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Monetary Policy Spillover into a Developing Country When the US Federal Fund Rate Rises: Evidence on a Bank Lending Channel

Daiju Aiba*

Abstract

Banks in developing countries are highly dependent on funding sources from abroad, and such high dependency on external funding could cause vulnerability to the sector by channeling the effects of foreign monetary policies to domestic bank lending. In this paper, we study the international transmission of monetary policy of US and banks' major shareholders' home countries into bank lending in Cambodia, using data on banks' loan disbursement and balance sheets from 2013Q1 to 2019Q2. Cambodia is one of the least developed countries in the south-east Asian region, while its economy is highly dollarized and capital movement is free. This environment is likely to allow banks to transmit financial shocks into domestic lending. As a result, we find that US monetary policy affected domestic lending through the channel of foreign funding exposure, suggesting that Cambodian banks with foreign funding exposure are likely to reduce lending when there is a rise in the cost of funding from abroad. We also find that an increase in the US monetary policy rate is associated with increases in loan disbursements in secured loans, USD currency loans, and retail loans, suggesting the monetary transmission also affected loan reallocations by changing risk-taking behavior in bank lending. In addition, we find that these results are robust for US monetary policy effects, but weak and not robust for monetary policies of banks' major shareholders' home countries.

Keywords: Bank Lending Channel, International Monetary Policy Transmission, Capital Inflow, Developing Countries, Dollarization, Cambodia

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1. Introduction

As economic integration has deepened over the world, developing countries have increasingly faced a flood of capital inflows. While the increasing capital inflows support economic growth, they also affect bank domestic lending both directly and indirectly, and can lead to financial instability (Baskaya et al., 2017). Banking sectors in some developing countries are highly dependent on funding sources from abroad as a result of a lack of stable domestic funding sources or lax regulations on entries of foreign banks (Korinek, 2018). Higher dependency on foreign funding sources could create risks for the banking sector, since banks might not be able to completely offset the decline of their foreign funds by raising capital from domestic sources due to imperfections in the capital market (Jeon et al., 2013). In other words, those banks would decrease their lending in the wake of sudden stop or an increase in costs of foreign funding. In fact, during the period of financial crisis, banks in many countries suffered from quick withdrawals of wholesale funding (Cao & Dinger, 2018). Guo and Stepanyan (2011) have shown that aggregated credit growth in countries in which banking sectors are dependent on foreign funding is more likely to be affected by the fluctuations of foreign funding flows. In addition, there are several empirical studies showing that global banks transmit financial shocks within home countries to their subsidiaries (Peek & Rosengren, 1997; De Haas & Levy, 2010; North & Busch, 2016, 2017). Furthermore, the impact of the external shocks is more severe in developing countries where capital markets are underdeveloped and domestic funds are not always stable.

This paper investigates a channel of monetary policy transmission into a banking sector of a developing country through foreign funding exposure of each individual bank. [1]

[1] We define foreign funding exposure mainly through two variables. One is non-resident liabilities defined as the sum of wholesale funding from abroad, deposits from foreign banks, and non-resident deposits. Another is foreign liabilities from banks abroad defined as the sum of wholesale funding from abroad, deposits from foreign banks (non-resident liabilities minus non-resident deposits). Resident deposits can be held by Cambodian citizens or foreigners who have lived in the country for more than 182 days in a row. Otherwise, foreigners can only open non-resident deposit accounts.

Specifically, we investigate the effect of the increase in US monetary policy rate from 2015Q4 and also other countries' monetary policy on domestic lending through non-resident funding into Cambodian commercial banks.[2] Cambodia is a small open economy and one of the most dollarized economies in the world, and capital movement is free. Buch et al. (2018) empirically documented that a country with free capital movement and a fixed exchange rate policy would likely transmit the foreign countries' monetary policy. Therefore, the effects of US and other foreign countries' policies are likely to affect foreign funding in the Cambodian banking sector as well.[3] In fact, Cambodian banks have experienced a decline in the flow of non-resident liabilities, after the US federal fund rate started increasing. In Figure 1, we present the average, median, and 25-75 percentile ranges of distributions of the ratios of non-resident liabilities to total liabilities in Cambodian banks, and also show the interest rates of Federal Fund overnight as the US monetary policy rate. During the period, the medium values increased to more than 10% in 2015Q4, suggesting that half of Cambodian banks were highly dependent on non-resident liabilities. Meanwhile, all of the statistics in Figure 1 have decreased after 2015Q4, suggesting that most banks have experienced decreases in the ratio of non-resident liabilities to total liabilities after the US federal fund rate started increasing. In the wake of the tightening of US monetary policy, Cambodian banks faced an increase in the cost of funding from abroad, which might affect the domestic lending due to limited substitutability for domestic funding sources.[4] This transmission of monetary policy might be intense particularly for banks which are highly dependent on non-resident liabilities.

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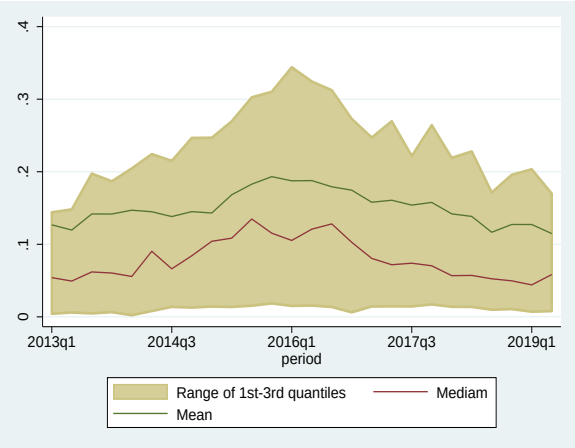
[2] Our interest in foreign funding flows are non-resident liabilities, and foreign liabilities taken from bank abroad of bank balance sheets (footnote 3). Also, equity finance is not possible to separate the abroad and domestic sources. But the equity finance from abroad need a permission from a central bank. Thus, it is not as flexibly meet the demand for collecting funding as wholesale borrowing from parent bank and other related party.

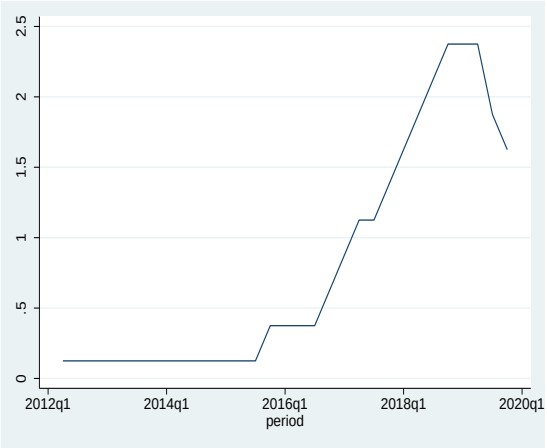
[3] Debola et al. (2018) also find the effect of US monetary policy on other countries' economic conditions. Their findings suggest that, if the exchange rate regime is fixed and the limit on capital mobility is small, spillover effects of US monetary policy is stronger.

[4] Even though Cambodia is highly dollarized, the interest rates on domestic USD deposits did not change during the period when US federal fund rate increased. Thus, the changes in US monetary policy affected Cambodian banks thorough non-resident sources.

Figure 1: Ratio of Non-Resident Liabilities to Total Liabilities (Left) and US Monetary Policy Rate (Right)



Source: National Bank of Cambodia, and authors' calculation.



Source: Data is from the International Financial Statistics, and author's calculations.US monetary policy is the interest rate of Feral Funds overnight. In this study, we exploit the unique data showing the exact amounts of the whole non-resident.

In this study, we exploit the unique data showing the exact amounts of the whole non-resident liabilities and foreign liabilities from banks abroad at the individual bank level, respectively. We construct the panel data from balance sheets of commercial banks on a quarterly basis from 2013Q1 to 2019Q2. The data allow us to examine the transmission channel of US monetary policy through foreign funding exposure, such as the whole non-resident liabilities and foreign liabilities from banks abroad. In addition, we use the disaggregated data of amounts of newly disbursed loans by currencies, maturities, security, and sectors. This detailed loan data allows us to understand the effects of periodic changes in demand and supply factors of certain types of loans. Using this data, we examine whether US monetary policy transfers to Cambodian banks' domestic lending. Furthermore, we examine which loan characteristics are more prone to increases in funding costs from abroad. Apart from US monetary policy, we also examine the effects of foreign countries' monetary policies. Specifically, we examine the effect of changes in monetary policy rates in the home countries of the bank's major shareholders. As the result, we find that changes in monetary policy have negative impacts on a bank's domestic lending if it has exposure to foreign funding, with the impact becoming larger as the exposure

increases. We also find that changes in US monetary policy also affected the loan composition of Cambodian commercial banks. In particular, an increase in the US monetary policy rate is associated with a longer maturity of loans, and more provision of retail loans and USD currency loans. It might suggest that an increase in funding cost led Cambodian banks to shift loan allocations to lower risk sector and clients. Furthermore, we find that the monetary policies of banks' shareholders' home countries are not strongly associated with Cambodian bank's domestic lending compared to US monetary policy, although there was a distributional effect on some specific loan types, such as USD and long-term loans. Lastly, we find that the changes in non-resident liabilities are associated with the US federal fund rate, but other funding sources, such as domestic deposits and equity, are not associated with the US federal fund rate or other foreign countries' monetary policy rates at statistical significance. These findings suggest that foreign monetary policy could transmit to a developing country through changes in foreign funding exposure to local banks.

There is vast literature on international monetary transmission through global banks (Peek & Rosengren, 1997; De Haas & Lelyveld, 2006, 2010; Jeon et al., 2013; Ongena et al., 2015; Bruno & Shin, 2015; Temesvary et al., 2018; Buch et al., 2018). Ongena et al. (2015) investigated the transmission of foreign financial shocks on bank domestic lending through the internal capital market and found that wholesale funding and foreign ownership is a key factor to transmitting the shocks in a home country to a host country. Temesvary et al. (2018) investigated US monetary policy's effect on cross-border lending and affiliate lending of US banks, and found that the monetary policy both of destinated countries and US are associated with cross-border lending of global banks. Although there is vast literature on the international transmission of financial shocks and monetary policy on domestic lending and cross-border lending, studies on the international transmission on domestic lending in developing countries are still limited (Buch et al., 2018). Our study complements the literature by investigating domestic bank lending in a less developed country. As of 2019Q2, 35 out of 44 commercial

banks in Cambodia have more than half their shares owned by foreigners; the nationalities of those shareholders vary widely across developed countries and neighboring Asian countries. In line with Ongena et al. (2015), our study shows that US monetary policy influences domestic lending within one of the least developed countries. Furthermore, several empirical studies documented the risk-taking channel of domestic and foreign monetary policy, finding that lower policy rates shift the allocation of banks toward more risky borrowers (Jiménez et al., 2014, for Spain; Ioannidou et al., 2015, for Bolivia). Similarly, by employing the detailed data by loan characteristics, our study finds that an increase in US monetary policy rates led to a shift of loan provisions to lower risk-profile loans, such as secured loans, consumer loans, long maturity loans, and USD loans.[5]

Our results also emphasize the importance of reliance on internal capital market and foreign funding sources. During the global financial crisis period, the increases in the cost of funding from internal capital markets affected bank domestic lending. Jeon et al. (2013) found that foreign subsidiaries with a shortage of their own internal funds are more likely to be affected by the financial shocks on their parent banks' markets. In contrast to Jeon et al., we use two measures to study the channel of international monetary transmission via reliance on foreign funding sources not limited to parent banks: the ratio of the entire non-resident liabilities to total liabilities and the ratio of foreign liabilities from banks abroad to total liabilities, respectively. We find similar results showing that if the banks collect funds from foreign funding sources (non-resident deposits or wholesale funding from abroad), US monetary policy has led to a decrease in domestic bank lending. In addition, we find that local-owned banks with a high dependency on foreign funding are more impacted by the increase in US monetary policy than their foreign-owned peers. Presumably, this reflects the fact that local-owned banks have less

[5] In Cambodia, the interest rates on USD loans are lower than local loans. Thus, the USD loans are provided to lower risk profile borrowers generally. For retail loans, although the interest rates are not necessarily lower than corporate loans, the size of loans are much smaller and mainly include a collateral requirement. Thus, the risk-profile is lower for retail loans. Regarding the provision of USD and local currency loans by Cambodian banks, Aiba & Sok (2017), Aiba et al. (2018), and Okuda (2018) analyze survey data on the currency denominations of bank loans to households and enterprises.

access to internal capital markets, implying that a high dependency on foreign funding for local-owned banks could be a cause of vulnerability within the financial sector. North and Busch (2016, 2017) and Kneer et al. (2019) also found that changes in foreign funding significantly affect bank domestic lending in Brazil and UK, respectively. Our paper provides the additional insights that foreign funding exposure could be the source of vulnerability within the banking sector via transmission of other countries' monetary policy.

Our paper also provides additional insights on monetary transmission in partially dollarized economies. Several studies find that the domestic monetary policy is limited in fully and partially dollarized countries, while bank lending is often affected by US monetary policy (Mora, 2013; Onegena et al., 2017). Our study finds that USD denominated deposits and the degree of dollarization are not necessarily the channel of monetary transmission. As we will show in the paper, interest rates on USD did not changed significantly after the US monetary policy started rising. Thus, the effects of foreign monetary policy was likely to be channeled through foreign funding exposure in the case of Cambodia. This result indicates that even in a dollarized economy, banks could mitigate the effect of foreign monetary policy by shifting to domestic deposits as a major funding source.

Our paper is also related to the literature of the role of ownership structure on a bank's lending and performance. The effect of foreign ownership is mixed. In developing countries, it is assumed that foreign-owned banks have the advantage of access to international capital market and the funding from a parent company abroad, and numerous studies provide the evidence of superiority of foreign ownership. However, Okuda and Aiba (2016) found that the performance of Cambodian financial institutions with a large share of foreign ownership is not always better than banks owned domestically. Our finding in this paper may provide an explanation that the disadvantages of foreign funding sources, such as large volatility, are large in the case of Cambodia. Therefore, diversifying ownership structures and committing to collect domestic funds could improve the entire performance of the banking sector.

The rest of the present paper is structured as follows. Section 2 describes the Cambodian banking sector and recent situation of foreign funding. Section 3 presents our data and empirical strategy, and Section 4 presents the results of empirical analyses. Section 5 concludes.

2. Overview of the Cambodian Banking Sector

In this section, we describe the institutional background of the Cambodian banking sector. After prolonged civil war ended in 1999, Cambodia experienced high economic growth, with an average of 8.3% of GDP growth over the last 15 years (Oudom, 2016). This recent high growth rate has attracted large amounts of capital inflows. Cambodia is a highly open economy, and the Cambodian government has adopted a liberal stance toward the foreign investment and trade, leading to huge capital inflows (Hill & Menon, 2014). Most of capital inflows are in the form of official development assistance (ODA), foreign direct investment (FDI), and banking and monetary market (BMM). As argued by previous studies, bank lending flows are most unstable and subject to sudden stoppages (de Brouwer, 1999; Becker & Noone, 2009). Thus, a high dependency on foreign funding as a result of borrowing or deposits is likely to make the entire economy vulnerable to external shocks. In the case of Cambodia, Oudom (2016) showed that the recent capital flow is volatile and its main driver is BMM.

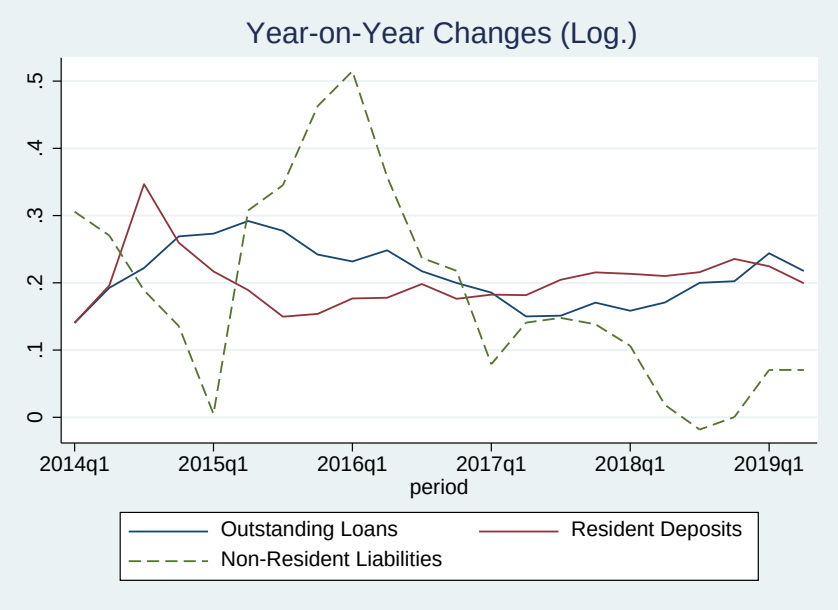
The banking sector plays a pivotal role in fund mobilization in Cambodia, since there is no other formal financial market functioning in the country: there is no bond market, and although a stock exchange market was opened in 2011, only five companies were listed as of 2017. The Cambodian banking sector is composed of three types of financial institutions: commercial banks, specialized banks, and microfinance institutions. Commercial banks are allowed to provide all financial services, while the regulations governing them are most strict in terms of capital requirements and reserve requirements. Specialized banks can be engaged in only one type of financial service, such as settlement network or loan provision to the

agricultural sector. Microfinance institutions are aimed to provide financial services for the poor, with restrictions on the amount of each loan grant. Prudential regulations are less stringent for specialized banks and microfinance institutions than commercial banks. As of 2017, commercial banks dominate almost 85% of total assets in the Cambodian banking sector, while microfinance institutions compose the remaining 15% (Aiba & Lam, 2019). Specialized banks have less than 1% of total assets in the entire banking sector. An important characteristic of the Cambodian banking sector is that there are no state-owned commercial banks, although there is one state-owned specialized bank. Thus, the credit supply is completely delegated to private entities.

Flows of non-resident liabilities are more volatile than those from domestic sources. Figure 2 shows year-on-year changes in aggregated outstanding loans, resident deposit, and non-resident liabilities. Non-resident liabilities include non-resident deposits and wholesale borrowing from abroad. The data is constructed from individual bank balance sheet data which includes the breakdown of deposits, borrowing, and equity by resident and non-resident sources. We obtained this administrative data from the National Bank of Cambodia. The data is on a quarterly basis and covers the period from 2013Q1 to 2019Q2. In the case of Cambodia, the year-on-year changes in outstanding loans and resident deposits have been stable from 2014Q1 to 2019Q2, except for the spike in changes in resident deposits in 2014Q3, which reflected the large deposit withdrawals in 2013Q3 due to increased political uncertainty after the national election in April 2013.[6] Meanwhile, non-resident liabilities fluctuated more during the same period. In particular, non-resident liabilities became lower after 2016Q1, when the US federal fund rate started increasing. Those fluctuations in funding flows mean foreign funding sources might be unstable compared to domestic funding sources, and could be a source of vulnerability in the banking sector.

[6] Ten percent of total deposits were withdrawn in August 2013, although most of that money returned to the banking sector in a few months. Even though the ruling party won the majority of seats, the number of seats and votes for the opposition party came close to those of the ruling party. After the election, there were rumors about frauds in voting during the election, and the opposition party boycotted the national assembly for one year. That political uncertainty led to the negative growth of domestic deposits in the third quarter of 2013.

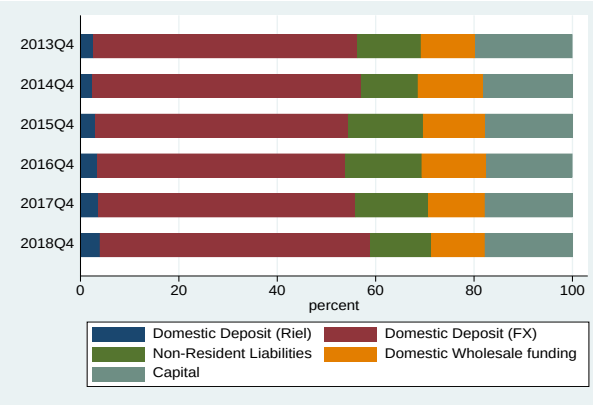
Figure 2: Growth of Loans and Funding of the Cambodian Banks



Source: National Bank of Cambodia, and authors' calculation. Log. growth rate of each variable is calculated as year-on-year changes.

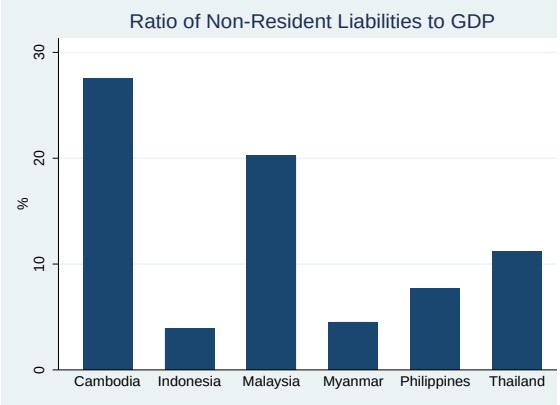
Figure 3 shows the composition of liabilities by funding sources in Panel A. Shares of non-resident liabilities fluctuate 10%-15% over the period, while about 60% of funds in the Cambodian banking sector are comprised of domestic residents' deposits. Non-resident liabilities (the sum of wholesale funding from abroad and non-resident deposits) in the banking sectors have been large and comparable to domestic wholesale funding over the period, meaning that foreign funding is one important funding source for the Cambodian banking sector. Non-resident liabilities in the Cambodian banking sector are large even compared to other countries. Panel B in Figure 3 provides a cross-country comparison of the ratio of non-resident liabilities to GDP across neighboring countries. It shows that the ratio of non-resident liabilities to GDP in Cambodia is higher than in other neighboring ASEAN countries.

Figure 3: Non-Resident Liabilities in the Cambodian Banking Sector



Panel A: Composition of liabilities by funding sources

Source: National Bank of Cambodia, and authors' calculation. Non-resident liabilities are the sum of wholesale funding from abroad and non-resident deposits.



Panel B: Cross-country comparison of non-resident liabilities to GDP

Source: International Financial Statistics.For the calculation, we used non-resident liabilities as of 2017Q4 and annual GDP as of 2017.

The figure also shows that a substantial share of deposits in the banking sector are denominated in foreign currency. However, gross official reserves only cover 57% of foreign currency deposits, which severely limits the capacity of the central bank as the lender of last resort (IMF, 2018). In addition to this limitation, the country lacks deposit insurance, both of which might lead to a high liquidity buffer in banks.

3. Data and Empirical Strategy

3.1 Data

To examine the effect of international transmission of monetary policy on banks' domestic lending, we use detailed information on banks' lending behavior and capital inflows into individual banks. The dataset used in the analysis is composed mainly from three data sources. The first one is the data of loan disbursements, which is quarterly aggregated data capturing the amounts of newly disbursed loans at the bank-level. We can observe buckets of loan disbarments in detail by loan segments such as currency, maturity, sector, and collateral requirements for each

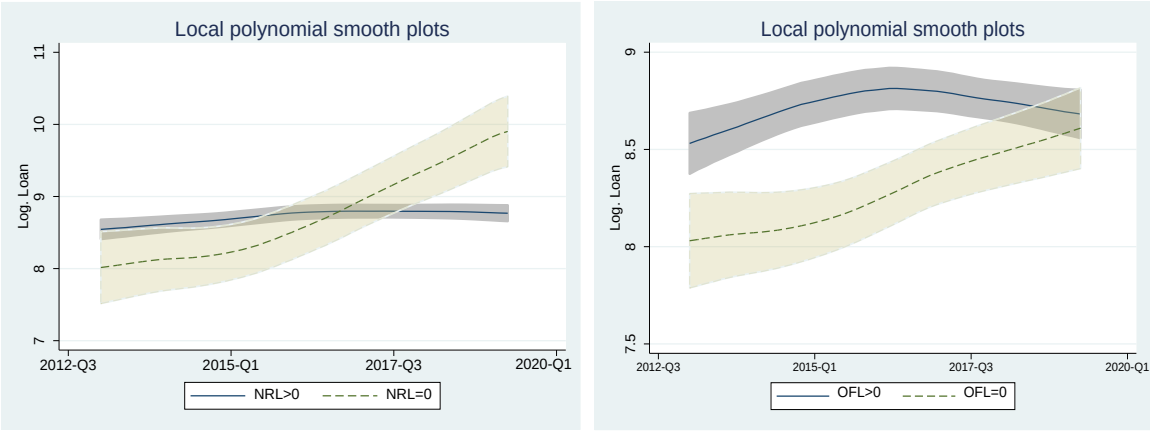
bank. Specifically, there are total of 16 loan segments, based on currency (USD or local currency), sector (business or consumer loans), maturity (long-term or short-term), and security (secured or unsecured); the amounts of loan disbursements are aggregated by each of 16 segments. The data tell us the amounts of loan disbursement at the aggregated level of each loan characteristic. For example, the amounts of disbursements of unsecured, long-term, USD denominated loans for business sector by bank *i* are available for each quarter. The second data source are banks' balance sheets in the period from 2013Q1 to 2019Q2.[7] This data allows us to investigate the non-resident liabilities and its components, and other bank characteristics, such as capital ratio, liquidity ratios, and total assets. The third data source is International Financial Statistics, from which we constructed the indicators of monetary policy rate of US federal funds and other foreign countries. The detailed definitions of variables used in estimation are available in Appendix Table 1.

According to our data, after the US monetary policy rate increased, the trend in lending among Cambodian banks depended on whether banks were reliant on foreign funding. In Figure 4, we compare the trend of loan disbursements between banks with and without foreign funding exposure. By using polynomial regression, we illustrate the trends of loan disbursement for banks with non-resident liabilities (NRL>0) and banks without non-resident liabilities (NRL=0) in Panel A, and banks with other foreign liabilities (OFL>0) and banks without other foreign liabilities (OFL=0) in Panel B. Other foreign liabilities are calculated as non-resident liabilities minus non-resident deposits, and may represent funding from other banks or companies including wholesale borrowing and deposits from foreign banks. Both figures show that the trends in amounts of loan disbursements are similar before the increase in US monetary policy in 2015Q4. However, the amounts of loan disbursements increased among banks without foreign funding exposures, while there is neither an increasing trend in Panel A or a decreasing trend in

[7] The data of aggregated loan disbursements and balance sheets is provided by National Bank of Cambodia under the project "Empirical Study on Promotion of Home Currency in Cambodia", which is joint research project of NBC and JICA Research Institute.

Panel B for banks with foreign funding exposure. It suggests that US monetary policy affected domestic bank lending in Cambodia, channeled through the dependency on foreign funding. In the next subsection, we propose the methodology to statistically examine this hypothesis.

Figure 4: Trends of Loan Disbursements



Panel A: Banks with and without non-resident liabilities

Note: The figure shows the fitted line by polynomial regression for amounts of loan disbursement of banks with non-resident liabilities (NRL>0) and banks without non-resident liabilities (NRL=0).

Panel B: Banks with and without other foreign liabilities

Note: The figure shows the fitted line by polynomial regression for amounts of loan disbursement of banks with other foreign liabilities (OFL>0) and banks without other foreign liabilities (OFL=0).

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia.

3.2 Empirical Model and Identification

In creating the empirical model, we exploit detailed information on banks' newly disbursed loans and balance sheets on a quarterly basis. Built on Jimenez et al. (2014), Buch et al. (2018) and Temesvary (2018), the model was constructed with lagged variables. We then identified the transmission of US monetary policy on banks' domestic lending by examining the heterogeneity in the effect across different levels of exposures to foreign monetary policy. Specifically, we estimate the following equation:

$$
\begin{aligned}
&ln(loan_{i,s,c,m,b,t}) \\
&= \alpha + \Sigma_{k=0}^{3}\beta_1 I_i \cdot US\ \ Policy_{t-k} + \Sigma_{k=0}^{3}\beta_{2k}\ \ I_i \cdot Z_{i,t-k-1} \\
&\cdot US\ \ Policy_{t-k} + \beta_{3k} BankControl_{i,t-k-1} \\
&+ \Sigma_{k=0}^{3}\beta_{4k} FDI\ \ Inflow_{j,t-k} + f_{i,s,c,m,b} + \psi_{s,t} + \psi_{c,t} + \psi_{m,t} + \psi_{b,t} \\
&+ u_{i,s,c,m,b,t} \qquad (1)
\end{aligned}
$$

where $ln(loan_{it})$ represents the logarithm of the amount of newly disbursed loans for bank *i* in quarter *t*. The subscripts represent the following dimensions: s ∈(Unsecured loan, Secured loan), c ∈ (USD loan or local currency loan), m ∈ (Long-term loan, Short-term loan), b ∈ (Business loan, Consumer loan), and subscript j represent the bank's major shareholder's country. We defined long-term loans as those with more than one year of maturity; we defined all other loans as short-term loans.

For identification of the effect of monetary policy, we employ the difference-in-difference-in-difference estimation strategy. In the empirical model, we included two variables to identify the effect of US monetary policy through the channel of foreign funding. First, we estimate the difference in the correlation of US monetary policy to loan disbursement between banks with foreign funding exposure and banks without it. I_i is a treatment dummy to represent whether a bank has foreign funding exposure. The interaction term of treatment dummy and US monetary policy rate, $I_i \cdot US\ \ Policy_{t-k}$, is supposed to capture the effect of US monetary policy through bank's foreign exposure. Second, we estimate whether the effect varies across levels of exposure. $Z_{i,t-k-1}$ represents the measure of foreign funding exposure, with the triple-interaction of treatment dummy, foreign funding exposure and US monetary policy $I_i \cdot Z_{i,t-k-1} \cdot US\ \ Policy_{t-k}$ intended to capture this effect. To examine the channels in detail, we look at two different measures of foreign funding exposure. First, we employ the ratio of non-resident liabilities to total liabilities as the measure of foreign funding exposure.[8] Second,

[8] Non-resident liabilities includes wholesale funding from abroad, deposits from foreign banks, and non-resident deposits.

instead of the ratio of non-resident liabilities, we employ the ratio of other foreign liabilities to total liabilities. Other foreign liabilities are calculated as non-resident liabilities minus non-resident deposits, and may represent funding from other banks or companies including wholesale borrowing and deposits from foreign banks. Since banks are to a large extent reliant on wholesale borrowing when they access the international capital market, the reliance on wholesale borrowing could be more likely to transmit shocks from abroad. A four-quarter cumulative effect of US monetary policy transmission is estimated as

$$\Sigma_{k=0}^{3} \frac{\partial^2 ln(loan_{i,s,c,m,b,j,t})}{\partial US\ Policy_{t-k}\ \partial I_i} = \Sigma_{k=0}^{3}\beta_1 + \Sigma_{k=0}^{3}\beta_{2k} Z_{i,t-k-1}. \quad [9]$$

Following prior studies (Temesvary et al., 2018, Kneer & Raabe, 2019), we also include lagged bank characteristics as $Bank\ Controls_{it-t}$, such as capital ratio, liquidity ratios, and total assets, and white noise, $u_{i,t}$. In addition, we control the bank-loan-characteristic-fixed effect $f_{i,s,c,m,b}$. Furthermore, by taking advantage of our data, we control for the factors specific to each loan characteristic. The data we use allow us to look at the breakdown of amounts of newly issued loans by currency, maturity, security, and sector on a quarterly basis. We include time-variant dummies for each loan characteristic ($\psi_{s,t}, \psi_{c,t}, \psi_{m,t}, \psi_{b,t}$), in order to absorb temporal increases in demand or supply in certain types of loans in each period, such as temporal increases in demand for local currency due to tax payment or changes in other regulations.[10]

We also control FDI inflows from each bank's major shareholders' country into Cambodia ($FDI\ Flow_{j,t}$), which are likely to affect the banks' lending behavior (Peek & Rosengren, 2000; Baskaya, 2017). FDIs could also affect the local demand for credit as FDI could be financed by the related banks. This potential mechanism of credit growth might affect our results as reverse causality. We include the FDI flows to control this channel of bank lending from foreign countries' economic conditions. The data on FDI inflows is provided by the

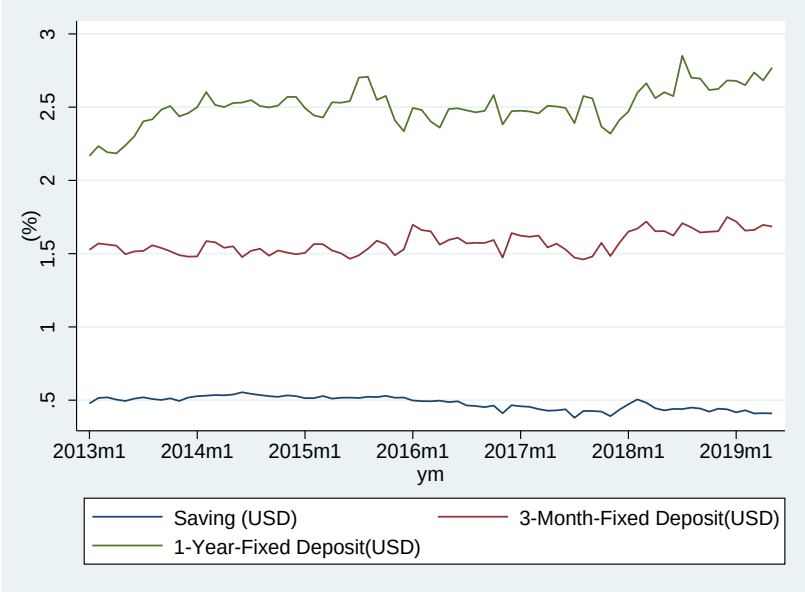
[9] By definition, $I_i \cdot Z_{i,t-k-1} \cdot US\ Policy_{t-k}$ equals $Z_{i,t-k-1} \cdot US\ Policy_{t-k}$.
[10] The National Bank of Cambodia announced a new regulation in effect as of December 2019 that requires banks to keep 10% of outstanding loans outstanding in local currency.

Council of Development in Cambodia, and covers the amount of newly implemented FDIs by country for every quarter from 2013Q1 to 2019Q2.

There might be other channels of international transmission in dollarized economies, such as domestic foreign currency deposits as Mora (2013) demonstrated in the examination of US monetary policy transmission through the foreign currency deposits in Mexico. However, the interest rates on domestic USD deposits have been stable even after the US federal fund rate started increasing in 2015Q4. Figure 5 shows the average interest rates of banks by maturities. This figure shows that interest rates on domestic USD deposits have not changed significantly after the US federal fund rate increased. Presumably, this is due to the high degree of dollarization in Cambodia. Banks can collect USD deposits from residents, and the interest rate on deposits are mostly determined by domestic factors.[11] Figure 1 and Figure 5 may indicate that changes in US monetary policy have affected only the cost of funding from abroad for Cambodian banks. Thus, the effect could be larger if banks are more dependent on foreign funding, since Cambodian commercial banks could collect USD deposits from domestic customers at a stable funding cost. Thus, the interactions of treatment dummy, US federal fund rate and foreign funding exposure ($I_i \cdot Z_{i,t-k-1} \cdot US\ \ Policy_{t-k}$) would capture the heterogeneity in the effect of US monetary policy change on the cost of non-resident liabilities into Cambodian banks. If the channel of non-resident liabilities plays a role in transmitting US monetary policy to banks' domestic lending, we expect $\Sigma_{k=1}^{l}\beta_{1k} < 0$, and $\Sigma_{k=1}^{l}\beta_{2k} < 0$, respectively.

[11] One of the other possible channels is FX deposits in banks, as previous studies suggested. However, FX deposits are mostly kept by residents, and as we show in Figure 4, the interest rate on FX deposits did not changed in response to US monetary policy. Thus, it is not likely that FX deposit channeled the US monetary policy in Cambodia. Indeed, we also estimated the model with interaction terms of FX deposits × US monetary policy, but the results are not consistent with the transmission hypothesis.

Figure 5: Average Interest Rates on USD Deposits of Cambodian Commercial Banks



Source: Author's calculations using monthly data of deposits of Cambodian commercial banks provided by National Bank of Cambodia. This figure shows average interest rates on USD deposits provided by Cambodian commercial banks from 2013m1 to 2019m6. Data source is National Bank of Cambodia, and authors' calculation.

We also examine which types of loans are likely to be affected by international monetary transmission. To do so, we extend the empirical model to the following equation.

$$
\begin{aligned}
&ln\left(loan_{i,s,c,m,b,j,t}\right) \\
&= \alpha + \Sigma_{k=0}^{3}\beta_1 I_i \cdot US\ \ Policy_{t-k} + \Sigma_{k=0}^{3}\beta_{2k}\ \ I_i \cdot Z_{i,t-k-1} \cdot US\ \ Policy_{t-k} \\
&\quad + \Sigma_{k=0}^{3} I_i \cdot US\ \ Policy_{t-k} \\
&\qquad \cdot (\gamma_{1k} SecuredDummy_s + \gamma_{2k} LongTermDummy_m + \gamma_{3k} USD\ \ Dummy_c \\
&\qquad + \gamma_{4k} BusinessDummy_b) \\
&\quad + \Sigma_{k=0}^{3} I_i \cdot Z_{i,t-k-1} \cdot US\ \ Policy_{t-k} \\
&\qquad \cdot (\delta_{1k} SecuredDummy_s + \delta_{2k} LongTermDummy_m + \delta\ _{3k} USD\ \ Dummy_c \\
&\qquad + \delta\ _{4k} BusinessDummy_b) \\
&\quad + \Sigma_{k=0}^{3}\beta_{3k} Bank\ \ Controls_{i,t-k-1} + \Sigma_{k=0}^{3}\beta_{4k} FDI\ \ Inflow_{j,t-k} + f_{i,s,c,m,b}\ \ + \psi_{s,t} + \psi_{c,t} + \psi_{m,t} + \psi_{b,t} \\
&\qquad + u_{i,s,c,m,b,t}
\end{aligned}
\tag{2}
$$

where $SecuredDummy_s$, $LongTermDummy_m$, $USD\ Dummy_c$, and $BusinessDummy_b$ are dummies that stand for whether loans are secured or unsecured, more than one year mature or not, in USD or the local currency, and for the business or consumer sector. As shown by Jiménez et al. (2014), monetary policy could also affect the structure of loan portfolios in terms of risk profile. Thus, the monetary policy could differently affect the loan provision across characteristics of loans. In particular, secured loans and short-term loans are generally less risky for lenders. In addition, in Cambodia, the interest rates on USD loans are lower than on local loans. Thus, the USD loans are provided to lower risk profile borrowers generally. For retail loans, although the interest rates are not necessarily lower than corporate loans, but the size of loans are far smaller and banks mostly require collateral. Thus, retail loans could be lower risk than business loans for Cambodian banks. In addition, foreign funding is generally long-term and large, thus facilitating banks to extend loans to the business sector. We examine which loan characters are highly affected by the US and other foreign monetary policy using equation 2.

3.3 Examination of Transmission of Monetary Policy from Other Foreign Countries

We further examine whether other countries' monetary policies affect Cambodian banks. In the same manner we treat the US monetary policy, we include and examine the effect of monetary policy of each bank's major shareholders' home country j at time $t(OF\ \ Policy_{jt})$. The variable is not likely to be affected by Cambodia's economic situation, as it has one of the smallest open economies, while the changes in foreign countries' monetary conditions affect capital inflows to Cambodian banks. In the case that the majority of shareholders of a given bank are Cambodian, we set the other countries' monetary policy rate $(OF\ \ Policy_{jt})$ to zero. In addition, since the monetary policy rate highly varies across countries, we standardize $OF\ \ Policy_{jt}$ by subtracting mean and dividing by standard errors of the monetary policy rates for each country. Avdjiev et al. (2018) empirically demonstrated that cross-border lending is affected by the monetary policy of

each of the lender's, borrower's and currency-issued country. Therefore, we conjecture that the monetary policy rate in parent bank's locations is also an important factor to understand the transmission mechanism through non-resident liabilities.

Table 1 shows breakdowns of ownerships of commercial banks in Cambodia. Ownership information is collected from the audited annual report of commercial banks or their websites. In addition, we define a home country of the bank as the country in which a shareholder with largest shares live. We find that the number of total banks has increased over the period, and majority of shareholders of most of entrants are foreigners. Most of origins of such foreign-owned banks are Asian countries: Thailand, Malaysia, Vietnam, Korea, and Japan.

Table 1: Home Countries of Major Shareholders of the Cambodian Banks

	2013	2014	2015	2016	2017	2018	2019
Australia	1	1	1	1	1	1	0
Cambodia	6	6	6	6	7	7	9
Canada	1	1	1	1	1	1	1
China	2	2	2	2	2	2	2
France	0	0	0	0	1	1	1
India	1	1	1	1	1	1	1
Japan	2	2	2	2	3	3	4
Korea	4	4	4	4	4	4	5
Laos	0	0	0	0	0	1	1
Malaysia	6	6	6	6	6	6	6
Singapore	1	1	1	1	1	1	1
Taiwan	5	5	5	5	5	5	5
Thailand	2	2	3	4	4	4	4
Vietnam	4	4	4	4	4	4	4
Total	35	35	36	37	40	41	44

Source: Data is collected from annual reports of financial institutions or their websites. We defined major shareholders as the largest shareholders of a bank.

3.4 Descriptive Statistics

Table 2 shows the summary statistics of variables used in the analysis. In the first row of Table 2, we presented mean values and standard errors of amounts of loan disbursements by currency (USD or local currency), sector (business or consumer loans), maturity (long-term or short-term),

and security (secured or unsecured). This table also shows another interesting feature of the Cambodian banking sector.[12] The liquidity ratio, defined as liquid assets over total assets, is high in the Cambodian banking sector. Other studies have found the liquidity ratio is 0.22 on average in the Brazilian banks (North & Busch 2017), and liquid- asset-to-deposit ratio is 0.36 in Ugandan banks (Abuka et al., 2020). Cambodia's high liquidity ratio could be a consequence of the high extent of the country's financial dollarization and political instability. As Delechat et al. (2012) have empirically shown that liquidity buffers are generally higher for banks in highly dollarized economies, because of lack of a lender's last resort. In addition, the Cambodian banking sector is vulnerable to external shocks, such as political turbulence. In the past, there were large-scale deposit withdrawals in the Cambodian banking sector just after the national election 2013. Those potential risks possibly make the Cambodian banks raise high liquidity buffers to offset potential risks of future deposit withdrawals.

[12] For the definition and correlation matrix of the variables, please see Appendix Table 1 and 2.

Table 2: Summary Statistics of Variables Used in the Estimation

		Mean	Standard Errors	Observations
Amounts of Loan Disbursement (By Loan Characteristics)				
	Business	36,715	128,345	2,827
	Consumer	140,507	662,656	2,218
	Short-term	68,789	288,087	2,147
	Long Term	95,335	506,456	3,492
	Local Currency	35,127	186,500	836
	USD	93,948	466,042	4,803
	Unsecured	26,712	353,112	1,006
	Secured	96,203	473,219	4,039
	All Loans	82,346	452,645	5045
Growth of Amont of Loan Disbursement (Log.)		0.04	1.29	4,725
Ratio of Non-resident Liablities		0.15	0.18	954
Capital Ratio		0.32	0.24	954
Liquidity Ratio		0.34	0.15	915
Log. Total Asset		13.95	1.25	954
Total Assets		2,454,523	3,835,078.00	954
Log. Growth of Non-Resident Liabilities		0.02	0.08	906
Log. Growth of Resident Deposits		0.06	0.23	925
Log. Growth of Equity		0.07	0.50	828
Ratio of FX Deposit to Liabilities		0.44	0.25	953
Ratio of Non-Resident Deposits		0.05	0.07	951
Ratio of Other Foreign Liabilities		0.10	0.17	951
Monetary Policy in Country *j*		-0.1567249	0.8600542	300
FDI Inflow into Cambodia from Country *j*		36.38813	48.0332	324
US Monetary Policy		0.7980769	0.8329743	26

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics. Unit is millions of KHR. Loan amounts mean the amounts of newly issued loans by quarters. Long-term loans are loans with more than one year of maturity, while short-term loans have less than one year of maturity. Growths of amounts of loan disbursements in Table 2 is a quarter-to-quarter change in log. of loan volume.

4. Empirical Results

4.1 Transmission of US Monetary Policy

Table 3 presents the results of the estimation. We run a regression with fixed-effect OLS estimation. In order to capture the effects over one year, our estimation model included 3 lags of each independent variable and its contemporaneous measure at k=0. The values in each column represent the cumulative values of estimated coefficients of all lagged and contemporaneous measure, and standard errors. For the calculation standard errors, we employed two-way clustered robust standard errors at the bank- and quarter- level, following Cameron and Miller (2016). We present the results of the ratio of non-resident liabilities to total liabilities in columns 1-4, and the results of the ratio of other foreign liabilities to total liabilities in columns 5-8.

In columns 1 and 5, we estimated the model with an interaction term of treatment dummy and US monetary policy rate ($I_i \cdot US\ Policy_{t-k}$) to examine the difference in the response to an increase in US monetary policy rate between banks with and without exposure. We find that the coefficient of the interaction term was negative at 1% statistical significance in column 1 and at 5% statistical significance in column 4; this interaction term is also significant in the other specifications in the table. Both of the measures of exposure to foreign monetary policy showed that banks with exposure decreased their domestic lending compared to banks without exposure following the increase in US monetary policy, suggesting that banks that are dependent on foreign funding are affected by US monetary policy changes. The estimated coefficient indicates the large economic impact of US monetary policy on banks with higher dependency on foreign funding. Based on the estimation results in column 1 (column 5), a 1% increase in US monetary policy rate leads to 0.45% (0.48%) decrease in domestic lending of banks with exposure on average compared to banks without exposure.

In columns 2 and 6, we estimated the model including the triple-interaction term of treatment dummy, US monetary policy rate and exposure ($I_i \cdot Z_{i,t-k-1} \cdot USPolicy_{t-k}$).[13] We find that the interaction term of treatment dummy and US monetary policy rate ($I_i \cdot US\ \ Policy_{t-k}$) is statistically significant, while the triple interaction term ($I_i \cdot Z_{i,t-k-1} \cdot USPolicy_{t-k}$) is not statistically significant in column 2, although the sign of coefficient is in line with our prediction. However, as shown in column 5, the triple-interaction term is negative at 5% statistical significance, in line with our prediction.

[13] By definition, $I_i \cdot Z_{i,t-k-1} \cdot US\ \ Policy_{t-k}$ equals $Z_{i,t-k-1} \cdot US\ \ Policy_{t-k}$.

Table 3: Estimation of Determinants of Newly Disbursed Loans

	Z: Ratio Non-Resident Liabilities to Total Liabilities				Z: Ratio of Foreign Wholesale Borrowing to Total Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Σ I (i) x US Policy (t)	-0.452***	-0.385*	-3.278***	-3.466***	-0.480**	-0.362*	-3.110***	-2.379***
	(0.187)	(0.198)	(0.485)	(0.608)	(0.210)	(0.199)	(0.495)	(0.768)
Σ I (i) x Z (i, t-1) x US Policy (t)		-0.498		-1.527		-1.310**		-4.823*
		(0.588)		(2.658)		(0.659)		(2.615)
Σ Z (i, t-1)	-0.583	-0.268	-0.584	-0.372	-0.848*	-0.104	-0.850*	-0.127
	(0.594)	(0.666)	(0.586)	(0.639)	(0.480)	(0.553)	(0.468)	(0.550)
Σ Liquidity Ratio (i, t-1)	-0.695	-0.788	-0.750	-0.817	-0.581	-0.726	-0.634	-0.834
	(0.894)	(0.817)	(0.916)	(0.903)	(0.874)	(0.747)	(0.894)	(0.848)
Σ Capital Ratio (i, t-1)	-0.264	-0.193	-0.045	-0.090	-0.607	-0.516	-0.364	-0.110
	(0.764)	(0.731)	(0.838)	(0.713)	(0.712)	(0.676)	(0.786)	(0.806)
Σ Log. Total Asset (j, t-1)	0.564***	0.578***	0.607***	0.592***	0.528***	0.505	0.577***	0.554***
	(0.221)	(0.214)	(0.237)	(0.219)	(0.216)	(0.206)	(0.232)	(0.221)
Σ Capital Inflow (j, t)	-0.005	-0.004	-0.005	-0.003	-0.004	-0.002	-0.004	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
Σ I (i) x US Policy (t) x Collateral Dummy			0.422	0.196			0.473	0.355
			(0.294)	(0.328)			(0.349)	(0.330)
Σ I (i) x US Policy (t) x USD Dummy			2.375***	2.661***			2.109***	1.572**
			(0.467)	(0.578)			(0.575)	(0.795)
Σ I (i) x US Policy (t) x Long-term Dummy			0.802***	0.902***			0.883***	0.863***
			(0.209)	(0.232)			(0.202)	(0.250)
Σ I (i) x US Policy (t) x Business Dummy			-0.413*	-0.242			-0.434*	-0.350
			(0.236)	(0.212)			(0.253)	(0.274)
Σ I (i) x Z (i, t-1) x US Policy (t) x Collateral Dummy				1.819				2.337
				(1.646)				(1.658)
Σ I (i) x Z (i, t-1) x US Policy (t) x USD Dummy				1.282				1.946
				(1.913)				(1.944)
Σ I (i) x Z (i, t-1) x US Policy (t) x Long-term Dummy				-1.579*				-0.173
				(0.925)				(0.945)
Σ I (i) x Z (i, t-1) x US Policy (t) x Business Dummy				-1.250*				-0.264
				(0.709)				(0.727)
Time-Currency Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Maturity Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time- Security Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Sector-Currency-Maturity-Security Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6.905	-7.136	-7.266	-6.961	-6.285	-5.958	-6.765	-6.507
	(3.781)	(3.680)	(4.041)	(3.714)	(3.617)	(3.440)	(3.893)	(3.642)
Number of Obseravations	4,176	4176	4176	4,176	4,119	4,119	4,119	4,119
R-squared	0.792	0.792	4176	0.794	0.794	0.796	0.795	0.798

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics. ***,**, and * represent statistical significance at 1%, 5%, and 10%, respectively. The fixed-effect OLS estimation is used for each column. In order to capture the effects over one year, each model included 3 lags of each independent variables and its contemporaneous measure at k=0. The values in each column show the cumulative values of estimated coefficients of all lagged variables, and two-way clustered robust standard errors at the bank- and quarter- level are presented in parentheses. The sample period spans from 2013Q1-2019Q2. Z(i, t-1) represent the measure of foreign funding exposure. In columns 1-4, the ratio of non-resident liabilities to total liabilities are adopted as Z(i, t-1). In columns 5-8, the ratio of other liabilities to total liabilities are adopted as Z(i, t-1). I(t) represents the treatment dummy which takes one if Z(i, t-1) is not zero. US policy (t) represents the US federal fund rate, and FC Policy (t, j) represents the rate in each bank's shareholders' home countries.

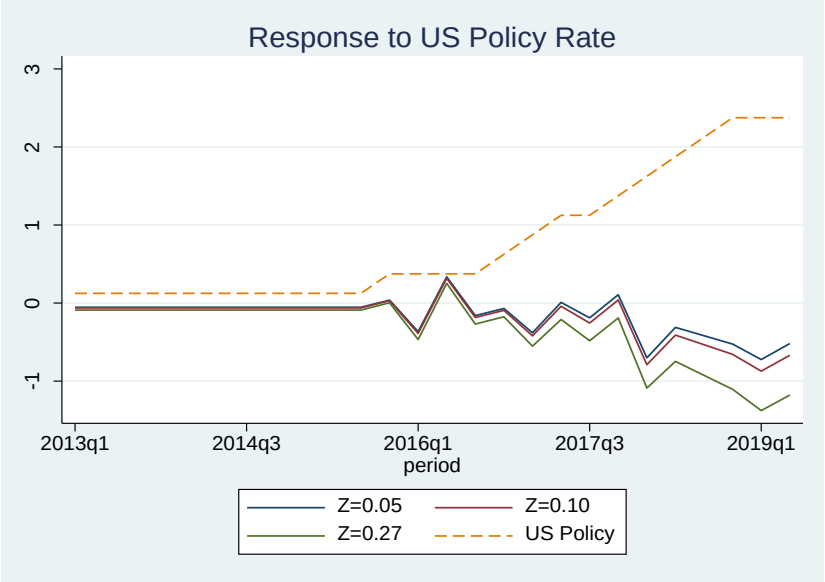
Overall, the estimated coefficients are similar between the ratio of other foreign liabilities and the ratio of non-resident liabilities. In addition, the triple-interaction term of treatment dummy, US monetary policy rate and exposure ($I_i \cdot Z_{i,t-k-1} \cdot USPolicy_{t-k}$) is estimated at statistical significance in the case of the ratio of other foreign liabilities. This might suggest that international monetary transmission is channeled via wholesale funding from abroad.

Based on the estimation in column 5, the banks with a one-standard-deviation higher ratio of other foreign liabilities (0.17) would experience a 0.22% larger decline in lending to one loan segment than other banks with exposure, and a 0.58% decline compared to banks without exposure. We also illustrated the estimated impact of the US monetary policy rate in Figure 6, based on the result of column 6. As a response to an actual change in the US monetary policy rate, we calculated the cumulative effects of US monetary policy rate for banks with the average exposure (Z=0.10), the bank with one-standard-deviation higher exposure (Z=0.27), and banks with small exposure (Z=0.05), using the following formula:

$$\Sigma_{k=0}^{3} \frac{\partial^2 ln(loan_{i,s,c,m,b,j,t})}{\partial US\ \ Policy_{t-k}\ \ \partial I_i} \cdot USPolicy_{t-k} = (\Sigma_{k=0}^{3}\beta_1 + \Sigma_{k=0}^{3}\beta_{2k}Z) \cdot USPolicy_{t-k}$$

Figure 6 shows that the US monetary policy rate decreased loan disbursements after 2015Q4, with a severe negative effect on banks with higher exposure. When the US monetary policy rate rose to 2.25% in 2018Q4, the estimated impact amounted to around a 1% decline for the average banks (Z=0.10), and a greater than 1% decline for the bank with one-standard-deviation higher exposure (Z=0.27). Our results suggest that tightening of US monetary policy severely affects the domestic lending of banks with higher dependency on foreign funding. The results are consistent to prior studies of international monetary transmission in other emerging markets (Ongena et al., 2015).

Figure 6: Estimated Economic Impacts of US Monetary Policy



Source: The figure illustrates the estimated impact of an increase in the US monetary policy rate, based on the estimated model shown in column 6 in Table 3. Each of the plotted line shows the estimated impact for banks of which the ratio of other foreign liabilities to total liabilities (Z) is 0.05, 0.10, 0.27.

In columns 3-4 and 7-8, we presented the results of the estimation of equation 2, which include the triple-interactions of treatment dummy, US monetary policy rates, and loan characteristic dummies, and the quadruple-interactions of treatment dummy, measure of exposure to foreign monetary policy, US monetary policy rates, and loan characteristic dummies.[14] We find that there were distributional effects of US monetary policy across different characteristics of loans. First, we find that coefficients of the triple-interaction term of treatment dummy, US monetary policy rate, and USD currency dummy ($I_i \cdot USPolicy_{t-k} \cdot USDDummy_c$) showed a positive sign and a statistical significance in all specifications in Table 3, suggesting that lending in USD is less affected by changes in the cost of funding from abroad than local currency loans. Given that risk profiles of clients are different between loan currencies, the results also suggest that increases in funding costs facilitated asset allocations of banks

[14] We also checked the robustness in the different specifications of equation 2 in a step-wise manner. These results are presented in Appendix Table 3.

toward less risky assets, in line with Jiménez et al. (2014) and De Jonghe et al. (2020). Furthermore, the dummy for secured loans is also estimated as positive and significant. The result also supports the asset reallocation hypotheses in response to changes in funding costs.

In the context of Cambodia, the results can be also interpreted as follows. Since collecting local currency deposits is costly in the sense that interest rates on local deposits are higher than USD deposits, the availability of cheaper foreign funds could affect lending in local currency. In fact, the National Bank of Cambodia started a currency swap operation "local currency collateralized provision operation" from 2016, which provides the local currency liquidity with banks in exchange for USD liquidity of banks as collateral. Thus, the increases in the funding cost from abroad decreases the lending in local currency, and instead increases USD lending.

We also find that US monetary policy rate is associated with banks' loan allocation across sectors. The interactions with the business loan dummy are estimated as negative and statistically significant in columns 3 and 7, meaning that increases in funding costs from abroad negatively affected the provision of domestic business loans. As a practice, Cambodian banks require collateral, such as land property, when they extend consumer loans. In the meantime, banks require financial statements and business plans for the provision of business loans. Thus, the results can be interpreted as banks reallocating loans from risky borrowers to safer ones.

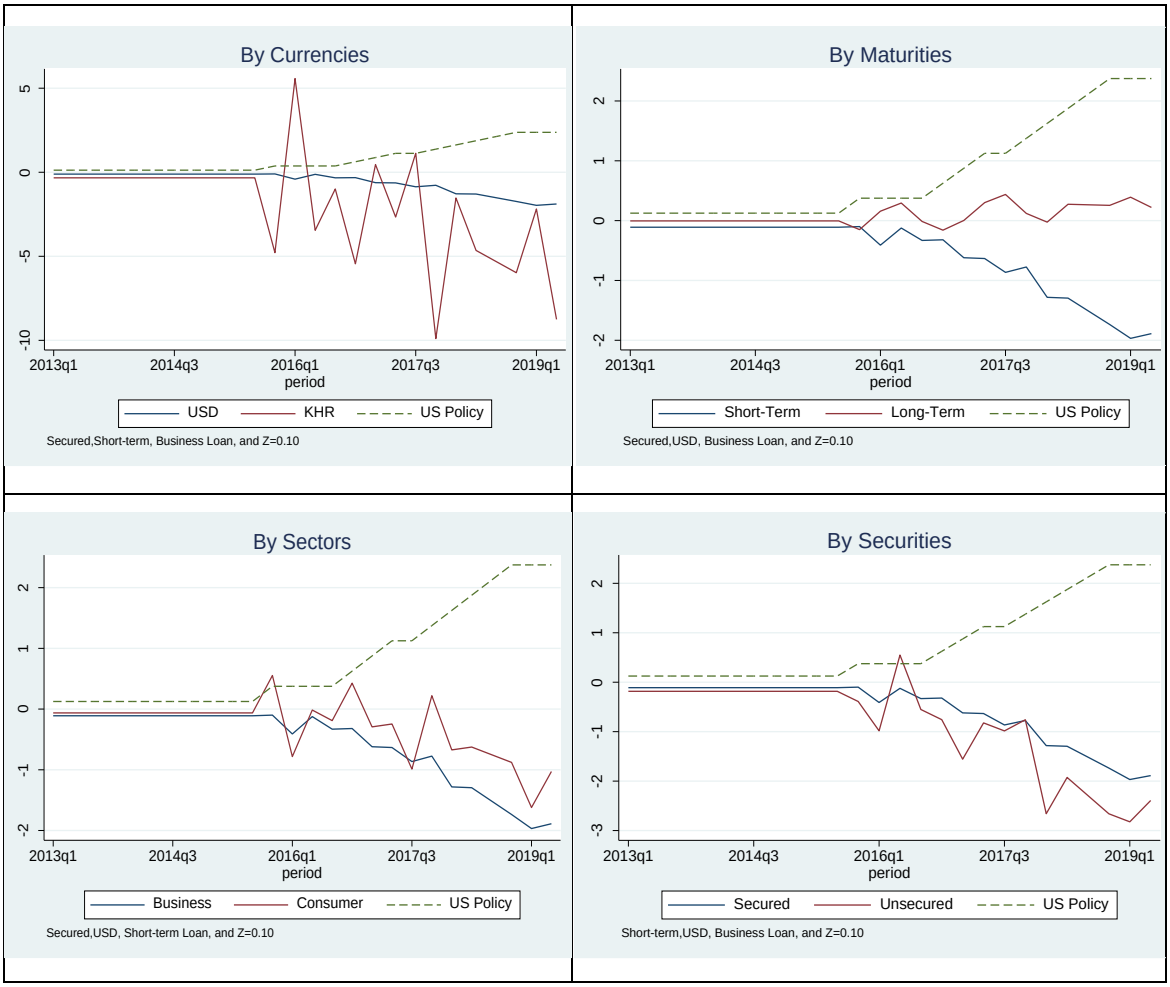
The triple-interactions of treatment dummy, US policy and long-term loans ($I_i \cdot US\ \ Policy_{t-k}$) are estimated as positive at 1% statistical significance in columns 3-4 and 7-8. This suggests that the effects of US monetary policy increased the number of long-term loans in the overall loan composition and decreased short-term loans. The result is different from our prediction that the bank loans would shift toward less risky loans. Presumably, the results might imply that short-term loans are riskier than long-term loans in Cambodia. Indeed, most loans in

Cambodia are short-term, with borrowers in rural areas more likely to take out short-term loans because of the availability of collateralized assets.[15]

Furthermore, the coefficient of the interactions of the treatment dummy and US monetary policy ($I_i \cdot USPolicy_{t-k}$) is estimated higher overall in the model including distributional effects (columns 3-4, and 7-8), and the triple-interaction term of treatment dummy, US monetary policy rate and exposure ($I_i \cdot Z_{i,t-k-1} \cdot USPolicy_{t-k}$) is also higher, particularly in column 8. In the estimated model of column 7, the estimated coefficient of the interaction of the treatment dummy and US monetary policy rate ($I_i \cdot US\ \ Policy_{t-k}$) is -3.110. This means that banks with exposure experienced a -3.110% decrease on average in loan provision in response to a 1% increase of US monetary policy, compared to banks without exposure. Furthermore, in column 8, the triple-interaction term of the treatment dummy, US monetary policy rate and exposure ($I_i \cdot Z_{i,t-k-1} \cdot USPolicy_{t-k}$) was estimated to be -4.123, meaning that the impact of US monetary policy increases as an exposure of foreign funding increases, and one-standard-deviation higher exposure (0.17) additionally deceases loan provision on average by 0.701%.

[15] We checked the credit registry data from the Credit Bureau of Cambodia. The average maturity of all the newly disbursed loans from banks in 2016-2019 was 33 months for individual lending, which include business purposes, personal loans, mortgage loans, and credit card loans.

Figure 7: Estimated Economic Impact of US Monetary Policy (By Loan Characteristics)



Source: The figure illustrates the estimated impact of an increase in US monetary policy rate, based on the estimated model showed in column 8 in Table 3. Each of the plotted line shows the estimated impact for banks of which the ratio of other foreign liabilities (Z) is 0.10. The secured, short-term, USD business loans are treated as baseline in each panel.

Furthermore, in Figure 7, we illustrated the estimated impact of an increase in the US monetary policy rate across loan characteristics, based on the estimated model showed in column 8 in Table 3. Each of the plotted lines shows the estimated impact for banks of which the ratio of other foreign liabilities (Z) is 0.10. The secured, short-term, USD business loans are treated as baseline in each panel. The figure indicates that distributional effects across loan characteristics are large enough to change loan composition significantly for banks with exposure of foreign funding on average. Decreases in secured, short-term, USD business loans amounted to about 2% in 2019Q2, while decreases in secured, short-term, KHR business loans

amounted to about 8%. The secured, long-term, USD business loans were not negatively affected by US policy, and it rather increased 0.1-0.2% after the US monetary policy rate increased. Decreases in secured, short-term, USD consumer loans amounted to about 1%. The decreases in unsecured, short-term, USD business loans amounted to about 2.5% in 2019Q2. The results suggests that US monetary policy increases especially affected the currency and maturity compositions of bank loans in Cambodia.

4.2 Transmission of Monetary Policy from Banks' Major Shareholders' Home Countries

We further investigate the relationship between domestic bank lending and other foreign countries' monetary policy. De Haas and Lelyveld (2006, 2010) empirically showed that economic and monetary shocks within the home countries of multinational banks affect the performance of local subsidiaries. Thus, aside from US monetary policy, other foreign countries' monetary policies will transmit to Cambodia through as a result of its banks' reliance on foreign funding. Here, we examine the hypothesis that the foreign monetary policy in the home countries of a bank's major shareholders affect that bank's lending in Cambodia. We also examine whether a home country's monetary policy has a comparable impact with the US monetary policy for a developing country. To do so, we added the interaction terms of treatment dummy and other foreign country monetary policy ($I_i \cdot OF\ Policy_{jt}$) in the same manner as we included the US monetary policy rate in equation 1 and 2.

We present the estimation results in Table 4. We ran a regression with fixed-effect OLS estimation. In order to capture the effects over one year, our estimation model included 3 lags of each independent variables and its contemporaneous measure at k=0. The values in each column show the cumulative values of the estimated coefficients of all lagged and contemporaneous measures and standard errors. For the calculation standard errors, we employed two-way clustered robust standard errors at the bank- and quarter- level, following Cameron and Miller (2016). We present the results of the ratio of non-resident liabilities to total liabilities in

columns 1-4, and the results of the ratio of other foreign liabilities to total liabilities in columns 5-8.

The estimated results in columns 1 and 5 reveals that the coefficient of the triple-interactions of the treatment dummy, exposure and monetary policy of majority shareholders' home countries ($I_i \cdot Z_{i,t-k-1} \cdot Other\ \ Foreign\ \ MP_{t-k}$) is not statistically significant, indicating the ratio of non-resident liabilities is not working to channel the monetary policy effects in other foreign countries. In the meantime, the effect of US monetary policy is still estimated as negative at statistical significance in both columns 1 and 4.

In columns 2 and 6, we included the triple- and the quadruple-interaction of the treatment dummy, exposure, monetary policy, and loan characteristic dummies, in order to capture the distributional effect of foreign monetary policy across different types of loans. In columns 3 and 6, we included country-period fixed effects to take into account the time-variant effect relating to the shareholders' home country for the robustness check of our results. Even though we include the capital inflows from shareholders' countries, there could still be omitted variable biases, such as changes in trade volumes and other macroeconomic variables within the countries. As a result, we find that statistical significance becomes smaller overall in coefficients relating to US monetary policy and monetary policy in shareholders' home countries in the model with the ratio of non-resident liabilities as the proxy of exposure. However, the model with the ratio of other foreign liabilities as the proxy of exposure shows a robust result even when we include the county-period fixed effect (column 7).

The significance of other foreign monetary policy is weak in most relevant variables. In columns 4 and 8, we only included the interactions of treatment dummies and other foreign monetary policy. However, we find that the interaction of treatment dummies, exposure and other foreign monetary policy ($I_i \cdot Z_{i,t-k-1} \cdot OFPolicy_{t-k}$) is negative at 10% statistical significance in column 8, and the significance disappears once US monetary policy variables are included in other specifications. In column 2, the quadruple-interaction with a long-term loan

dummy ($I_i \cdot Z_{i,t-k-1} \cdot OFPolicy_{t-k} \cdot LongTerm\ \ Dummy_c$) is positive but statistically significant at 10% level. In columns 6, 7, 8, we find that the triple-interaction with USD loan dummy ($I_i \cdot OF\ \ Policy_{t-k} \cdot USDDummy_c$) is positive at 5%, 10%, and 1% statistical significance, respectively. However, the point estimation of this coefficient was weaker than the one for US monetary policy. Therefore, overall, there is no strong evidence on the effect of monetary policy of majority shareholders' home countries across different specifications in Table 4.

Table 4: Determinants of Newly Disbursed Loans with Other Foreign Monetary Policy

	Z: Ratio Non-Resident Liabilities to Total Liabilities				Z: Ratio of Foreign Wholesale Borrowing to Total Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Σ I (i) x US Policy (t)	-0.549	-3.626***	-5.131***		-0.597	-2.882***	-4.066***	
	(0.384)	(0.845)	(1.557)		(0.382)	(0.812)	(1.428)	
Σ I (i) x Z (i, t-1) x US Policy (t)	-0.703	-2.554	-3.519		-1.653**	-8.208***	-7.467***	
	(0.685)	(4.021)	(3.669)		(0.737)	(2.309)	(2.326)	
Σ I (i) x OF Policy (t)	-0.028	-0.235	0.170	-0.544	0.046	0.023	-0.143	-0.843
	(0.264)	(0.610)	(0.816)	(0.734)	(0.258)	(0.237)	(0.677)	(0.659)
Σ I (i) x Z (i, t-1) x OF Policy (t)	-0.193	-0.479	-2.270	-4.187	-0.037	-0.104	-2.633	-4.417*
	(0.688)	(3.791)	(3.599)	(3.135)	(0.449)	(2.384)	(2.751)	(2.676)
Σ Z (i, t-1)	-0.490	-0.629	-1.209	-1.762	-0.053	-0.062	-1.599**	-2.300***
	(0.617)	(0.579)	(0.771)	(0.728)	(0.445)	(0.521)	(0.725)	(0.844)
Σ Liquidity Ratio (i, t-1)	-0.336	-0.371	-0.972	-1.399	-0.306	-0.640	-0.547	-1.025
	(0.933)	(0.960)	(1.177)	(1.105)	(0.840)	(0.897)	(1.140)	(1.126)
Σ Capital Ratio (i, t-1)	-0.451	-0.283	0.663	-0.119	-0.656	-0.319	-0.482	-0.823
	(0.696)	(0.842)	(1.699)	(1.304)	(0.662)	(0.817)	(1.719)	(1.367)
Σ Log. Total Asset (j, t-1)	0.441*	0.590**	1.017**	0.606	0.359	0.546**	0.790	0.619*
	(0.237)	(0.288)	(0.520)	(0.387)	(0.225)	(0.267)	(0.496)	(0.361)
Σ OF Policy (j, t)	-0.003	-0.002			0.001	0.000		
	(0.003)	(0.004)			(0.004)	(0.004)		
Σ FDI Inflow (j, t)	-0.019	0.049			-0.086	0.035		
	(0.210)	(0.063)			(0.230)	(0.070)		
Σ I (i) x US Policy (t) x Collateral Dummy		0.404	-0.839			0.617**	-0.500	
		(0.270)	(1.161)			(0.284)	(1.171)	
Σ I (i) x US Policy (t) x USD Dummy		2.507***	3.551***			1.694*	2.346*	
		(0.893)	(1.420)			(0.930)	(1.402)	
Σ I (i) x US Policy (t) x Long-term Dummy		0.750***	0.874***			0.695**	0.868***	
		(0.301)	(0.289)			(0.323)	(0.321)	
Σ I (i) x US Policy (t) x Business Dummy		-0.182	0.140			-0.219	0.082	
		(0.281)	(0.298)			(0.343)	(0.319)	
Σ I (i) x Z (i, t-1) x US Policy (t) x Collateral Dummy		1.685	2.125			2.920**	2.670*	
		(1.563)	(1.825)			(1.447)	(1.623)	
Σ I (i) x Z (i, t-1) x US Policy (t) x USD Dummy		2.676	1.965			4.982***	4.844**	
		(3.559)	(3.151)			(2.049)	(2.248)	
Σ I (i) x Z (i, t-1) x US Policy (t) x Long-term Dummy		-1.896**	-1.675			-0.581	-0.824	
		(0.982)	(1.035)			(1.148)	(1.190)	
Σ I (i) x Z (i, t-1) x US Policy (t) x Business Dummy		-1.509	-1.714*			-0.466	-0.781	
		(0.978)	(1.016)			(0.939)	(0.960)	
Σ I (i) x OF Policy (t) x Collateral Dummy		-0.338	-0.385	-0.358		-0.484	-0.424	-0.459
		(0.380)	(0.398)	(0.358)		(0.327)	(0.344)	(0.336)
Σ I (i) x OF Policy (t) x USD Dummy		0.546	0.349	-0.034		0.381**	0.402*	0.587***
		(0.602)	(0.529)	(0.392)		(0.182)	(0.213)	(0.218)
Σ I (i) x OF Policy (t) x Long-term Dummy		-0.109	-0.070	0.113		0.059	0.122	0.119
		(0.266)	(0.299)	(0.236)		(0.224)	(0.249)	(0.243)
Σ I (i) x OF Policy (t) x Business Dummy		-0.031	-0.122	0.033		-0.147	-0.198	-0.197
		(0.291)	(0.303)	(0.228)		(0.226)	(0.234)	(0.232)
Σ I (i) x Z (i, t-1) x OF Policy (t) x Collateral Dummy		0.625	0.553	0.782		-0.027	0.112	0.152
		(1.683)	(1.636)	(1.393)		(1.390)	(1.342)	(1.393)
Σ I (i) x Z (i, t-1) x OF Policy (t) x USD Dummy		-0.784	1.023	2.551		0.075	1.550	0.921
		(2.915)	(2.702)	(2.552)		(1.830)	(2.015)	(2.100)
Σ I (i) x Z (i, t-1) x OF Policy (t) x Long-term Dummy		1.434*	1.427	0.948		0.716	0.730	0.761
		(0.801)	(0.886)	(0.855)		(0.788)	(0.849)	(0.844)
Σ I (i) x Z (i, t-1) x OF Policy (t) x Business Dummy		-0.732	-0.461	-0.699		-0.616	-0.457	-0.489
		(0.881)	(0.946)	(0.885)		(0.763)	(0.825)	(0.821)

Table 4: Determinants of Newly Disbursed Loans with Other Foreign Monetary Policy (Cont.)

	Z: Ratio Non-Resident Liabilities to Total Liabilities				Z: Ratio of Foreign Wholesale Borrowing to Total Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time-Currency Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Maturity Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time- Security Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Period Fixed Effect	No	No	Yes	Yes	No	No	No	Yes
Bank-Sector-Currency-Maturity-Security Fixed Effe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.996	-7.084	-13.795	-9.541	-3.655	-6.255	-10.156	-9.514
	(4.111)	(4.980)	(8.653)	(6.647)	(3.751)	(4.534)	(8.257)	(6.296)
Number of Obseravations	3,959	3,959	3,959	3,959	3,902	3,902	3,902	3,902
R-squared	0.792	0.797	0.803	0.799	0.796	0.802	0.807	0.803

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics. ***,**, and * represent statistical significance at 1%, 5%, and 10%, respectively. The fixed-effect OLS estimation is used for each column. In order to capture the effects over one year, each model included 3 lags of each independent variable and its contemporaneous measure at k=0. The values in each column show the cumulative values of estimated coefficients of all lagged variable, and two-way clustered robust standard errors at the bank- and quarter-level are presented in parentheses. The sample period spanned from 2013Q1-2019Q2. Z(i, t-1) represent the measure of foreign funding exposure. In columns 1-3, the ratio of non-resident liabilities to total liabilities are adopted as Z(i, t-1). In columns 4-6, the ratio of other liabilities to total liabilities are adopted as Z(i, t-1). I(t) represents the treatment dummy which takes one if Z(i, t-1) is not zero. US policy (t) represents the US federal fund rate, and FC Policy (t, j) represents the monetary policy rate in banks' shareholders' home countries.

4.3 Robustness Check

We further examine the robustness with regard to other possible channels of transmission of foreign monetary policy. Prior studies have examined the effect of monetary transmission using the interactions of the monetary policy rate with the capital ratio and liquidity ratio (Peek & Rosengren, 2000; Baskaya, 2017; Temesvary et al., 2018). Following these studies, we include the interaction terms between monetary policy stance rate in the US and other foreign countries and $Bank\ Controls_{i,t-1}$ as follows. Banks with liquidity constraints are likely to be affected by increases in the cost of funding. Thus, the interaction between the liquidity ratio and US monetary policy rate will be estimated to be positive. Likewise, since less capitalized banks are likely to be affected by the increase in the cost of funding, the interaction between the capital ratio and US monetary policy rate will also be estimated to be positive. If there is heterogeneity in the effects of foreign monetary policy across different levels of liquidity ratios and

capitalization, interaction terms between these variables and monetary policy will be estimated as positive at statistical significance.

In Table 5, we estimated the other specifications. Likewise, we run a regression with a fixed-effect OLS estimation. In order to capture the effects over one year, each model included 3 lags of each independent variable and its contemporaneous measure at k=0. The two-way clustered robust standard errors both at the bank- and quarter-level are applied in the estimation. The cumulative effects of the all lagged variables are presented in the table.

In columns 1 and 5, we estimated the model including US monetary policy transmission with potential channels of liquidity ratio and capitalization. In columns 2 and 6, we estimated the model including both US and other foreign monetary policy transmission with the potential channels of liquidity ratio and capitalization. We find that the results relevant to the exposure to foreign funding and US monetary policy ($I_i \cdot US\ \ Policy_{t-k}$ and $I_i \cdot Z_{i,t-k-1} \cdot US\ \ Policy_{t-k}$) did not change from Table 3 and Table 4. Thus, we find the robust result that US monetary policy transmitted through the foreign funding channel.

In the meantime, the coefficients of liquidity ratio and capitalization measures are estimated in opposite signs that we predicted in columns 1 and 2, and it was not even statistical significant in columns 4 and 5. The results suggest that bank capitalization and a liquidity buffer do not necessarily mitigate the impact of changes in the cost of foreign funding on bank domestic lending.

In columns 3 and 7, we examined the models without Cambodian-owned banks. In columns 4 and 8, we estimated the models with the Cambodian ownership dummy to examine the difference in the effect of US monetary policy between Cambodian-owned banks (6 banks) and foreign-owned banks. Firstly, when we exclude the Cambodian banks from the sample (columns 3 and 7), the statistical significance disappears in the variable relevant to US monetary policy transmission. It suggests that Cambodian-owned banks might have driven the results in previous estimation, or that the reduction in the sample size contributed to the insignificance in

the results. In fact, since some of Cambodian-owned banks also have a large extent of exposure to foreign funding, and Cambodian-owned banks existed throughout the period of our analysis, the exclusion of these banks did lead to a large reduction in sample size.

Table 5: Robustness Checks with Other Specifications

	Z: Ratio Non-Resident Liabilities to Total Liabilities				Z: Ratio of Foreign Wholesale Borrowing to Total Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Σ I (i) x US Policy (t)	-0.819**	-0.451	0.036	-0.613**	-0.547*	-0.529	0.085	-0.567**
	(0.387)	(0.408)	(0.507)	(0.260)	(0.311)	(0.444)	(0.431)	(0.263)
Σ I (i) x Z (i, t-1) x US Policy (t)	-0.811	-1.040**	0.199	0.110	-1.428**	-1.584***	-0.566	-0.703
	(0.548)	(0.513)	(0.542)	(0.527)	(0.683)	(0.651)	(0.616)	(0.599)
Σ I (i) x OF Policy (t)		-0.338	-0.379	0.057		-0.175	-0.400	0.038
		(0.208)	(0.449)	(0.181)		(0.217)	(0.380)	(0.143)
Σ I (i) x Z (i, t-1) x OF Policy (t)		-0.019	-0.329	-0.459		0.085	-0.175	-0.288
		(0.637)	(0.733)	(0.679)		(0.493)	(0.522)	(0.478)
Σ Z (i, t-1)	-6.183	-0.441	-0.461	-0.601	-0.184	-0.123	-0.082	-0.199
	(5.689)	(0.511)	(0.747)	(0.647)	(0.536)	(0.458)	(0.601)	(0.514)
Σ Liquidity Ratio (i, t-1)	-0.914	-0.277	-0.574	-0.396	-0.955	-0.671	-0.761	-0.403
	(0.869)	(0.979)	(1.152)	(0.914)	(0.741)	(0.871)	(0.933)	(0.817)
Σ Capital Ratio (i, t-1)	-0.583	-0.833	-1.318**	-0.454	-0.888	-0.837	-1.305*	-0.735
	(0.863)	(0.914)	(0.586)	(0.653)	(0.776)	(0.925)	(0.702)	(0.620)
Σ Log. Total Asset (j, t-1)	0.543*	0.431	0.157	0.370	0.414	0.388	0.092	0.210
	(0.298)	(0.313)	(0.236)	(0.235)	(0.278)	(0.310)	(0.239)	(0.233)
Σ OF Policy (j, t)	-0.030	0.001	0.418	-0.010	-0.009	-0.003	0.443	-0.005
	(0.055)	(0.064)	(0.347)	(0.062)	(0.059)	(0.065)	(0.311)	(0.070)
Σ FDI Inflow (j, t)	-0.003	0.000	-0.000	-0.001	-0.001	0.001	0.003	0.002
	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Σ Liquidity Ratio (i, t-1) x US Policy (t)	-0.910***	-1.286***			-0.243	-0.432		-8.748***
	(0.321)	(0.291)			(0.355)	(0.424)		(0.960)
Σ Capital Ratio (i, t-1) x US Policy (t)	-0.298	-0.819			-0.074	-0.767		0.483***
	(0.302)	(0.524)			(0.269)	(0.630)		(0.192)
Σ Liquidity Ratio (i, t-1) x OF Policy (t)		0.395				-0.078		
		(0.538)				(0.608)		
Σ Liquidity Ratio (i, t-1) x OF Policy (t)		0.532				0.596		
		(0.390)				(0.499)		
Σ I (i) x US Policy (t) x Cambodia Dummy				0.704***				0.483***
				(0.243)				(0.192)
Σ Z (i, t-1) x US Policy (t) x Cambodia Dummy				-8.632***				-8.748***
				(1.849)				(0.960)
Time-Currency Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Maturity Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time- Security Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Sector-Currency-Maturity-Security Fixed Effe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6.386	-6.737	0.158	-3.779	-4.349	-3.969	1.244	-1.144
	(5.089)	(5.458)	(3.644)	(3.990)	(4.710)	(5.182)	(3.481)	(3.764)
Number of Obseravations	3,959	3,959	2,878	3,959	3,902	3,902	2,821	3,902
R-squared	0.793	0.794	0.750	0.796	0.797	0.797	0.754	0.801

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics. ***,**, and * represent statistical significance at 1%, 5%, and 10%, respectively. The fixed-effect OLS estimation is used for each column. In order to capture the effects over one year, each model included 3 lags of each independent variables and its contemporaneous measure at k=0. The values in each column show the cumulative values of estimated coefficients of all lagged variables, and two-way clustered robust standard errors at the bank- and quarter-level are presented in parentheses. The sample period spanned from 2013Q1-2019Q2. Z(i, t-1) represent the measure of foreign funding exposure. In columns 1-4, the ratio of non-resident liabilities to total liabilities are adopted as Z(i, t-1). In columns 5-8, the ratio of other liabilities to total liabilities are adopted as Z(i, t-1). I(t) represents the treatment dummy which takes one if Z(i, t-1) is not zero. US policy (t) represents the US federal fund rate, and FC Policy (t, j) represents the monetary policy rate in banks' shareholders' home countries.

Secondly, when we include the interaction terms of Cambodian ownership dummy with variables relevant to US monetary policy transmission (columns 4 and 8), we find that the statistical significance in the interaction terms of the treatment dummy and US monetary policy $I_i \cdot US\ \ Policy_{t-k}$ remains, meaning that the effect of monetary policy transmission is still found in non-Cambodian-owned banks. In the meantime, the quadruple-interaction with the Cambodian-ownership dummy ($I_i \cdot \mathrm{Z_{i,t-k-1}} \cdot USPolicy_{t-k} \cdot CambodianDummy$) is estimated as negative at 1% statistical significance in both columns 4 and 8. This suggests that the Cambodian owned banks have a more severe negative impact from the increase in US monetary policy compared to the foreign-owned banks with the same level of exposure to foreign funding. Furthermore, the magnitude of the coefficient is -8.563 in column 4 and -10.482 in column 8, suggesting that the Cambodian-owned banks with a higher dependency on foreign funding decreased the provision of loans by approximately -8.563% (-10.482%) more than foreign-owned banks with the same level of dependency on foreign funding when the US monetary policy rate changed by 1%. Our analysis revealed that banks with Cambodian ownership and a higher dependence on foreign funding are particularly prone to a decline in lending when the cost of foreign funding increases. Presumably, the results imply that local banks have a disadvantage in access to the capital market, which is particularly serious when US monetary policy tightens.

In Table 6 and Table 7, we further carried out additional robustness checks. Specifically, we replaced measures of foreign funding exposure for other potential channels of international monetary transmission. In columns 1-4, we included the ratio of non-resident deposits to total liabilities. In columns 5-8, we included the ratio of FX deposits to total liabilities. Likewise, we run a regression with fixed-effect OLS estimation for each specification, and each model included 3 lags of each independent variable and its contemporaneous measure at k=0. Two-way clustered robust standard errors at the bank- and quarter-level are applied in the estimation. The cumulative effects of all the lagged variables are presented in the table.

Regarding the ratio of non-resident deposits to total liabilities, the coefficients of interaction with US monetary policy are not significant in column 5 or 6. Although it is statistically significant, the coefficient is estimated in the opposite directions in columns 7 and 8. Even when we look at the distributional effects of US monetary policy and other foreign monetary policy in loan characteristics, the estimated coefficients are mostly not significant. Again, although it is significant, the signs of the coefficients are opposite from the results of non-resident liabilities and other foreign liabilities in Table 4. Those results might suggest that international monetary transmission is likely to be channeled through wholesale funding from abroad rather than non-resident deposits. However, given that the coefficients relevant to US monetary policy were in a different direction from other foreign liabilities, the results might imply that non-resident deposits could work to buffer the effect of US monetary policy changes.

Lastly, we examine the channel of FX deposits. In the Cambodia, about 80% of FX deposits are denominated in USD. Mora (2013) empirically documented that FX deposits were a channel of US monetary policy into Mexico by testing the interaction terms of the ratio of USD deposit and US monetary policy. However, in Tables 6 and 7, we find that the coefficients of interactions of the ratio of FX deposits to total liabilities and US monetary policy are not estimated with statistical significance overall in all the columns.

All in all, our findings suggest that the international monetary transmission is likely to be channeled through wholesale funding from abroad rather than non-resident deposits or FX deposits. In other words, the effect of US monetary policy is likely to be transmitted from parent banks or associated banks in foreign countries.

Table 6: Robustness Check with Other Variables of Channel of Internal Monetary Transmission

	Z: Ratio of Non-Resident Deposit to Liabilities		Z: Ratio of FX Deposit to Liabilities	
	(1)	(2)	(3)	(4)
Σ I (i) x US Policy (t)	-0.257	-0.117		
	(0.263)	(0.516)		
Σ I (i) x Z (i, t-1) x US Policy (t)	0.814	11.268**	-0.045	0.642
	(1.392)	(5.176)	(0.303)	(1.131)
Σ Z (i, t-1)	0.254	0.304	-0.150	-0.015
	(1.124)	(1.146)	(0.648)	(0.599)
Σ Liquidity Ratio (i, t-1)	-0.717	-0.739	-0.788	-0.803
	(0.859)	(0.890)	(0.881)	(0.880)
Σ Capital Ratio (i, t-1)	-0.397	-0.076	-0.499	-0.369
	(0.753)	(0.799)	(0.976)	(0.963)
Σ Log. Total Asset (j, t-1)	0.453**	0.508***	0.371	0.373*
	(0.194)	(0.182)	(0.225)	(0.203)
Σ FDI Inflow (j, t)	-0.005	-0.005	-0.004	-0.004
	(0.004)	(0.004)	(0.003)	(0.003)
		0.667		
Σ I (i) x US MP (t) x Collateral Dummy		(0.413)		
		-1.041**		
Σ I (i) x US MP (t) x USD Dummy		(0.417)		
		0.627**		
Σ I (i) x US MP (t) x Long-term Dummy		(0.244)		
		0.047		
Σ I (i) x US MP (t) x Business Dummy		(0.247)		
		0.293		-0.556
Σ I (i) x Z (i, t-1) x US Policy (t) x Collateral Dummy		(3.060)		(0.963)
		-8.930**		-0.301
Σ I (i) x Z (i, t-1) x US Policy (t) x USD Dummy		(4.135)		(0.754)
		-3.64388		-0.233
Σ I (i) x Z (i, t-1) x US Policy (t) x Long-term Dummy		(1.928)		(0.660)
		1.276		0.536
Σ I (i) x Z (i, t-1) x US Policy (t) x Business Dummy		(2.505)		(0.686)
Time-Currency Fixed Effect	Yes	Yes	Yes	Yes
Time-Sector Fixed Effect	Yes	Yes	Yes	Yes
Time-Maturity Fixed Effect	Yes	Yes	Yes	Yes
Time- Security Fixed Effect	Yes	Yes	Yes	Yes
Bank-Sector-Currency-Maturity-Security Fixed Effect	Yes	Yes	Yes	Yes
Constant	-5.182	-6.138	-3.833	-4.024
	(3.280)	(2.981)	(4.042)	(3.684)
Number of Obseravations	4,119	4,119	4,139	4,139
R-squared	0.794	0.797	0.793	0.794

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics. ***,**, and * represent statistical significance at 1%, 5%, and 10%, respectively. The fixed-effect OLS estimation is used for each column. In order to capture the effects over one year, each model included 3 lags of each independent variable and its contemporaneous measure at k=0. The values in each column show the cumulative values of estimated coefficients of all lagged variable, and two-way clustered robust standard errors at the bank- and quarter-level are presented in parentheses. The sample period is spanned from 2013Q1-2019Q2. Z(i, t-1) represent the measure of foreign funding exposure. In columns 1-4, the ratio of non-resident deposits to total liabilities are adopted as Z(i, t-1). In columns 5-8, the ratio of FX deposits to total liabilities are adopted as Z(i, t-1). I(t) represents the treatment dummy which takes one if Z(i, t-1) is not zero. US policy (t) represents the US federal fund rate, and FC Policy (t, j) represents the monetary policy rate in banks' shareholders' home countries.

Table 7: Robustness Check with Other Variable of Channel of Internal Monetary Transmission

	Ratio of Non-Resident Deposit to Liabilit				Z: Ratio of FX Deposit to Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Σ I (i) x US Policy (t)	-0.257	-0.117	-0.321	-0.216				
	(0.263)	(0.516)	(0.340)	(0.667)				
Σ I (i) x Z (i, t-1) x US Policy (t)	0.814	11.268**	0.408	16.440***	-0.045	0.642	0.004	0.780
	(1.392)	(5.176)	(1.780)	(4.485)	(0.303)	(1.131)	(0.435)	(1.205)
Σ I (i) x OF Policy (t)			-0.001	(0.027)				
			(0.151)	(0.745)				
Σ I (i) x Z (i, t-1) x OF Policy (t)			0.566	1.989			-0.002	-0.024
			(1.276)	(5.604)			(0.210)	(0.367)
Σ Z (i, t-1)	0.254	0.304	0.759	0.356	-0.150	-0.015	-0.457	-0.189
	(1.124)	(1.146)	(1.624)	(1.914)	(0.648)	(0.599)	(0.686)	(0.643)
Σ Liquidity Ratio (i, t-1)	-0.717	-0.739	-0.691	-0.931	-0.788	-0.803	-0.775	-1.016
	(0.859)	(0.890)	(0.838)	(0.905)	(0.881)	(0.880)	(0.840)	(0.897)
Σ Capital Ratio (i, t-1)	-0.397	-0.076	-0.654	-0.354	-0.499	-0.369	-0.854	-0.331
	(0.753)	(0.799)	(0.775)	(0.786)	(0.976)	(0.963)	(1.087)	(1.034)
Σ Log. Total Asset (j, t-1)	0.453**	0.508***	0.364	0.506*	0.371	0.373*	0.233	0.385
	(0.194)	(0.182)	(0.281)	(0.283)	(0.225)	(0.203)	(0.277)	(0.254)
Σ OF Policy (j, t)	-0.005	-0.005	-0.004	-0.004	-0.004	-0.004	-0.003	-0.003
	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)	(0.004)	(0.004)
Σ FDI Inflow (j, t)			0.018	0.047			0.018	0.039
			(0.070)	(0.067)			(0.072)	(0.062)
Σ I (i) x US Policy (t) x Collateral Dummy		0.667		0.824*				
		(0.413)		(0.434)				
Σ I (i) x US Policy (t) x USD Dummy		-1.041**		-1.290***				
		(0.417)		(0.428)				
Σ I (i) x US Policy (t) x Long-term Dummy		0.627**		0.565**				
		(0.244)		(0.287)				
Σ I (i) x US Policy (t) x Business Dummy		0.047		0.299				
		(0.247)		(0.329)				
Σ I (i) x Z (i, t-1) x US Policy (t) x Collateral Dummy		0.293		-0.871		-0.556		-0.855
		(3.060)		(1.427)		0.963		(1.023)
Σ I (i) x Z (i, t-1) x US Policy (t) x USD Dummy		-8.930**		-12.515***		-0.301		-0.392
		(4.135)		(4.148)		0.754		(0.833)
Σ I (i) x Z (i, t-1) x US Policy (t) x Long-term Dummy		-3.643**		-3.525		-0.233		-0.170
		(1.928)		(2.110)		0.660		(0.862)
Σ I (i) x Z (i, t-1) x US Policy (t) x Business Dummy		1.276		-0.052		0.536		1.215
		(2.505)		(2.495)		0.686		(0.853)
Σ I (i) x OF Policy (t) x Collateral Dummy				-0.014				
				(0.624)				
Σ I (i) x OF Policy (t) x USD Dummy				0.124				
				(0.347)				
Σ I (i) x OF Policy (t) x Long-term Dummy				-0.030				
				(0.267)				
Σ I (i) x OF Policy (t) x Business Dummy				-0.339				
				(0.251)				
Σ I (i) x Z (i, t-1) x OF Policy (t) x Collateral Dummy				-5.338				-0.822*
				(5.142)				(0.442)
Σ I (i) x Z (i, t-1) x OF Policy (t) x USD Dummy				1.589				0.819**
				(1.873)				(0.373)
Σ I (i) x Z (i, t-1) x OF Policy (t) x Long-term Dummy				1.586				0.206
				(1.709)				(0.434)
Σ I (i) x Z (i, t-1) x OF Policy (t) x Business Dummy				1.714				-0.481
				(2.067)				(0.305)

Table 7: Robustness Check with Other Variable of Channel of Internal Monetary Transmission (Cont.)

	Ratio of Non-Resident Deposit to Liabilit				Z: Ratio of FX Deposit to Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time-Currency Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Maturity Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time- Security Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Sector-Currency-Maturity-Security Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-5.182	-6.138	-3.796	-5.914	-3.833	-4.024	-1.376	-4.033
	(3.280)	(2.981)	(4.785)	(4.771)	(4.042)	(3.684)	(4.993)	(4.641)
Number of Obseravations	4,119	4,119	3,902	3,902	4,139	4,139	3,922	3,922
R-squared	0.794	0.797	0.794	0.798	0.793	0.794	0.793	0.796

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics. ***,**, and * represent statistical significance at 1%, 5%, and 10%, respectively. The fixed-effect OLS estimation is used for each column. In order to capture the effects over one year, each model included 3 lags of each independent variable and its contemporaneous measure at k=0. The values in each column show the cumulative values of estimated coefficients of all lagged variables, and two-way clustered robust standard errors at the bank- and quarter-level are presented in parentheses. The sample period spanned from 2013Q1-2019Q2. Z(i, t-1) represent the measure of foreign funding exposure. In columns 1-4, the ratio of non-resident deposits to total liabilities are adopted as Z(i, t-1). In columns 5-8, the ratio of FX deposits to total liabilities are adopted as Z(i, t-1). I(t) represents the treatment dummy which takes one if Z(i, t-1) is not zero. US policy (t) represents the US federal fund rate, and FC Policy (t, j) represents the monetary policy rate in banks' shareholders' home countries.

4.4 Sensitivity Analysis of Funding Flows to Foreign Monetary Policy

To confirm which funding sources are important to channel monetary policy, we further examined the following equation using bank-level data.

$$\Delta ln(\ Funding\ \ Flow_{i,j,t}) = \alpha + \Sigma_{k=0}^{3}\gamma_{1k}Z_{i,t-k-1}\cdot USPolicy_{t-k} + \Sigma_{k=0}^{3}\gamma_{2k}Z_{i,t-k-1}\cdot FC\ \ Policy_{j,t-k} + \Sigma_{k=0}^{3}\gamma_{3k}BankControls_{i,t-k-1} + \Sigma_{k=0}^{3}\gamma_{4k}FDIflow_{j,t-k} + \nu_i + \tau_t + \epsilon_{i,j,t} \quad (4)$$

Where $\Delta ln(Funding\ \ Flow_{i,j,t})$ is the log growth of (i) non-resident liabilities, (ii) resident deposits, and (iii) equity for bank *i* with a majority of owners from country *j* at time *t*.[16]

[16] In our data, it is not possible to separate equity finance according to foreign or domestic sources. Thus, we just examine the correlation between the gross paid-up capital and monetary policy rates of foreign countries.

Each specification included 3 lags of each independent variable and its contemporaneous measure at k=0, in order to capture the effects over one year. In this analysis, we examined the coefficient of US monetary and other foreign countries' monetary policies. The results are presented in Table 8. We estimated the models in the fixed-effect OLS estimation. In the table, we presented the cumulative effects of all lags for each variable. The standard errors are calculated with a cluster robust method at the bank-level.

Table 8: Sensitivity Analysis of Funding Flows to Foreign Monetary Policy

	Log Growth of Non-Resident Liabilities	Log Growth of Resident Deposits	Log Growth of Equity
Σ Ratio of Non-Resident Funding (i, t-1) x US Policy (t)	-0.493*	-0.083	-0.005
	(0.247)	(0.086)	(0.031)
Σ Ratio of Non-Resident Funding (i, t-1) x FC Policy(t)	-0.208	0.077	-0.044*
	(0.188)	(0.069)	(0.025)
Σ Ratio of Non-Resident Funding (i, t-1)	-1.062**	0.273**	-0.023
	(0.468)	(0.132)	(0.042)
Σ Liquidity Ratio (i, t-1)	-0.167	-0.128	-0.077*
	(0.317)	(0.131)	(0.040)
Σ Capital Ratio (i, t-1)	0.567	0.517***	-0.081
	(0.381)	(0.174)	(0.069)
Σ Log. Total Asset (j, t-1)	0.100	-0.081*	-0.016
	(0.138)	(0.047)	(0.017)
Σ FC Policy (j, t)	(0.011)	(-0.004)	(0.006)
	(0.058)	(0.014)	(0.005)
Σ Capital inFlow (j, t)	0.001	-0.001	0.000
	(0.001)	(0.001)	(0.000)
Time Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Constant	-0.499	1.377*	0.294
	(0.828)	(0.780)	(0.283)
Number of Observations	646	717	701
R-Squared Adjusted	0.155	0.213	0.217

Source: ***,**, and * represent statistical significance at 1%, 5%, and 10%, respectively. The fixed-effect estimation is used for each column. In order to capture the effects over one year, each specification included 4 lags of each independent variable and its contemporaneous measure at k=0. The values in each column show the cumulative values of estimated coefficients of all lagged variable, and the clustered robust standard errors at bank-level. The values in each cell show the cumulative values of estimated coefficients of all lagged variables. The sample period spanned from 2013Q1-2019Q2.

We find that interactions with US monetary policy rates are significantly and negatively associated only with the growth of non-resident liabilities at 10% significance. However, of the results have no statistical significance in other funding growth. This supports our view that non-resident liabilities are the key factor in shaping the channel of international monetary transmission in Cambodia. The shareholders' home country's monetary policy is not statistically significant in column 1, although the sign of the coefficient is negative. In column 3, the shareholders' home country's monetary policy is negative at 10% significance, although the point estimation is lower than in column 1.

However, as De Haas and Lelyveld (2010) empirically showed, the economic conditions within shareholders' home countries are also factors behind the fluctuation of funding costs for banks. The results could be subject to omitted variable biases particularly in the correlation between monetary policy and funding flows. However, the investigation of the exact factors influencing funding flows are outside the scope of our study.

5. Conclusion

Globalization in the banking sector and an increase in foreign funding flows increase the likelihood of financial contagion and vulnerability to external shocks within the banking sector. In particular, US monetary policy plays a role in increasing or decreasing the cost of foreign funding through international money markets, which are sometimes dominant funding sources for banks in developing countries.

In our study, we investigated the international monetary transmission of US and other foreign countries' monetary policy during 2013Q1-2019Q2 into Cambodian commercial banks through the channel of non-resident liabilities. Specifically, we exploit unique data that allow us to measure the amounts of exposure to changes in foreign funding flows and also investigate in detail amounts of newly disbursed loans by loan characteristics on a quarterly basis. Our paper

provides empirical evidence that US monetary policy is transmitted through non-resident liabilities into bank domestic lending in Cambodia, and the funding from foreign banks, such as parent companies and associated banks, is a particularly important channel. We also find that the monetary policies of banks' shareholders' home countries are not strongly associated with Cambodian banks' domestic lending compared to US monetary policy, although there was a distributional effect on some specific loan types, such as USD and long-term loans. Furthermore, we found that US monetary policy also affected allocations of domestic bank loans. Specifically, the increases in the cost of funding from abroad facilitates the provision of USD currency loans, secured loans, long-term loans, and consumer loans. This might suggest that foreign monetary policy led Cambodian banks to shift loan allocations to lower risk sectors and clients.

The Cambodian financial sector is still underdeveloped and vulnerable to political shocks, and the capacity to serve as the lender of last resort is limited due to dollarization, while non-resident liabilities comprise substantial shares of the banking sector in the last decade. It may be worth noting that diversifying the ownership of foreign affiliation might be one strategy to stabilize the financial sector. This is needed not to only permit banks to collect funds from abroad, but also to make them commit to collecting domestic funds. In the case of Cambodia, bank ownership is concentrated in neighboring countries, some of which are still among developed countries, with financial systems and economies still vulnerable to shocks. In addition, most firms are strongly dependent on the funding from abroad. Further diversification of bank ownership and a commitment from foreign banks to collect domestic funds is necessary.

Looking at de-dollarization from the policy-making view, a better understanding of monetary transmission is important in order to properly control the supply of local and foreign currencies through banks. In the literature of dollarization, Ongena et al. (2016) find that foreign currency lending was less likely to be affected by domestic monetary policy in a dollarized economy, and rather foreign monetary policy has an impact on foreign currency lending. In the case of Cambodia, 90% of bank lending is in USD. Thus, the domestic monetary policy is less

likely to affect the bank supply. However, our study revealed that the effects of foreign monetary policy is likely to be channeled through foreign funding exposure.This indicates that banks in Cambodia could mitigate the effect of foreign monetary policy by collecting domestic funds, and governments could be required to support that funding through deposits for those banks.

Furthermore, our finding that the rising costs of funding from abroad led to increases in USD lending has implications for policies that promote the local currency. Since collecting local currency deposits are costly in the sense that interest rates on local deposits are higher than USD deposits, the availability of cheaper foreign funds might affect lending in local currency. Banks can swap the local currency with USD through the currency swap operation by National Bank of Cambodia, which is called as "local currency collateralized provision operation." In this operation, banks can obtain local currency liquidity in exchange for USD liquidity as collateral. The increases in funding costs from abroad might have decreased banks' USD funds for this operation.

There are limitations on our analysis. Our study revealed that there were distributional effects of US monetary policy across types of loans, for example, between business loans and consumer loans. However, due to data limitations, our study did not identify what types of firms and consumers were particularly affected by the policy. An increase in the cost of funding could have a larger impact on lending to SMEs since the costs of SME lending, such as monitoring costs, are relatively higher than lending to large firms. If this is the case, the distributional impact across firm sizes could affect the structure of an industry, and pose a long-term effect in the industry. Therefore, an investigation into this heterogeneity in the monetary policy effect among borrowers could have important implications from the perspectives of industrial organization and policy-making. Future study is required to investigate the distributional effects across borrowers in detail by employing granular data at the borrower-level.

In addition, the determinants of funding costs and funding flows into Cambodian banks are not sufficiently investigated by our study. Apart from monetary policies, other economic conditions

within shareholders' home countries and the US could be factors behind funding costs and the fluctuations of funding flows. Such omitted variable biases could cause the insignificance in the correlation between monetary policy and bank lending. Apart from shareholders' countries of origin, it is also necessary to identify the exact origins of funding. In fact, the sources of foreign funding are not limited to parent banks, and there is an increasing number of investments into Cambodian banks due to the high interest rates in the Cambodian financial market. However, the investigation of funding flows is outside the scope of our study. Future study should consider recent capital inflows into the banking sector of developing countries.

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Appendix Table 1: Definition of Variables

Variable	Definition
$Loans_{i,s,b,c,m,t}$	The amounts of loans disbursed in quarter *t* by bank *i*. Subscript s stands for whether loans are secured or unsecured. Subscript c stands for whether loans are in USD or local currency. Subscript b stands for whether loans are for business loans or consumer loans. Subscript m stands for whether maturity of loans are more than one year or less than one year. Data is provided from National Bank of Cambodia.
Ratio of Other Foreign Liabilities$_{it}$	The ratio of other foreign liabilities to total liabilities. The foreign liabilities are calculated as non-resident liabilities minus non-resident deposits. Data is from National Bank of Cambodia.
Ratio of Non-Resodent Liabilities$_{i,t}$	Bank *i*'s ratio of non-resident liabilities to total liabilities at quarter *t*. Non-resident liabilities are the sum of non-resident deposits and wholesale funding from abroad. Data is from National Bank of Cambodia.
Capital Ratio$_{i,t}$	Bank *i*'s capital-to-asset ratio at quarter *t*. Data is from National Bank of Cambodia.
Liquidity Ratio$_{i,t}$	Bank *i*'s ratio of liquid asset to total asset at quarter *t*. Data is from National Bank of Cambodia.
US Policy$_t$	US federal fund rate at quarter *t*. Data source is International Financial Statistics.
OF Policy$_{j,t}$	Monetary policy rate in bank's major shareholders' home country *j*. Data source is International Financial Statistics.
FDI inflow$_{j,t}$	The amounts of FDI from country *j* into Cambodia at quarter *t*. We standardize the rate by subtracting mean and dividing by standard errors of the monetary policy. Data is provided from Council of Development in Cambodia
Ratio of Non-Resident Deposit$_{it}$	The ratio of non-resident deposits to total liabilities. Data is from National Bank of Cambodia.
Ratio of FX Deposit$_{it}$	The ratio of FX deposits to total liabilities. FX deposits are composed of foreign currency denominated resident deposits and non-resident deposits. Data is from National Bank of Cambodia.
Log. Growths of Non-Resident Liabilities$_{i,t}$	Logarithm of growths of non-resident liabilities (log(*Non-Resident Liabilities*$_{i,t}$ / *Non-Resident Liabilities*$_{i,t-1}$) Data is from National Bank of Cambodia.
Log. Growths of Equity$_{i,t}$	Logarithm of growths of paid-up capital (log(*equity*$_{i,t}$/ *equity*$_{i,t-1}$). Data is from National Bank of Cambodia.
Log. Growths of Resident Deposit$_{i,t}$	Logarithm of growths of resident deposit (log(*Resident Deposit*$_{i,t}$ / *Resident Deposit*$_{i,t-1}$). Data is from National Bank of Cambodia.

Appendix Table 2: Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Ratio of Non-resident Liablities	1.00											
(2) Capital Ratio	-0.22	1.00										
(3) Liquidity Ratio	-0.22	0.20	1.00									
(4) Log. Total Asset	-0.01	-0.72	-0.05	1.00								
(5) Total Assets	-0.13	-0.33	0.00	0.77	1.00							
(6) Capital Flow	0.28	-0.02	0.14	0.04	-0.11	1.00						
(7) Log. Growth of Non-Resident Liabilities	0.01	-0.07	0.01	0.14	0.10	0.08	1.00					
(8) Log. Growth of Resident Deposits	-0.07	0.05	0.09	-0.06	-0.04	0.00	0.02	1.00				
(9) Log. Growth of Equity	0.06	-0.03	-0.02	0.01	0.01	-0.04	0.01	0.00	1.00			
(10) Ratio of FX Deposit to Liabilities	-0.42	-0.59	0.03	0.58	0.31	-0.14	0.04	0.02	-0.01	1.00		
(11) Ratio of Non-Resident Deposits	0.93	-0.18	-0.15	-0.02	-0.10	0.27	0.01	-0.06	0.06	-0.52	1.00	
(12) Ratio of Other Foreign Liabilities	0.25	-0.13	-0.19	0.03	-0.10	0.06	0.01	-0.04	0.02	0.24	-0.13	1.00

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics

Appendix Table 3: Estimation Results (Step-wise)

	Z: Ratio Non-Resident Liabilities to Total Liabilities				Z: Ratio of Foreign Wholesale Borrowing to Total Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Σ I (i) x US Policy (t)	-1.997***	-1.520*	-0.940***	-0.696***	-1.573***	-3.811***	-0.818***	-0.215
	(0.483)	(0.817)	(0.303)	(0.267)	(0.352)	(1.474)	(0.303)	(0.184)
Σ I (i) x Z (i, t-1) x US Policy (t)	-4.699***	-6.302*	-1.350*	-0.439	-6.600***	-7.683***	-2.495**	-1.359*
	(1.458)	(3.540)	(0.728)	(0.565)	(1.584)	(2.142)	(1.097)	(0.775)
Σ I (i) x OF Policy (t)	0.491***	-1.047*	0.088	0.052	0.576**	-0.538***	-0.050	0.043
	(0.183)	(0.546)	(0.151)	(0.154)	(0.251)	(0.192)	(0.165)	(0.152)
Σ I (i) x Z (i, t-1) x OF Policy (t)	-0.637	3.055	-1.067***	0.226	0.388	0.854	-0.656*	0.365
	(0.945)	(2.400)	(0.433)	(0.515)	(0.689)	(1.703)	(0.357)	(0.470)
Σ Z (i, t-1)	-0.167	-0.265	-0.313	-0.378	0.228	0.102	-0.023	-0.019
	(0.518)	(0.522)	(0.495)	(0.476)	(0.422)	(0.461)	(0.430)	(0.404)
Σ Liquidity Ratio (i, t-1)	-0.862	-0.698	-0.455	-0.482	-0.921	-0.614	-0.322	-0.532
	(0.845)	(0.800)	(0.806)	(0.786)	(0.839)	(0.801)	(0.808)	(0.789)
Σ Capital Ratio (i, t-1)	0.929	-0.795	-0.399	-0.598	0.705	-1.020*	-0.509	-0.732
	(0.974)	(0.625)	(0.718)	(0.745)	(0.929)	(0.608)	(0.674)	(0.720)
Σ Log. Total Asset (j, t-1)	0.828***	0.387	0.508*	0.507*	0.734**	0.253	0.4498	0.421
	(0.324)	(0.250)	(0.275)	(0.281)	(0.309)	(0.248)	(0.267)	(0.270)
Σ OF Policy (j, t)	-0.004	-0.004	-0.003	-0.004	-0.000	-0.001	0.000	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Σ FDI Inflow (j, t)	0.059	-0.009	0.016	0.019	0.042	-0.003	0.024	0.019
	(0.069)	(0.065)	(0.067)	(0.068)	(0.070)	(0.066)	(0.069)	(0.070)
Σ I (i) x US Policy (t) x Collateral Dummy	1.638***				1.427***			
	(0.500)				(0.421)			
Σ I (i) x US Policy (t) x USD Dummy		0.888				3.437**		
		(0.730)				(1.448)		
Σ I (i) x US Policy (t) x Long-term Dummy							0.784**	
			0.571**				(0.343)	
Σ I (i) x US Policy (t) x Business Dummy			(0.250)					-0.271
				0.116				(0.253)
Σ I (i) x Z (i, t-1) x US Policy (t) x Collateral Dummy	3.972***			(0.327)	5.207***			
	(1.356)				(1.323)			
Σ I (i) x Z (i, t-1) x US Policy (t) x USD Dummy		5.192				6.008***		
		(3.564)				(2.195)		
Σ I (i) x Z (i, t-1) x US Policy (t) x Long-term Dummy							0.979	
			0.243				(1.158)	
Σ I (i) x Z (i, t-1) x US Policy (t) x Business Dummy			(0.911)					-1.098
				-1.705**				(0.866)
				(0.813)	-0.684**			
Σ I (i) x OF Policy (t) x Collateral Dummy	-0.579***				(0.263)			
	(0.224)					0.548***		
Σ I (i) x OF Policy (t) x USD Dummy		1.095**				(0.179)		
		(0.547)					0.011	
Σ I (i) x OF Policy (t) x Long-term Dummy			-0.143				(0.231)	
			(0.227)					-0.242
Σ I (i) x OF Policy (t) x Business Dummy				-0.198				(0.202)
				(0.223)				
Σ I (i) x Z (i, t-1) x OF Policy (t) x Collateral Dummy	0.568				-0.317			
	(0.969)				(0.956)			
Σ I (i) x Z (i, t-1) x OF Policy (t) x USD Dummy		-3.210				-0.894		
		(2.546)				(1.851)		
Σ I (i) x Z (i, t-1) x OF Policy (t) x Long-term Dummy			1.333***				0.885	
			(0.478)				(0.566)	
Σ I (i) x Z (i, t-1) x OF Policy (t) x Business Dummy				-0.715				-0.787
				(0.541)				(0.564)

Appendix Table 3: Estimation Results (Step-wise) (Cont.)

	Z: Ratio Non-Resident Liabilities to Total Liabilities				Z: Ratio of Foreign Wholesale Borrowing to Total Liabilities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time-Currency Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Maturity Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time- Security Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Sector-Currency-Maturity-Security Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-10.982	-3.872	-5.965	-5.959	-9.434	-1.494	-5.071	-4.590
	(5.469)	(4.250)	(4.663)	(4.776)	(5.158)	(4.207)	(4.469)	4.561
Number of Obseravations	3,959.000	3,959.000	3,959.000	3,959.000	3,902.000	3,902.000	3,902.000	3,902.000
R-squared	0.796	0.793	0.795	0.794	0.801	0.797	0.798	0.797

Source: Author's calculations using data of loan disbursements and balance sheets of Cambodian commercial banks provided by National Bank of Cambodia, data from financial statements of each commercial banks, and data from the International Financial Statistics. ***,**, and * represent statistical significance at 1%, 5%, and 10%, respectively. The fixed-effect OLS estimation is used for each column. In order to capture the effects over one year, each model included 3 lags of each independent variable and its contemporaneous measure at k=0. The values in each column show the cumulative values of estimated coefficients of all lagged variables, and two-way clustered robust standard errors at the bank- and quarter-level is presented in parentheses. The sample period spanned from 2013Q1-2019Q2. Z(i, t-1) represent the measure of foreign funding exposure. In columns 1-4, the ratio of non-resident liabilities to total liabilities are adopted as Z(i, t-1). In columns 5-8, the ratio of other liabilities to total liabilities are adopted as Z(i, t-1). I(t) represents the treatment dummy which takes one if Z(i, t-1) is not zero. US policy (t) represents the US federal fund rate, and FC Policy (t, j) represents the monetary policy rate in banks' shareholders' home countries.

Abstruct (in Japanese)

要約

開発途上国の銀行は外国からの資金に高く依存する傾向があり、そのような外部資金への依存は外国の金融政策の影響を受けやすくなるといった脆弱性を銀行セクターにもたらすことが考えられる。特に、海外の政策金利の増減は金融機関の資本コストの変化を通じて、金融機関の貸出行動に影響を与えることが考えられる。本稿では、2013 年第一四半期から 2019 年第二四半期までの銀行の新規貸出とバランスシートのデータを用いて米国政策金利の変更やその他の外国の金融政策の変更のカンボジアの銀行貸出への波及効果を検証した。カンボジアは東南アジアでは最も発展が遅れている国の一つであり、金融セクターが高度にドル化し、資本移動の制約がない。このような環境は、海外の金融ショックが銀行の国内貸出を通じて、カンボジア経済に影響を及ぼしやすいと考えられる。

分析の結果、外国からの資金に依存している銀行ほど 2015 年第四四半期以降の米国金利の上昇に対し、貸出を減少させる傾向があることが示された。これは、米国の政策金利の上昇に応じて海外からの資本のコストが上昇したため、それに依存していた銀行が貸出を減らさざるを得なくなったためと考えられる。また、分析では、政策金利の上昇は新規貸出の配分にも影響を与えていたこともわかった。特に、米国金利上昇に対し、米国ドル建て貸出、消費者向け貸出、担保付貸出の割合が増える傾向にあることがわかった。これは、資本コストの上昇に対し、銀行がリスクのより低い貸出へと貸出行動を変えていたことを示す結果であると考えられる。以上の結果に関して、米国金利の変化に関しては様々な分析モデルで頑健な結果が得られたが、銀行の主要な株主の母国の金融政策に関しては頑健な結果が得られなかった。つまり、カンボジアのような高度にドル化した開発途上国では、米国政策金利の動向が国内のマクロ経済の安定性に影響を与える重要なファクターであることが示唆される結果であった。

キーワード: 銀行貸出チャネル、国際的な金融政策効果の波及、資本流入、開発途上国、ドル化、カンボジア

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