interaction terms of interest.

The results confirm our previous conclusion regarding the bank lending channel: for specifications where we interact the conventional monetary policy measure with overall cross-border

[19]Since our baseline specification did not provide consistent evidence regarding the transmission of unconventional monetary policy, we refrain from a detailed discussion of unconventional monetary policy and focus on conventional monetary policy.

deposits, the coefficient is either positive or statistically insignificant. Again, this result is driven by deposits from foreign banks. In all three specifications that include international deposits from banks only, the coefficient is positive and statistically significant. By contrast, in specifications with liabilities to non-banks only, the coefficient is negative and statistically significant in two out of three cases, as predicted by the bank lending channel. This supports our previous finding that that the counterparty matters when studying the interaction of monetary policy with funding frictions. We also continue to find a role for the portfolio channel. When we interact conventional monetary policy with total cross-border assets in a specific currency, the coefficient is positive and statistically significant in two out of three cases.

As a second robustness check and for a comparison with the IBRN meta analysis, we run specifications including foreign monetary policy in all three jurisdictions jointly (results are shown in Table 8). Due to the high number of regressors such a specification may suffer from multicollinearity problems. Nonetheless, our main results regarding the effects of conventional monetary policy continue to hold. The level effect of contractionary conventional foreign monetary policy for the average bank is either statistically insignificant or positive, as was found previously. Turning to variation across banks, interactions with foreign assets are positive and statistically significant in certain cases, again consistent with the portfolio channel. Furthermore, evidence from interaction with foreign liabilities does in most cases not support the international bank lending channel, as was the case before. However, contrary to the baseline specification these interactions no longer have a statistically significant positive sign, but are statistically insignificant in most cases. This may be a result of the high number of regressors.

So far, we have investigated how monetary transmission varies with cross-border assets and liabilities, using interaction terms. As an additional check, we compare the response of two groups of banks to foreign monetary policy: those of local retail banks that do not report to the BIS locational statistics and those of internationally active banks which are included in our main sample. As expected, we find that local banks do not show a statistically significant response to changes in foreign monetary policy in all of the specifications (not reported).

In a last robustness check, we exclude the two G-SIBs from our sample. The G-SIBs differ from other banks because they have large activities in capital markets and large foreign affiliates, while the other banks are mainly domestically oriented (see also Auer et al. [2017] for a more detailed description of the characteristics of the Swiss banking sector). While the G-SIBs have large international activities, they have at the same time an important market share in the domestic market (see Table 1). Excluding these banks from our sample weakens our results considerably. In most cases interactions of conventional monetary policy with cross-border

liabilities and cross-border assets are no longer statistically significant (not reported). This indicates that the transmission of foreign monetary policy occurs mainly through those banks with large international activities, while banks with limited international activities play a lesser role. Our result may indicate that international exposures matter for transmission only above a certain threshold. Unfortunately, the limited number of banks with large international exposures does not allow for a more detailed investigation.

4 Outward Transmission of Monetary Policy – Evidence from Canada

4.1 Methodology

4.1.1 Data

Canadian Bank-Level Data

Our data are obtained from regulatory returns filed by all federally chartered financial institutions in Canada. Bank-time-level data are globally consolidated at the parent level.[20]

We perform the following adjustments to the original data. As in Section 3.1.1, we exclude all foreign banks and foreign bank branches from our sample as well. In addition, we drop all outstanding foreign lending observations below CAD $50 million and limit our sample to sequences of bank-country-time observations with at least eight consecutive non-missing quarterly observations. The resulting sample for our baseline specifications consists of 4,975 observations from four Canadian banks with lending activities in 31 destination countries over the period 2000Q1 to 2015Q4.

Dependent variable: We primarily rely on lending activities by Canadian banks' foreign affiliates to the local non-bank sector. This variable represents the growth rate in local lending by foreign affiliates of Canadian banks, calculated as changes in the logarithm of stock values in Canadian dollars. To ensure that our results are not driven by outliers, our data are adjusted by cutting off the edges of the lending growth distribution at -100% and +100%. In selected specifications, we also use cross-border lending activities of Canadian banks (i.e., direct lending from a Canadian bank's head office in Canada to the foreign economy) as our dependent variable.

[20]The data are obtained from two forms: the quarterly "Basel Capital Adequacy Return" (for the Tier 1 capital ratio) and the monthly "Balance Sheet" return (for all other bank-level data). To measure the foreign lending activities of globally active Canadian banks, we use data from two sources. The form "Geographic Assets and Liabilities Booked in Canada" contains information on the cross-border activities (claims and liabilities) at the bank-country-time level, while the "Geographic Assets and Liabilities Booked Outside of Canada" provides claims and liabilities booked by foreign affiliates of Canadian banks.

Balance sheet characteristics: We construct a set of bank-specific balance sheet control variables, described in Appendix B. These variables include a measure of banks' total assets as a proxy for bank size (Log Total Assets), the share of banks' liquid assets (Liquid Asset Ratio), the banks' core deposit funding as a measure of the extent to which banks access alternative sources of funding (Core Deposits Ratio), a measure of banks' capital (Tier 1 Ratio) and the percentage of banking organizations' net intragroup funding across all countries (Net IG Funding Ratio). All variables are winsorized at the 1-percent level to avoid the impact of outliers.

Monetary Policy in Canada

Canada's monetary policy framework is centered on an inflation-control target of two per cent, which is the midpoint of a 1 to 3 percent target range. Introduced in 1991 and reviewed every five years, this inflation target is jointly determined by the central bank (the Bank of Canada) and the federal government. To achieve its inflation target, the Bank of Canada adjusts the overnight rate. Since the inflation target is symmetric, the Bank of Canada is equally concerned about inflation rising above or falling below the target.[21]

Figure 3 displays the dynamics of the Canadian monetary policy interest rate (henceforth, the "policy rate") over our sample period. The 16-year period is characterised by three distinct subperiods. First, in the early 2000s, the policy rate decreased from close to 6 percent in 2000Q2 to 2 percent in 2002Q1. Second, after rising again in the run-up to the global financial crisis, when it reached its maximum of 4.5 percent in 2007Q3, the policy rate was rapidly lowered to 0.25 percent in 2009Q2.[22] Third, after the global financial crisis, the policy was kept constant at 1 percent for a four-year long period between 2010Q4 and 2014Q4. Finally, in response to the decline in oil prices, the policy rate was lowered again to 0.75 percent in 2015Q1 and to 0.5 percent in 2015Q3.

In addition to a change in the Canadian monetary policy rate, we rely on a Canadian monetary policy shock measure (also referred to as "Taylor Rule Residual"). A monetary policy shock measure has the advantage that the monetary policy change is considered to be exogenous and not an endogenous policy response of the central bank to the business cycle. We construct the shock measure for Canada based on a methodology employed by Zdzienicka et al. [2016].

[21] The operationalisation of monetary policy lies entirely in the responsibility of the Bank of Canada's Governing Council. The target for the overnight rate, Canada's key monetary policy interest rate, is the interest rate that the Bank of Canada expects major financial institutions to use when borrowing and lending one-day (or "overnight") funds among themselves. This interest rate serves as the benchmark that banks and other financial institutions use to set their own interest rates, such as for consumer loans, mortgages and other forms of lending. See BoC [2016] for details.

[22] The Canadian policy interest rate remained at 0.25 percent from 2009Q2 to 2010Q2, which also constitutes its lowest value during our sample period. Since the Bank of Canada did not rely on quantitative easing in this situation, a potential Canadian shadow policy rate would be essentially identical to the Canadian short-term policy interest rate.

Their methodology has the additional advantage that by relying on forecast errors, the problem of "policy foresight" is eliminated, i.e., agents may alter their behavior already in response to the announcement of the policy and thus before the policy has been actually been implemented. Hence, the policy change for the shock measure is unexpected. Since Zdzienicka et al. [2016] compute their monetary policy shocks based on annual data, we modify their approach to fit our quarterly data frequency.

First, we construct the 1-year ahead forecast of the Canadian interest rate for each quarter using data from Consensus Economics.[23] Next, we compute the forecast error of the interest rate (FE_t^i), defined as the difference between the actual interest rate in year t and quarter q and the calculated forecast of the interest rate for year t and quarter q as of the previous quarter (i.e., $q-1$).[24] We then repeat this procedure for the GDP growth rate and the inflation rate and obtain their respective forecast errors, $FE_t^{\Delta y}$ and FE_t^{π}. Finally, we run the following regression:

$$FE_t^i = \alpha FE_t^{\Delta y} + \beta FE_t^{\pi} + \varepsilon_t \tag{3}$$

where the residual, ε_t, represents the measure of the Canadian monetary policy shock.

4.1.2 Empirical Approach

Empirical Specification

As in Section 3.1.2, we use two empirical specifications that assess how Canadian monetary policy changes affect Canadian banks' foreign lending activities. First, Equation (4) documents the aggregate effect of a monetary policy change in Canada on Canadian banks' foreign lending activities:

$$\Delta Y_{b,j,t} = \alpha_0 + \sum_{k=0}^{K} \alpha_{1,k} \Delta MP_{t-k}^{domestic} + \alpha_2 X_{b,t-1} + Z_t + f_j + f_b + \varepsilon_{b,j,t} \tag{4}$$

with K = 3, where $\Delta Y_{b,j,t}$ is the growth of "foreign lending," measured by Canadian bank b's affiliate's local lending activities in country j at time t.[25] The main term of interest is

[23] Consensus Economics provides monthly forecasts of several macroeconomic variables for the current year and the next calendar year. We construct quarterly forecasts by taking quarter-specific weighted averages of these two annual forecasts. In particular, we weight the current year's interest rate forecast by the number of months remaining in the current year and next year's interest rate forecast value by the difference between this number and 12. Then, monthly values are averaged to quarterly frequency.

[24] The interest rate forecasts and the actual rates from Consensus Economics refer to the 3-months short-term rate.

[25] For selected specifications, we additionally use as measures of foreign lending the growth of bank b's direct cross-border lending to country j at time t and the growth of bank b's inter office lending to its foreign affiliate in country j at time t.

$\Delta MP_{t-k}^{domestic}$, which captures changes of Canadian monetary policy over time. Then, $X_{b,t-1}$ is a vector of time-varying bank-specific control variables that enter the specification with a lag of one quarter and Z_t controls for demand effects, such as the business and the financial cycle, in the domestic and in the foreign economy.[26] We also include the VIX and a measure of monetary policy in all destination countries in the specification. We further include country fixed effects f_j and bank fixed effects f_b to absorb the impact of time-invariant difference across countries and across banks. Finally, $\varepsilon_{b,j,t}$ is the error term. Standard errors are clustered at the bank level.

In the next step, we explore the importance of different transmission channels through which domestic monetary policy is transmitted abroad. A key challenge in this setting is to disentangle demand effects (e.g., general macroeconomic effects of monetary policy) and supply effects (e.g., banks' willingness or ability to lend following a change in monetary policy). Our identification strategy relies on exploiting the relationship between heterogeneity in banks' balance sheet characteristics and heterogeneity in banks' ability to isolate their foreign lending activities from a change in the domestic monetary policy measure. The resulting differential response in foreign lending activities across banks with different balance sheet characteristics allows us to determine if there is evidence consistent with theoretical transmission channels. Equation (5) implements this strategy, which is characterized by adding the interaction term between the Canadian monetary policy measure, $\Delta MP_{t-k}^{domestic}$, and different transmission variables, $Channel_{b,j,t-K-1}$:

$$\begin{aligned} \Delta Y_{b,j,t} &= \alpha_0 + \sum_{k=0}^{K} \alpha_{1,k} \Delta MP_{t-k}^{domestic} \cdot Channel_{b,j,t-K-1} + \alpha_2 Channel_{b,j,t-K-1} \\ &\quad + \alpha_3 X_{b,t-1} + f_{j,t} + f_b + \varepsilon_{b,j,t} \end{aligned} \tag{5}$$

Further, Equation (5) differs from Equation (4) through a (stricter) set of country-time fixed effects, $f_{j,t}$, which absorbs various confounding factors in the destination country j, such as demand effects or monetary policy changes. This setting replaces the inclusion of the business and financial cycle measures, the VIX as well as the foreign monetary policy measure.[27] Standard errors are clustered at the bank level.

Transmission Channels

The international bank lending channel suggests that a tightening of domestic monetary policy

[26] We control for the business cycle and the financial cycle in the domestic economy as well as in all destination countries by including output gaps and financial gaps in the regression. The corresponding series are obtained from the Bank of International Settlements (BIS). In Equation (5), these variables are absorbed by a set of country-time fixed effects.

[27] The direct effect of the domestic monetary policy measure will be absorbed.

raises banks' domestics funding costs and thus *reduces* their foreign lending activities. However, the reduction in foreign lending should be lower under the following circumstances: (i) a bank is less dependent on domestic funding (and in particular, less dependent on domestic short-term deposit funding) (ii) a bank is able to use liquid assets in order to meet its funding needs in a more timely manner, (iii) a bank's foreign lending activities are not cut in order to provide funds to the head office through an internal capital market, (iv) a bank has more collateral, such as capital,[28] that can be used to acquire wholesale funding at lower costs.

Hence, the sign on the sum of the interaction term coefficients $\sum_{k=0}^{K} \alpha_{1,k}$ should be *negative* when the "Short-Term Deposit Funding Ratio" is used, *positive*, when the "Liquid Asset Ratio" is used, and *negative*, when the share of "Net Intragroup Funding to the Affiliate/Total Assets" is used. The effect of "Log Total Assets," a fourth potential transmission variable, is ambiguous as a larger asset side could point to the presence of more illiquid assets that amplify the reduction in lending as well as to a larger set of opportunities to mitigate the expected reduction. We finally consider the "Tier 1 Ratio" as part of the international bank lending channel and thus would expect a *positive* effect.[29]

The international portfolio channel suggests that a tightening of domestic monetary policy raises the default risk of domestic borrowers and lowers banks' risk-adjusted returns of domestic lending. This prompts banks to substitute away from risky domestic lending to safer foreign lending whereby banks avoid the effect of information frictions regarding domestic borrowers net worth. Hence, a domestic monetary policy tightening *increases* banks' foreign lending activities through the international portfolio channel. In turn, foreign lending should *increase less* if: (i) a bank has a lower exposure to risky borrowers in the domestic economy, such as through commercial and industrial loans (C&I loans), (ii) a bank has a higher exposure to securities than to domestic loans and (iii) a bank has a higher exposure to less risky foreign borrowers.

Hence, the sign on the sum of the interaction term coefficients, $\sum_{k=0}^{K} \alpha_{1,k}$ should be *positive* when the share of "C&I Loans/Total Assets" is used as a transmission variable, *negative*, when the share of "Securities/Total Assets" is used and *negative* when the share of "Total Claims on Foreign Borrowers/Total Assets" is used. All transmission channels enter the specification with their fourth lag.

4.2 Results

We present the results from estimating Equations (4) and (5) for local lending growth of Canadian banks' foreign affiliates for both monetary policy measures. Tables 9 and 10 show results

[28]This channel is also referred to as the "(International) bank capital channel" of monetary policy.

[29]For consistency with other studies, the "Tier 1 Ratio" is shown in the international portfolio channel table.

that rely on a change in the Canadian monetary policy rate and Tables 11 and 12 contain results that are based on Canadian monetary policy shocks.

4.2.1 Baseline Specification

No channel specification: Specification (1) in Table 9 (and Table 10) contains the results from estimating Equation (4). This specification quantifies the aggregate effect of a change in the Canadian monetary policy rate on local lending activities of Canadian banks' foreign affiliates. The sum of the $\alpha_{1,k}$ coefficients, which capture the joint effect of the contemporaneous change in Canadian monetary policy as well as its three lags, amounts to -0.004 and is not statistically significant. Hence, this result suggests that the local lending activities of Canadian banks' affiliates abroad are, on aggregate, not significantly affected by changes in Canadian monetary policy. A potential reason for the insignificant aggregate effect is that the international bank lending channel and the international portfolio channel are expected to have opposing effects on foreign lending. It is therefore important to test for the presence of the two transmission channels explicitly.

International bank lending channel: We start with an assessment of the international bank lending channel, which suggests that foreign bank lending should decrease following a tightening of domestic monetary policy. As discussed in Section 4.1.2, we assess the role of five transmission channel variables (serving as proxies for underlying frictions) that can amplify or mitigate the decreasing effect of domestic monetary policy on foreign lending. These variables are the Short-Term Deposit Funding Ratio, the Liquid Asset Ratio, Net Intragroup Funding to the Affiliate/Total Assets, Log Total Assets and the Tier 1 Ratio—corresponding to Specifications (2) to (5) in Table 9 and Specification (2) in Table 10. We evaluate their results according to the sign and significance of the sum of the $\alpha_{1,k}$ coefficients in Equation (5), which capture the impact of the interaction term between the domestic monetary policy measure (contemporaneous effect as well as the first three lags) and the fourth lag of each transmission variable.[30]

Specification (2) uses the Short-Term Deposit Funding Ratio. As discussed Section 4.1.2, the idea behind this channel is that banks with a high exposure to domestic short-term deposit funding are more exposed to a tightening in domestic monetary policy and thus are expected to reduce their foreign lending more. Holding all else equal, banks would avoid the role of friction related to substitution of funding sources. We find that the sum of the coefficients on the interaction terms amounts to -2.204 and is statistically significant. Consequently, this

[30]It should be kept in mind throughout the result section that this coefficient indicates the *differential* effect that explains how banks with different characteristics respond to a change in domestic monetary policy.

coefficient estimate implies that following a 100 basis point increase in the Canadian monetary policy rate, foreign affiliates of Canadian banks with high levels of short-term deposit funding (i.e., the 75th percentile of the Short-Term Deposit Funding Ratio distribution or a value of 0.135) decrease their local lending activities by 16.09 percentage points more than those of banks with low levels of short-term funding (i.e., the 25th percentile of the Short-Term Deposit Funding Ratio distribution or a value of 0.062, respectively). These results confirm the expected negative sign and suggest that the negative impact of the international bank lending channel on foreign lending is amplified through this channel. We further find a significant coefficient on the contemporaneous interaction term, which takes on a value of -1.396 and suggests that the impact of a change in domestic monetary policy on foreign lending materializes relatively fast but appears to persist for several quarters. Overall, our findings suggest that local lending activities by Canadian banks' foreign affiliates respond significantly to monetary policy changes in Canada.

Specification (3) relies on the Liquid Asset Ratio. The idea behind this transmission variable is that banks with a large share of liquid assets will find it easier to adjust their assets to changes in domestic monetary policy. The sum of the coefficients on the interaction terms is negative but statistically insignificant. Hence, this channel variable does not seem to be a key determinant of the differential impact of Canadian monetary policy changes on local lending activities by foreign affiliates of Canadian banks.

Specification (4) then uses the Net Intragroup Funding to the Affiliate/Total Assets. This specification assess the existence of an internal capital market link between the bank's head office and its foreign affiliates. Since the head office and its domestic lending activities are impacted first by a change in Canadian monetary policy, one would expect foreign lending to be reduced more, when the financial links between the head office and the foreign affiliates are stronger. However, since the sum of the interaction term coefficients is insignificant, we do not see much evidence for the importance of this channel for Canadian banks.[31]

Specification (5) employs an identification strategy based on Log Total Assets. Since a large balance sheet could correspond to a less liquid asset side but also provide more opportunities to obtain funds from the wholesale market, the expected differential impact is undetermined. The sum of the interaction term coefficients could be reflecting these opposing effects as they turn out insignificant.

Finally, Specification (2) in Table 10 relies on the Tier 1 Ratio as a transmission channel. With a higher capital ratio, a bank will be able to obtain wholesale funding at a lower rate and

[31] Alternatively, if a bank's objective is to stabilize foreign instead of domestic lending, a larger internal capital market would be expected to have the opposite effect on foreign lending.

by avoiding information frictions will be in a better situation to maintain its foreign lending activities after a tightening of domestic monetary policy. In line with the expected positive coefficient, we find the sum of the interaction term coefficients to amount to a statistically significant value of 15.79. This suggests that the negative impact of domestic monetary policy on foreign lending is mitigated through this channel variable.

International portfolio channel: We then turn to the international portfolio channel, which suggests that foreign lending increases in response to a tightening of domestic monetary policy. In particular, we assess the role of the three associated transmission variables to amplify or mitigate this effect. The three transmission variables are C&I Loans/Total Assets, Securities/Total Assets, and Total Claims on Foreign Borrowers/Total Assets—corresponding to Specifications (3) to (5) in Table 10. Again, we evaluate their results according to the sign and significance of the sum of the $\alpha_{1,k}$ coefficients in Equation (5).

Specification (3) uses C&I Loans as a transmission variable. Banks with a large exposure to risky loans in the domestic economy (i.e., subject to greater information frictions about borrowers quality) will be more likely to increase their foreign lending activities in response to a tightening of domestic monetary policy. The sum of the coefficients on the interaction terms carries the expected positive sign but is statistically insignificant.

Specification (4) relies on the Securities/Total Assets as a transmission variable. This channel suggests that banks with a high share of securities among their assets are less likely to increase their foreign lending activities as they are less exposed to more risky borrowers in the domestic economy following a policy tightening. Hence, we would expect the positive effect on foreign lending from the portfolio channel to be mitigated by a high exposure to securities. The sum of the coefficients on the interaction terms carries the expected negative sign, amounts to -1.723 but is marginally insignificant (with a p-value of 0.11). When focusing on the contemporaneous impact, however, we find that the coefficient on the interaction term is significant and amounts to -0.855. Hence, evidence on this transmission variable is largely consistent with the expected negative differential impact for this channel and the substitution effect between domestic and foreign lending.

Finally, in Specification (5), Total Claims on Foreign Borrowers/Total Assets is used as a transmission variable. The more claims a bank has already towards foreign borrowers, the less it should be affected by the increase in the risk profile of the domestic economy following a tightening of domestic monetary policy. The sum of the coefficients on the interaction terms, carries the expected sign but is not statistically significant. Hence, based on the evidence above,

we expect this channel to matter little.

So far, we find primarily evidence for the presence of an international bank lending channel in response to a change in the Canadian monetary policy rate, as two out of five transmission variables are significant and carry their expected signs.

4.2.2 Alternative Measure of Monetary Policy

After having used the change in the Canadian monetary policy rate as our monetary policy measure, we now turn to the Canadian monetary policy shock measure, which focuses on the unexpected part of a monetary policy change. Using this alternative measure, we re-run all specification in Tables 9 and 10 with the alternative measure. The results are shown in Tables 11 and 12.

Specification (1) in Table 11 (and Table 12) corresponds to Equation (4) again. The sum of the $\alpha_{1,k}$ coefficients, which capture the joint effect of the contemporaneous change in Canadian monetary policy, as well as its three lags, amount to 0.019 but are again not statistically significant. Hence, there is little evidence for an aggregate effect on foreign lending also for this measure of monetary policy.

Turning next to the assessment of the two outward transmission channels, we find the following results to be noteworthy. Starting with the international bank lending channel in Table 11, Specification (5), which relies on Log Total Assets as the transmission variable, yields now negative and significant coefficients on the sum of the interaction terms as well as on impact. These coefficients are both statistically significant and amount to -0.815 and -0.175, respectively. Hence, the negative sign for this channel variable suggests that a larger balance sheet might amplify and not mitigate the impact of a domestic monetary policy tightening on foreign lending – in particular, when the policy tightening is unexpected. In addition, Specification (2) in Table 12 provides additional support for the finding that the Tier 1 Ratio has a mitigating effect on the reduction in foreign lending. While the coefficient on the sum of the four interaction terms is marginally not significant (amounting to 16.91 with a p-value of 0.16), we observe a positive and statistically effect on impact. The coefficient on the contemporaneous interaction term is statistically significant and amounts to 5.427.

For the international portfolio channel, we find supporting evidence in Specification (4) in Table 12, where the transmission variable Securities/Total Assets produces the expected negative effect under the alternative monetary policy measure. The sum of the coefficients on the interaction terms amounts to -3.239 and is statistically significant. This estimate suggests that, following an unexpected tightening in Canadian monetary policy, banks with a higher exposure

to securities are less affected by the policy tightening and the expected positive impact on foreign lending through the portfolio channel will be mitigated. Finally, Specification (5), which relies on Total Claims on Foreign Borrowers/Total Assets also shows the expected negative sign. The sum of the interaction terms amounts to a statistically significant value of -5.248 and thus suggests that banks with relatively higher foreign exposure are less affected by an unexpected change in domestic monetary policy. The conclusion derives again from the argument that the expected positive impact of the portfolio channel on foreign lending will be mitigated by the negative effect for this specific channel variable.

To sum up, we find more supporting evidence for the presence of an international portfolio channel with the Canadian monetary policy shock. In this case, two of the three transmission variables were statistically significant and carried their expected signs. A potential explanation that could align these findings with those from above is that the change in the Canadian monetary policy rate contains both expected and unexpected changes in monetary policy. However, the Canadian monetary policy shock measure focuses primarily on unexpected changes in monetary policy. Since the international bank lending channel works through a change in banks' funding costs both expected and unexpected changes of monetary policy might be important for this channel. As the international portfolio channel relies on a change in the risk profile of domestic borrowers, however, the unexpected – and thus the non-hedgeable – elements of monetary policy might be more important driver for this channel.

4.2.3 Alternative Dependent Variables

This section describes the results with a dependent variable that measures growth of (direct) cross-border lending from the Canadian head office. Replicating Tables 9 and 10 with the alternative dependent variable yields Tables 13 and 14.

The first notable difference is that Specification (1) in Table 13 and Table 14, corresponding to Equation (4), produces a positive and significant coefficient. This suggests that the aggregate impact of domestic monetary policy on cross-border lending is positive. Turning to the assessment of the two channels, i.e., estimating Equation (5), we find that the only significant effects appear in Specifications (5) in Table 13 and Specification (3) in Table 14. Using Log Total Asset as the transmission variable, Specification (5) in Table 13 confirms the results of Specification (5) in Table 11. A tightening of domestic monetary policy results in a stronger reduction of contemporaneous foreign lending, when a bank's assets are large. The resulting coefficient is significant and amounts to a -0.108. However, when summed over four quarters, a larger asset side mitigates the shock substantially and the differential effect turns positive with a significant

coefficient of 0.139 this time. This provides additional evidence consistent with the presence of the international bank lending channel.

When C&I loans are used as transmission variable in Specification (3) in Table 14, we obtain the opposite sign as we obtained in Tables 10 and 12. While a higher exposure to risky loans in the domestic economy should amplify the increase in foreign lending through the international portfolio channel and thus a positive sign should emerge, we find that the coefficient on the sum of the interaction terms carries a significant and negative sign (with no significant effect on impact). Hence, a domestic monetary policy tightening implies a relatively stronger reduction of cross-border lending for banks that are more exposed to risky loans. Together with the significant relative increase of local lending by Canadian banks' foreign affiliates in response to a monetary policy tightening, a potential explanation is that Canadian banks cut their cross-border lending in such a case to supply their foreign affiliates with even more funds.

5 Conclusion

This paper has studied the international transmission of monetary policy for banks in small open economies using the examples of Switzerland and Canada. Based on confidential bank-level data, we have assessed the inward transmission of foreign monetary policy for Switzerland and the outward transmission of domestic monetary policy for Canada. The focus of our empirical analysis was to test for the presence of an international bank lending channel and an international portfolio channel of monetary policy in both economies.

Our results on the inward transmission of foreign monetary policy through banks in Switzerland are consistent with a role for the international portfolio channel, but we find no evidence for the traditional international bank lending channel. The results on the outward transmission of domestic monetary policy suggest that foreign lending by Canadian banks is affected by domestic monetary policy through both channels, which work as predicted and largely balance each other. Overall, for both, outward and inward transmission, the quantitative effect on bank lending appears to be limited.

Our findings inform the policy debate about macroeconomic and financial stability in small open economies. While we know that small open economies are exposed to global economic conditions through real channels, in particular trade linkages, less is known about monetary transmission through banks. Our results indicate that the inward and outward transmission of monetary policy through banks can be limited, at least through the two investigated transmission channels. This can be either a result of a balance sheet structure that is not sensitive to foreign monetary policy or different channels of transmission that work in opposite directions

and balance each other. These are relevant insights when assessing the effectiveness of domestic monetary policy in small open economies as well as the transmission of monetary shocks through globally operating banks.

Future research could extend the analysis to other small open economies in order to assess how much of our findings depend on the structure and quality of the domestic financial system. In particular, it would be helpful to know if bank lending in countries with less developed financial systems is equally isolated against changes in foreign monetary policy. Finally and closely related, it would be interesting to see whether the missing evidence for the international bank lending channel in the inward transmission of foreign monetary policy is a phenomenon specific to Switzerland or whether it generalizes to other small open economies.

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Appendix A - Figures and Tables

Figure 1: Foreign Monetary Policy: Interest Rate

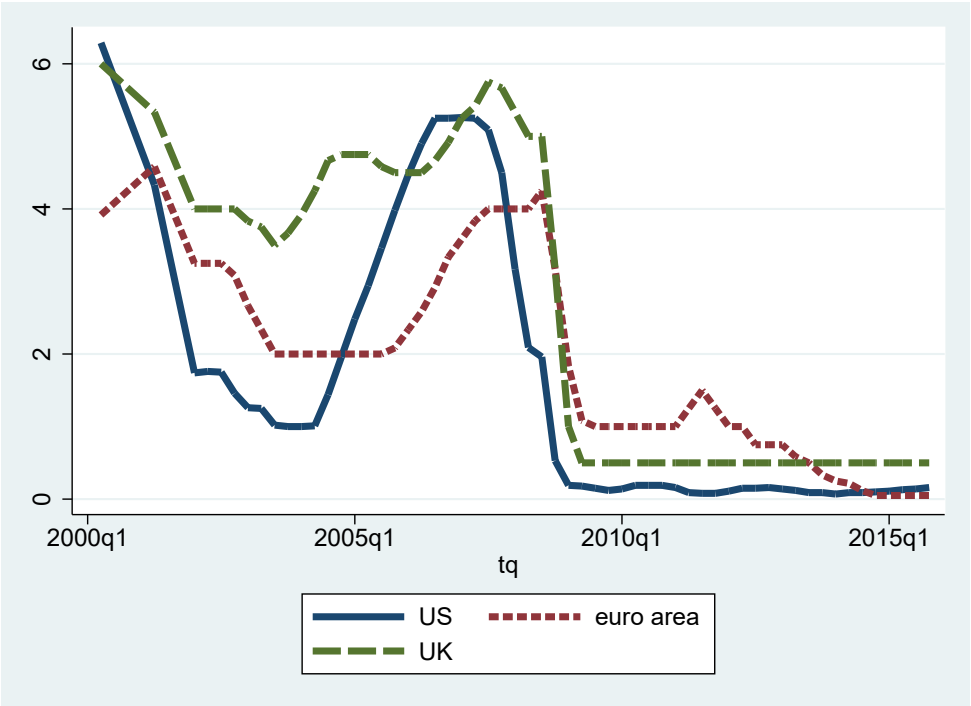

Figure 2: Foreign Monetary Policy: Central Bank Balance Sheet

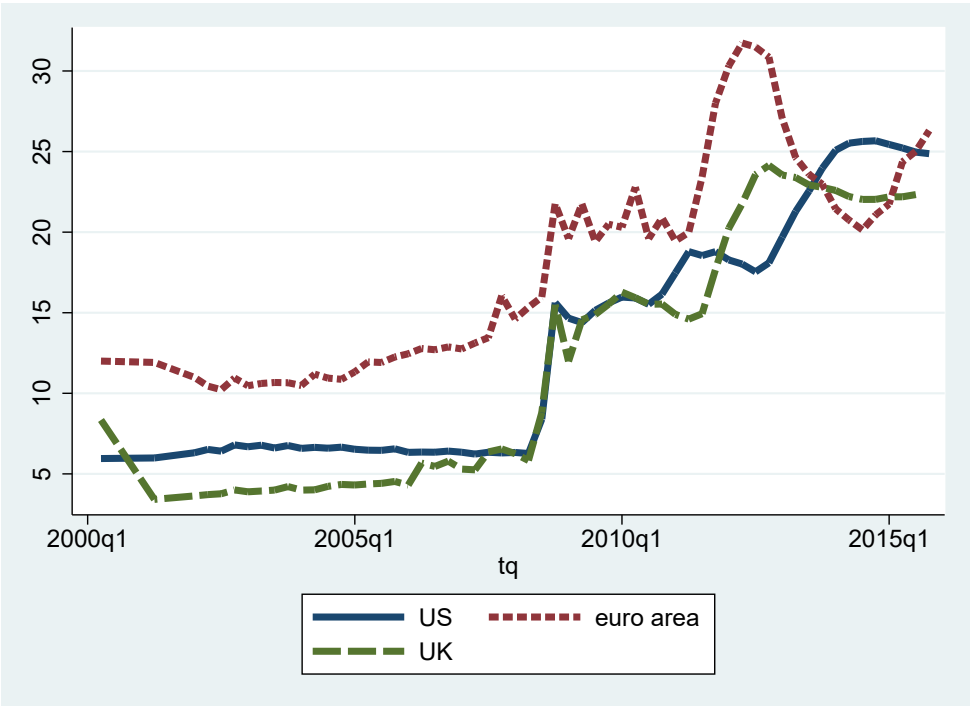

Figure 3: Canadian Monetary Policy: Interest Rate

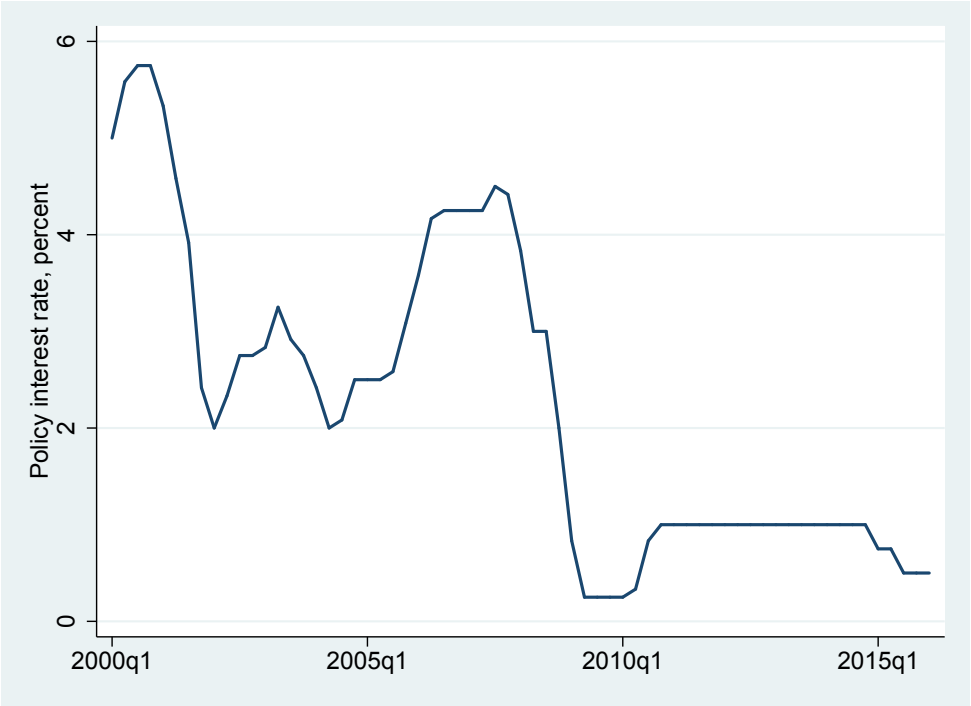

Table 1: **Market Shares by Bank and Asset Categories (% of Respective Balance Sheet Position)**
Source: SNB Banking Statistics, consolidated data as of December 31, 2015.

	Domestic Big Banks	Domestic Retail Banks	Domestic Wealth-Management Banks (incl. Private Banks)	Affiliates of Foreign Banks (incl. Branches)
Domestic Assets	28	56	6	10
Domestic Loans to non-banks	30	65	1	4
Foreign Assets	76	4	8	11
Foreign Loans to non-banks	77	1	7	15

Table 2: **Composition of Banks' Balance Sheets (% of Consolidated Total Assets)**
Source: SNB Banking Statistics, consolidated data as of December 31, 2015.

	Domestic Big Banks	Domestic Retail Banks	Domestic Wealth-Management Banks (incl. Private Banks)	Affiliates of Foreign Banks (incl. Branches)
Domestic Assets	27	93	42	48
Domestic Loans to non-banks	18	67	7	11
Foreign Assets	73	7	58	52
Foreign Loans to non-banks	29	1	20	26

Table 3: **Inward Transmission Channels (in % of consolidated total assets)**
Source: SNB Locational Banking Statistics as of December 31, 2015.

	Mean	SD	Median
US Liabilities	0.6	1.4	0.1
of which to Banks	0.4	1.4	0.0
Euro area Liabilities	3.9	3.1	3.0
of which to Banks	1.5	2.2	0.7
UK Liabilities	0.8	1.9	0.2
of which to Banks	0.6	1.8	0.0
Japan Liabilities	0.1	0.2	0.0
of which to Banks	0.0	0.2	0.0
US Assets	0.6	1.3	0.2
of which from Banks	0.4	1.1	0.1
Euro area Assets	4.0	3.6	3.1
of which from Banks	2.6	2.4	1.8
UK Assets	1.2	2.4	0.4
of which from Banks	1.0	2.4	0.2
Japan Assets	0.1	0.3	0.0
of which from Banks	0.1	0.3	0.0

Table 4: **Switzerland: No Channel Specification**
The dependent variable is log changes in loans to the domestic non-financial private sector. The data are quarterly from 2000Q1 to 2015Q4 for a panel of domestic banks with foreign exposures. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Note that only coefficients of interest are shown. The complete specification is in the main text.

	No channel: MP US	No channel: MP EA	No channel: MP GB
	(1a)	(1b)	(1c)
$\sum \Delta$MP country i$_{t\ to\ t-3}$	0.005*	0.005	0.001
	[0.100]	[0.154]	[0.476]
$\sum \Delta$QE country i$_{t\ to\ t-3} \times ZLB$	0.001	-0.004**	0.000
	[0.151]	[0.010]	[0.938]
Log total assets$_{t-1}$	0.001	0.002	0.001
	[0.800]	[0.634]	[0.717]
Total Capital Ratio$_{t-1}$	0.012	0.027	0.022
	[0.608]	[0.175]	[0.322]
Liquid asset ratio$_{t-1}$	-0.056***	-0.018	-0.020
	[0.006]	[0.301]	[0.156]
Core deposits ratio$_{t-1}$	0.025*	0.031**	0.032**
	[0.063]	[0.017]	[0.010]
Business Cycle country i$_{t-1}$	-0.002*	0.000	0.000
	[0.061]	[0.779]	[0.858]
Business Cycle Domestic$_{t-1}$	0.002**	0.000	0.001
	[0.038]	[0.960]	[0.538]
Financial Cycle country i$_{t-1}$	0.000	0.001**	0.000*
	[0.136]	[0.038]	[0.052]
Financial Cycle Domestic$_{t-1}$	0.000*	0.000**	0.000
	[0.058]	[0.020]	[0.592]
ΔMP Domestic$_{t-1}$	-0.004*	-0.006**	-0.004*
	[0.057]	[0.040]	[0.065]
VIX_{t-1}	-0.000	-0.000	-0.000
	[0.559]	[0.897]	[0.393]
Time fixed effects	No	No	No
Bank fixed effects	Yes	Yes	Yes
Observations	947	947	930
R-squared	0.171	0.176	0.173
Adjusted R-squared	0.137	0.142	0.139
Number of banks	18	18	18

Table 5: **Switzerland: Inward Bank Lending Channel (Short Rate and QE)**
The dependent variable is log changes in loans to the domestic non-financial private sector. The data are quarterly from 2000Q1 to 2015Q4 for a panel of domestic banks with foreign exposures. *Channel* is defined in each column. CBL/CBL banks/CBL non-banks stands for cross-border liabilities/cross-border liabilities to banks/cross-border liabilities to non-banks. TA stands for total assets. Other columns have similar definitions. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Note that only coefficients of interest are shown. The complete specification is reported in the main text.

	Country US $\frac{CBL}{TA}$	Country EA $\frac{CBL}{TA}$	Country UK $\frac{CBL}{TA}$	Country US $\frac{\text{CBL banks}}{TA}$	Country EA $\frac{\text{CBL banks}}{TA}$	Country UK $\frac{\text{CBL banks}}{TA}$	Country US $\frac{\text{CBL non-banks}}{TA}$	Country EA $\frac{\text{CBL non-banks}}{TA}$	Country UK $\frac{\text{CBL non-banks}}{TA}$
	(2a-1)	(2b-1)	(2c-1)	(2a-2)	(2b-2)	(2c-2)	(2a-3)	(2b-3)	(2c-3)
$\sum \Delta$MP country $i_{t\ to\ t-3} \times Channel_{t-4}$	0.247***	-0.019	0.118***	0.232***	0.024	0.154***	-2.233	-0.138	-1.355*
	[0.001]	[0.721]	[0.007]	[0.001]	[0.634]	[0.001]	[0.470]	[0.311]	[0.068]
$\sum \Delta$QE country $i_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	-0.047	0.021	0.011	-0.100	0.027	0.059	0.790*	0.028	-0.886***
	[0.660]	[0.465]	[0.805]	[0.533]	[0.632]	[0.387]	[0.087]	[0.534]	[0.000]
Log total assets_{t-1}	0.000	0.000	-0.001	0.000	0.001	-0.001	0.001	0.001	0.001
	[0.987]	[0.998]	[0.886]	[0.982]	[0.889]	[0.851]	[0.723]	[0.804]	[0.741]
Total Capital Ratio_{t-1}	0.013	0.015	0.012	0.014	0.013	0.011	0.018	0.022	0.019
	[0.588]	[0.487]	[0.628]	[0.567]	[0.559]	[0.668]	[0.447]	[0.331]	[0.387]
Liquid asset ratio_{t-1}	-0.027	-0.042*	-0.000	-0.017	-0.045*	0.003	-0.032*	-0.031	-0.022
	[0.121]	[0.055]	[0.995]	[0.412]	[0.070]	[0.868]	[0.067]	[0.166]	[0.158]
Core deposits ratio_{t-1}	0.030**	0.025**	0.029**	0.030**	0.022*	0.029**	0.027**	0.028**	0.027**
	[0.010]	[0.050]	[0.014]	[0.011]	[0.087]	[0.011]	[0.026]	[0.023]	[0.022]
Channel country i_t-4	0.118**	-0.056	0.122	0.096	-0.053	0.040	-1.281	0.023	0.023
	[0.014]	[0.131]	[0.158]	[0.103]	[0.209]	[0.201]	[0.429]	[0.784]	[0.861]
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	947	947	930	947	947	930	947	947	930
R-squared	0.251	0.251	0.256	0.248	0.255	0.258	0.246	0.243	0.260
Adjusted R-squared	0.171	0.172	0.176	0.168	0.176	0.178	0.166	0.162	0.180
Number of banks	18	18	18	18	18	18	18	18	18

Table 6: **Switzerland: Inward Portfolio Channel (Short Rate and QE)**
The dependent variable is log changes in loans to the domestic non-financial private sector. The data are quarterly from 2000Q1 to 2015Q4 for a panel of domestic banks with foreign exposures. *Channel* is defined in each column. CBA/CBA banks/CBA non-banks stands for cross-border assets/cross-border assets to banks/cross-border assets to non-banks. TA stands for total assets. Other columns have similar definitions. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Note that only coefficients of interest are shown. The complete specification is reported in the main text.

	Country US $\frac{CBA}{TA}$	Country EA $\frac{CBA}{TA}$	Country UK $\frac{CBA}{TA}$	Country US $\frac{\text{CBA banks}}{TA}$	Country EA $\frac{\text{CBA banks}}{TA}$	Country UK $\frac{\text{CBA banks}}{TA}$	Country US $\frac{\text{CBA non-banks}}{TA}$	Country EA $\frac{\text{CBA non-banks}}{TA}$	Country UK $\frac{\text{CBA non-banks}}{TA}$
	(3a-1)	(3b-1)	(3c-1)	(3a-2)	(3b-2)	(3c-2)	(3a-3)	(3b-3)	(3c-3)
$\sum \Delta$MP country i$_{t\ to\ t-3} \times Channel_{t-4}$	0.189**	-0.034	0.096**	0.174	-0.066	0.107***	0.915**	0.091	-0.401
	[0.033]	[0.670]	[0.011]	[0.122]	[0.575]	[0.000]	[0.021]	[0.340]	[0.404]
$\sum \Delta$QE country i$_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	0.100	0.025	0.004	0.230*	0.036	0.020	0.427*	0.034	-0.950**
	[0.116]	[0.317]	[0.917]	[0.075]	[0.495]	[0.512]	[0.053]	[0.490]	[0.035]
Log total assets$_{t-1}$	-0.001	0.001	-0.001	-0.001	0.000	-0.001	-0.000	0.000	0.002
	[0.809]	[0.882]	[0.885]	[0.880]	[0.930]	[0.849]	[0.968]	[0.912]	[0.582]
Total Capital Ratio$_{t-1}$	0.012	0.019	0.011	0.013	0.018	0.011	0.017	0.019	0.023
	[0.624]	[0.399]	[0.672]	[0.582]	[0.417]	[0.677]	[0.472]	[0.405]	[0.297]
Liquid asset ratio$_{t-1}$	-0.012	-0.032	-0.000	-0.011	-0.033	0.002	-0.010	-0.030	-0.033**
	[0.448]	[0.150]	[0.977]	[0.439]	[0.125]	[0.916]	[0.514]	[0.135]	[0.032]
Core deposits ratio$_{t-1}$	0.029***	0.027**	0.031**	0.029***	0.029**	0.031**	0.030**	0.029**	0.024*
	[0.007]	[0.020]	[0.014]	[0.007]	[0.016]	[0.012]	[0.010]	[0.020]	[0.093]
Channel country i_t-4	0.071*	0.012	0.052	0.094**	-0.020	0.046	0.279	0.098	-1.320***
	[0.097]	[0.762]	[0.126]	[0.016]	[0.514]	[0.188]	[0.465]	[0.301]	[0.002]
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	947	947	930	947	947	930	947	947	930
R-squared	0.244	0.252	0.247	0.246	0.246	0.247	0.244	0.257	0.277
Adjusted R-squared	0.163	0.172	0.167	0.166	0.166	0.166	0.163	0.178	0.200
Number of banks	18	18	18	18	18	18	18	18	18

Table 7: **Switzerland: Inward Transmission (Robustness)**
The dependent variable is log changes in loans to the domestic non-financial private sector. The data are quarterly from 2000Q1 to 2015Q4 for a panel of domestic banks with foreign exposures. Channel is defined in each column. CBL stands for cross-border liabilities. CBA stands for cross-border assets. TA stands for total assets. MP stands for monetary policy. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Note that only coefficients of interest are shown.

	Country US $\frac{\text{CBL USD}}{TA}$	Country EA $\frac{\text{CBL EUR}}{TA}$	Country UK $\frac{\text{CBL GBP}}{TA}$	Country US $\frac{\text{CBA USD}}{TA}$	Country EA $\frac{\text{CBA EUR}}{TA}$	Country UK $\frac{\text{CBA GBP}}{TA}$
	(4-1)	(4-2)	(4-3)	(5-1)	(5-2)	(5-3)
Regression with all liabilities or assets						
$\sum \Delta MP$ *country* $i_{t\ to\ t-3} \times Channel_{t-4}$	0.135***	0.048	0.092	0.13***	0.004	0.328***
	[0.000]	[0.364]	[0.472]	[0.000]	[0.959]	[0.003]
$\sum \Delta QE$ *country* $i_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	0.049**	-0.03	-0.16	0.053**	-0.027	0.047
	[0.021]	[0.221]	[0.139]	[0.027]	[0.382]	[0.519]
Regression with bank liabilities or assets						
$\sum \Delta MP$ *country* $i_{t\ to\ t-3} \times Channel_{t-4}$	0.148***	0.163**	0.219**	0.127***	0.139	0.343***
	[0.000]	[0.044]	[0.002]	[0.000]	[0.491]	[0.004]
$\sum \Delta QE$ *country* $i_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	0.007	-0.025	-0.053	0.02	-0.061	0.067
	[0.887]	[0.850]	[0.656]	[0.721]	[0.576]	[0.392]
Regression with non-bank liabilities or assets						
$\sum \Delta MP$ *country* $i_{t\ to\ t-3} \times Channel_{t-4}$	-0.098	-0.48**	-1.04***	0.148*	0.029	-0.278
	[0.688]	[0.022]	[0.000]	[0.073]	[0.650]	[0.935]
$\sum \Delta QE$ *country* $i_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	0.067**	-0.024	-0.723***	0.099***	-0.031	-2.326
	[0.019]	[0.216]	[0.009]	[0.002]	[0.204]	[0.157]
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	816	816	804	816	816	804
Number of banks	18	18	18	18	18	18

Table 8: **Switzerland: Inward Transmission (Robustness 2)**
The dependent variable is log changes in loans to the domestic non-financial private sector. The data are quarterly from 2000Q1 to 2015Q4 for a panel of domestic banks with foreign exposures. CBL/CBL banks/CBL non-banks stands for cross-border liabilities/cross-border liabilities to banks/cross-border liabilities to non-banks. CBA/CBA banks/CBA non-banks stands for cross-border assets/cross-border assets to banks/cross-border assets to non-banks. TA stands for total assets. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Note that only coefficients of interest are shown.

	No channel All countr	All countr $\frac{CBL}{TA}$	All countr CBL banks $\frac{}{TA}$	All countr CBL non-banks $\frac{}{TA}$	All countr $\frac{CBA}{TA}$	All countr CBA banks $\frac{}{TA}$	All countr CBA non-banks $\frac{}{TA}$
	(6)	(7-1)	(7-2)	(7-3)	(8-1)	(8-2)	(8-3)
$\sum \Delta$MP US$_{t\ to\ t-3} \times Channel_{t-4}$	-0.008	0.120	0.078	-1.424	0.104	0.102	0.846**
	[0.261]	[0.149]	[0.335]	[0.636]	[0.194]	[0.365]	[0.023]
$\sum \Delta$MP EA$_{t\ to\ t-3} \times Channel_{t-4}$	0.031**	-0.034	-0.002	-0.058	-0.042	-0.051	0.023
	[0.045]	[0.500]	[0.963]	[0.695]	[0.590]	[0.607]	[0.800]
$\sum \Delta$MP GB$_{t\ to\ t-3} \times Channel_{t-4}$	-0.007	-0.020	0.047	-1.194**	0.113***	0.136***	-0.275
	[0.226]	[0.800]	[0.708]	[0.031]	[0.002]	[0.000]	[0.450]
$\sum \Delta$QE US$_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	0.003	-0.091	-0.117	0.427	0.055	0.166	0.316
	[0.550]	[0.574]	[0.513]	[0.291]	[0.476]	[0.197]	[0.174]
$\sum \Delta$QE EA$_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	-0.002	0.065**	0.221***	0.068	0.074**	0.103	0.123**
	[0.450]	[0.026]	[0.000]	[0.185]	[0.030]	[0.248]	[0.015]
$\sum \Delta$QE GB$_{t\ to\ t-3} \times Channel_{t-4} \times ZLB$	0.004*	-0.051	0.019	-0.836***	0.004	0.037	-0.717
	[0.093]	[0.450]	[0.799]	[0.000]	[0.927]	[0.328]	[0.157]
$\sum$ZLB US$_{t\ to\ t-3} \times Channel_{t-4}$	-0.013	0.564**	0.494	1.030	0.032	0.026	-0.403
	[0.634]	[0.020]	[0.144]	[0.513]	[0.825]	[0.930]	[0.209]
$\sum$ZLB EA$_{t\ to\ t-3} \times Channel_{t-4}$	-0.009	0.214***	0.539***	0.191**	0.145**	0.246	0.214
	[0.519]	[0.000]	[0.000]	[0.033]	[0.028]	[0.153]	[0.131]
$\sum$ZLB GB$_{t\ to\ t-3} \times Channel_{t-4}$	0.026	-0.320*	-0.402*	0.382**	-0.087	-0.136*	1.822***
	[0.264]	[0.053]	[0.077]	[0.022]	[0.233]	[0.065]	[0.000]
Log total assets$_{t-1}$	0.001	-0.002	-0.001	0.001	-0.001	-0.002	0.001
	[0.780]	[0.584]	[0.721]	[0.805]	[0.753]	[0.661]	[0.734]
Total Capital Ratio$_{t-1}$	0.022	0.011	0.010	0.019	0.013	0.011	0.025
	[0.308]	[0.656]	[0.659]	[0.438]	[0.602]	[0.652]	[0.229]
Liquid asset ratio$_{t-1}$	-0.007	-0.037*	-0.036	-0.048**	-0.010	-0.007	-0.042**
	[0.684]	[0.080]	[0.119]	[0.023]	[0.612]	[0.730]	[0.030]
Core deposits ratio$_{t-1}$	0.032***	0.024**	0.022*	0.026**	0.031***	0.032***	0.026*
	[0.009]	[0.048]	[0.058]	[0.025]	[0.007]	[0.004]	[0.081]
Channel US$_{t-4}$		-0.158	-0.146	-0.598	-0.032	-0.058	0.062
		[0.248]	[0.326]	[0.689]	[0.604]	[0.390]	[0.864]
Channel EA$_{t-4}$		-0.065*	-0.058	-0.047	0.013	-0.014	0.006
		[0.075]	[0.187]	[0.592]	[0.725]	[0.637]	[0.925]
Channel GB$_{t-4}$		0.322*	0.218	0.071	0.072	0.075	-1.044***
		[0.088]	[0.177]	[0.684]	[0.111]	[0.195]	[0.005]
Business Cycle US$_{t-1}$	-0.001						
	[0.523]						
Business Cycle EA$_{t-1}$	-0.001						
	[0.663]						
Business Cycle GB$_{t-1}$	0.001						
	[0.349]						
Business Cycle Domestic$_{t-1}$	-0.002						
	[0.277]						
Financial Cycle US$_{t-1}$	0.001						
	[0.412]						
Financial Cycle EA$_{t-1}$	0.000						
	[0.816]						
Financial Cycle GB$_{t-1}$	-0.000						
	[0.394]						
Financial Cycle Domestic$_{t-1}$	-0.000						
	[0.292]						
$\Delta MPDomestic_{t-1}$	-0.005						
	[0.124]						
VIX_{t-1}	-0.000						
	[0.622]						
Time fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	930	930	930	930	930	930	930
R-squared	0.199	0.291	0.290	0.281	0.277	0.275	0.301
Adjusted R-squared	0.144	0.195	0.194	0.184	0.180	0.178	0.207
Number of banks	18	18	18	18	18	18	18

Table 9: **Canada: Outward Bank Lending Channel**
The dependent variable is log changes in local lending by affiliates abroad to non-bank sector. The data are quarterly from 2000Q1 to 2015Q4 for a panel of foreign affiliates of domestically-owned banks. *Channel* is defined in each column. *MP Domestic* is the policy rate. ST Funding Ratio is short-term funding (demand and notice deposits) to total assets; LA Ratio is liquid assets to total assets; Net IF to the Affiliate/TA is net intra-group funding to the affiliate in country j to total assets. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	No channel	ST Funding Ratio	LA Ratio	Net IF to the Affiliate/TA	Log TA
	(1)	(2)	(3)	(4)	(5)
$\sum \Delta MP\ domestic_{t\ to\ t-3} \times Channel_{t-4}$	-0.004	-2.204**	-0.281	3.000	-0.054
	[0.931]	[0.030]	[0.753]	[0.703]	[0.613]
Log total assets$_{t-1}$	0.058	-0.014	-0.026	-0.014	
	[0.242]	[0.432]	[0.524]	[0.581]	
Tier1 Ratio$_{t-1}$	0.426	4.380*	5.788	4.044**	3.949
	[0.886]	[0.056]	[0.127]	[0.033]	[0.132]
Liquid asset ratio$_{t-1}$	0.635	0.617*		0.707	0.677
	[0.138]	[0.092]		[0.213]	[0.142]
Net IG funding ratio$_{t-1}$	-0.27	0.361	0.257		0.419
	[0.710]	[0.582]	[0.729]		[0.506]
Core deposits ratio$_{t-1}$	0.094	0.059	-0.054	0.067	-0.069
	[0.358]	[0.790]	[0.541]	[0.240]	[0.438]
$Channel_{t-4}$		-0.251	0.592	-0.303	-0.008
		[0.143]	[0.089]	[0.926]	[0.593]
Business Cycle Domestic$_{t-1}$	0.014				
	[0.284]				
Business Cycle$_{j,t-1}$	0.005				
	[0.480]				
Financial Cycle $Domestic_{t-1}$	-0.001				
	[0.598]				
Financial Cycle$_{j,t-1}$	0.000*				
	[0.097]				
$\Delta MP_{j,t-1}$	0.0002				
	[0.827]				
VIX_{t-1}	-0.002				
	[0.199]				
$\Delta MP\ domestic \times Channel_{t-4}$	0.002	-1.396*	0.842	-6.041	0.107
	[0.933]	[0.075]	[0.971]	[0.437]	[0.107]
Country fixed effects	Yes	No	No	No	No
Country-time fixed effects	No	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4975	4975	4975	4975	4975
R-squared	0.013	0.385	0.384	0.384	0.384
Adjusted R-squared	0.004	0.023	0.023	0.022	0.0215
Number of banks	4	4	4	4	4
Number of countries	31	31	31	31	31

Table 10: **Canada: Outward Portfolio Channel**
The dependent variable is log changes in local lending by affiliates abroad to non-bank sector. The data are quarterly from 2000Q1 to 2015Q4. *Channel* is defined in each column. *MP Domestic* is the policy rate. C&I Loans/TA is the ratio of commercial and industrial loans to total assets; Securities/TA is securities over total assets; claims on foreign borrowers/TA is claims on foreign borrowers to total assets. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	No channel	Tier 1 Ratio	C&I Loans/TA	Securities/TA	Claims on For. Borr./TA
	(1)	(2)	(3)	(4)	(5)
$\sum \Delta MP\ domestic_{t\ to\ t-3} \times Channel_{t-4}$	-0.004	15.79**	0.719	-1.723	-2.008
	[0.931]	[0.031]	[0.556]	[0.114]	[0.304]
Log total assets$_{t-1}$	0.058	-0.005	-0.02	-0.050*	-0.024
	[0.242]	[0.903]	[0.805]	[0.078]	[0.350]
Tier1 Ratio$_{t-1}$	0.426		4.922**	6.124**	5.769*
	[0.886]		[0.044]	[0.021]	[0.066]
Liquid asset ratio$_{t-1}$	0.635	0.417	0.742	0.658*	0.786
	[0.138]	[0.258]	[0.258]	[0.090]	[0.115]
Net IG funding ratio$_{t-1}$	-0.27	0.383	0.568	0.648	0.501
	[0.710]	[0.448]	[0.580]	[0.587]	[0.365]
Core deposits ratio$_{t-1}$	0.094	-0.131	-0.075	-0.057	-0.07
	[0.358]	[0.180]	[0.736]	[0.764]	[0.569]
$Channel_{t-4}$		0.085	0.089	-0.072	0.382
		[0.097]	[0.879]	[0.858]	[0.606]
Business Cycle Domestic$_{t-1}$	0.014				
	[0.284]				
Business Cycle$_{j,t-1}$	0.005				
	[0.480]				
Financial Cycle Domestic$_{t-1}$	-0.001				
	[0.598]				
Financial Cycle$_{j,t-1}$	0.000*				
	[0.097]				
$\Delta MP_{j,t-1}$	0.000				
	[0.827]				
VIX_{t-1}	-0.002				
	[0.199]				
$\Delta MP\ domestic \times Channel_{t-4}$	0.002	1.328	-0.249	-0.855*	0.508
	[0.933]	[0.827]	[0.692]	[0.071]	[0.770]
Country fixed effects	Yes	No	No	No	No
Country-Time fixed effects	No	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4,975	4,975	4,975	4,975	4,975
R-squared	0.013	0.385	0.385	0.385	0.384
Adjusted R-squared	0.004	0.024	0.022	0.023	0.022
Number of banks	4	4	4	4	4
Number of countries	31	31	31	31	31

Table 11: **Canada: Outward Bank Lending Channel Using A Taylor-Rule Residual** The dependent variable is log changes in local lending by affiliates abroad to non-bank sector. The data are quarterly from 2000Q1 to 2015Q4. *Channel* is defined in each column. *MP Domestic* is a Taylor residual. ST Funding Ratio is short-term funding (demand and notice deposits) to total assets; LA Ratio is liquid assets to total assets; Net IF to the Affiliate/TA is net intra-group funding to the affiliate in country j scaled to total assets. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	No channel	ST Funding Ratio	LA Ratio	Net IF to the Affiliate/TA	Log TA
	(1)	(2)	(3)	(4)	(5)
$\sum \Delta MP\ domestic_{t\ to\ t-3} \times Channel_{t-4}$	-0.004	-0.209	2.910	-23.51	-0.815*
	[0.931]	[0.921]	[0.398]	[0.66]	[0.058]
Log total assets$_{t-1}$	0.058	-0.039	-0.016	0.106*	
	[0.242]	[0.109]	[0.676]	[0.079]	
Tier1 Ratio$_{t-1}$	0.426	5.076*	4.307	5.941*	5.227**
	[0.886]	[0.050]	[0.208]	[0.086]	[0.041]
Liquid asset ratio$_{t-1}$	0.635	0.654		0.257	0.420**
	[0.138]	[0.111]		[0.389]	[0.027]
Net IG funding ratio$_{t-1}$	-0.271	0.259	0.491		-0.769
	[0.710]	[0.713]	[0.497]		[0.318]
Core deposits ratio$_{t-1}$	0.094	0.195	-0.104	-0.112	0.08
	[0.358]	[0.386]	[0.453]	[0.741]	[0.840]
$Channel_{t-4}$		-0.437*	0.523	-0.091	0.119**
		[0.089]	[0.166]	[0.925]	[0.025]
Business Cycle Domestic$_{t-1}$	0.014				
	[0.284]				
Business Cycle$_{j,t-1}$	0.005				
	[0.480]				
Financial Cycle Domestic$_{t-1}$	-0.001				
	[0.598]				
Financial Cycle$_{j,t-1}$	-0.001				
	[0.097]				
$\Delta MP_{j,t-1}$	0.000				
	[0.827]				
VIX_{t-1}	-0.002				
	[0.199]				
$\Delta MP\ domestic \times Channel_{t-4}$	0.002	-0.397	-0.597	-18.1	-0.175**
	[0.933]	[0.485]	[0.534]	[0.112]	[0.035]
Country fixed effects	Yes	No	No	No	No
Country-Time fixed effects	No	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4,975	4,975	4,975	4,975	4,975
R-squared	0.014	0.384	0.384	0.364	0.365
Adjusted R-squared	0.005	0.021	0.022	-0.010	-0.010
Number of banks	4	4	4	4	4
Number of countries	31	31	31	31	31

Table 12: **Canada: Outward Portfolio Channel Using A Taylor-Rule Residual**
The dependent variable is log changes in local lending by affiliates abroad to non-bank sector. The data are quarterly from 2000Q1 to 2015Q4. *Channel* is defined in each column. *MP Domestic* is Taylor residuals. C&I Loans/TA is the ratio of commercial and industrial loans to total assets; Securities/TA is securities to total assets; claims on foreign borrowers/TA is claims on foreign borrowers to total assets. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	No channel	Tier 1 Ratio	C&I Loans/TA	Securities/TA	Claims on Foreign Borr./TA
	(1)	(2)	(3)	(4)	(5)
$\sum \Delta MP\ domestic_{t\ to\ t-3} \times Channel_{t-4}$	-0.004	16.91	2.537	-3.239**	-5.248**
	[0.931]	[0.16]	[0.155]	[0.046]	[0.035]
Log total assets$_{t-1}$	0.058	-0.007	0.007	-0.041	-0.029
	[0.242]	[0.753]	[0.935]	[0.267]	[0.255]
Tier1 Ratio$_{t-1}$	0.426		4.649	6.208**	5.308*
	[0.886]		[0.144]	[0.013]	[0.087]
Liquid asset ratio$_{t-1}$	0.614	0.541	0.784	0.756*	0.783
	[0.166]	[0.279]	[0.208]	[0.082]	[0.114]
Net IG funding ratio$_{t-1}$	-0.271	0.376	0.608	0.284	0.473
	[0.710]	[0.454]	[0.528]	[0.788]	[0.430]
Core deposits ratio$_{t-1}$	0.094	-0.139	-0.093	0.039	-0.043
	[0.358]	[0.281]	[0.677]	[0.881]	[0.822]
$Channel_{t-4}$		-0.875	0.145	0.152	0.515
		[0.695]	[0.775]	[0.662]	[0.593]
Business Cycle Domestic$_{t-1}$	0.014				
	[0.284]				
Business Cycle$_{j,t-1}$	0.005				
	[0.480]				
Financial Cycle Domestic$_{t-1}$	-0.001				
	[0.598]				
Financial Cycle$_{j,t-1}$	0.000*				
	[0.097]				
$\Delta MP_{j,t-1}$	0.000				
	[0.827]				
VIX_{t-1}	-0.002				
	[0.199]				
$\Delta MP\ domestic \times Channel_{t-4}$	0.002	5.427**	0.341	-0.811	0.425
	[0.933]	[0.049]	[0.426]	[0.251]	[0.823]
Country fixed effects	Yes	No	No	No	No
Country-Time fixed effects	No	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4,975	4,975	4,975	4,975	4,975
R-squared	0.014	0.384	0.384	0.385	0.384
Adjusted R-squared	0.005	0.021	0.022	0.023	0.022
Number of banks	4	4	4	4	4
Number of countries	31	31	31	31	31

Table 13: **Canada: Outward Bank Lending Channel (Cross-Border Lending)**
The dependent variable is log changes in cross-border lending by headquarter to the non-bank sector abroad. The data are quarterly from 2000Q1 to 2015Q4. *Channel* is defined in each column. *MP Domestic* is the policy rate. ST Funding Ratio is short-term funding (demand and notice deposits) to total assets; LA Ratio is liquid assets to total assets; Net IF to the Affiliate/TA is net intra-group funding to the affiliate in country j scaled to total assets. All specifications include fixed effects as specified in the lower part of the table. P-values are in brackets. Standard errors are clustered by bank. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	No channel	ST Funding Ratio	LA Ratio	Net IF to the Affiliate/TA	Log TA
	(1)	(2)	(3)	(4)	(5)
$\sum \Delta MP\ domestic_{t\ to\ t-3} \times Channel_{t-4}$	0.063***	1.597	-0.187	-0.682	0.139**
	[0.000]	[0.148]	[0.928]	[0.959]	[0.037]
Log total assets$_{t-1}$	0.102**	0.108	0.107	0.108*	
	[0.017]	[0.161]	[0.118]	[0.081]	
Tier1 Ratio$_{t-1}$	-4.925	-6.207	-5.441*	-5.994*	-5.262*
	[0.188]	[0.134]	[0.072]	[0.093]	[0.066]
Liquid asset ratio$_{t-1}$	-0.101	0.321***		0.244	0.433***
	[0.693]	[0.003]		[0.398]	[0.007]
Net IG funding ratio$_{t-1}$	-0.611**	-1.034	-0.971		-1.099
	[0.044]	[0.235]	[0.243]		[0.216]
Core deposits ratio$_{t-1}$	0.062	0.249	0.099	-0.108	0.237
	[0.312]	[0.664]	[0.655]	[0.754]	[0.432]
$Channel_{t-4}$		-0.201	0.002	-0.359	0.106*
		0.736	0.996	0.838	[0.085]
Business Cycle Domestic$_{t-1}$	-0.022**				
	[0.041]				
Business Cycle$_{j,t-1}$	0.007				
	[0.315]				
Financial Cycle Domestic$_{t-1}$	-0.003				
	[0.145]				
Financial Cycle$_{j,t-1}$	-0.001				
	[0.178]				
$\Delta MP_{j,t-1}$	-0.003				
	[0.104]				
VIX_{t-1}	-0.002				
	[0.315]				
$\Delta MP\ domestic \times Channel_{t-4}$		0.262	1.134	-7.661	-0.108*
		[0.588]	[0.475]	[0.427]	[0.053]
Country fixed effects	No	No	No	No	No
Country-Time fixed effects	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4975	4975	4975	4975	4975
R-squared	0.009	0.364	0.364	0.364	0.364
Adjusted R-squared	0.002	0.002	0.002	0.002	0.002
Number of banks	4	4	4	4	4
Number of countries	31	31	31	31	31

Table 14: **Canada: Outward Portfolio Channel (Cross-Border Lending)**
The dependent variable is log changes in cross-border lending by headquarters to non-bank sector abroad. The data are quarterly from 2000Q1 to 2015Q4. *Channel* is defined in each column. *MP Domestic* is the policy rate. C&I Loans/TA is the ratio of commercial and industrial loans to total assets; Securities/TA is securities over total assets; claims on foreign borrowers/TA is claims on foreign borrowers to total assets. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. P-values are in brackets. Each ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	No channel	Tier 1 Ratio	C&I Loans/TA	Securities/TA	Claims on For. Borr./TA
	(1)	(2)	(3)	(4)	(5)
$\sum \Delta MP\ domestic_{t\ to\ t-3} \times Channel_{t-4}$	0.063***	-1.168	-1.202**	0.356	0.17
	[0.000]	[0.849]	[0.038]	0.539	0.922
Log total assets$_{t-1}$	0.102**	0.131	0.115	0.122	0.125*
	[0.017]	[0.111]	[0.205]	[0.103]	[0.057]
Tier1 Ratio$_{t-1}$	-4.925		-7.502*	-6.252	-4.883
	[0.188]		[0.064]	[0.118]	[0.120]
Liquid asset ratio$_{t-1}$	-0.101	0.500**	0.149	0.339***	0.410**
	[0.693]	[0.031]	[0.455]	[0.007]	[0.020]
Net IG funding ratio$_{t-1}$	-0.611**	-0.912	-1.089	-1.076	-0.934
	[0.044]	[0.235]	[0.274]	[0.370]	[0.286]
Core deposits ratio$_{t-1}$	0.062	0.152	0.16	0.142	-0.004
	[0.312]	[0.643]	[0.591]	[0.694]	[0.991]
$Channel_{t-4}$		-5.324	-0.142	0.108	-0.0557
		0.267	0.767	0.786	0.898
Business Cycle Domestic$_{t-1}$	-0.022**				
	[0.041]				
Business Cycle$_{j,t-1}$	0.007				
	[0.315]				
Financial Cycle Domestic$_{t-1}$	-0.003				
	[0.145]				
Financial Cycle$_{j,t-1}$	-0.001				
	[0.178]				
$\Delta MP_{j,t-1}$	-0.003				
	[0.104]				
VIX_{t-1}	-0.002				
	[0.315]				
$\Delta MP\ domestic \times Channel_{t-4}$		1.945	-0.0819	0.029	
		[0.518]	[0.354]	[0.954]	
Country fixed effects	No	No	No	No	No
Country-Time fixed effects	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	4975	4,975	4,975	4,975	4,975
R-squared	0.009	0.364	0.364	0.364	0.17
Adjusted R-squared	0.002	0.002	0.002	-0.0101	-0.00843
Number of banks	4	4	4	4	4
Number of countries	31	31	31	31	31

Appendix B: Construction of Balance Sheet Variables

Switzerland

- Liquid Assets Ratio is liquid assets/total assets. SNB Monthly Banking Statistics, Form MONA-M011, Bloomberg for UBS and CS.
- Log Total Assets is log total assets SNB Monthly Banking Statistics, Form MONA-M011, Bloomberg for UBS and CS.
- Core Deposit Ratio is saving and deposit accounts to total assets. SNB Monthly Banking Statistics, Form MONA-M011, Bloomberg for UBS and CS.
- Total Capital Ratio is total capital to total assets. Supervisory Reporting. Forms Cxxx.
- Foreign Claims and Liabilities/Total Assets. Foreign claims are the sum of liquid assets, loans and debt instruments, and foreign liabilities include data on deposits. In some specifications we distinguish international assets and liabilities by bank/non-bank. SNB Locational Banking Statistics (EURO), Forms EUXX.

Canada

- Log Real Assets: Ln(Total assets in 2012 Canadian Dollars). OSFI Balance Sheet (M4).
- Liquid Assets Ratio: (Cash, Treasury bills and short-term paper)/(Total assets). OSFI Balance Sheet (M4).
- Short-Term Funding: (Demand individual deposits)/(Total assets). OSFI Balance Sheet (M4).
- Tier 1 Ratio: Common equity Tier 1 capital/Total assets. Basel Capital Adequacy Return (BCAR-BA).
- Net IG Funding Ratio: (Total head office liabilities on foreign branches, agencies and consolidated subsidiaries--Total head office claims to foreign branches, agencies and consolidated subsidiaries)/(Total assets). Geographic Assets and Liabilities Booked in Canada (GQ). Total liabilities from OSFI Balance Sheet (M4).

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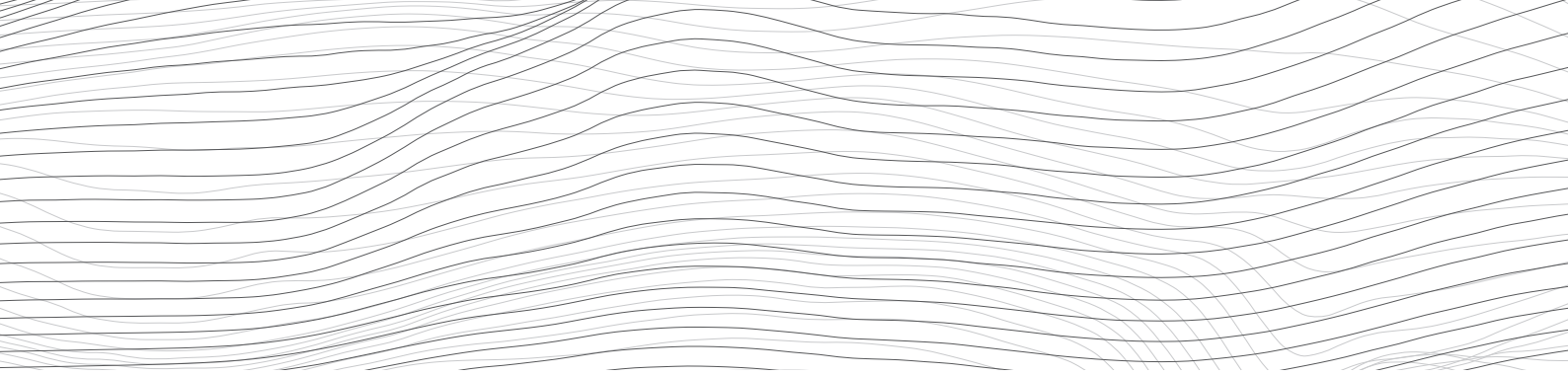

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