Do Banks Hedge Their Return on Assets from Monetary Policy Shocks? *

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This version: August 29, 2019

Abstract

Using bank-level data from Mexico, this paper shows that banks insulate their return on assets (ROA) from monetary policy changes using different strategies. The ROA components of some banks are insensitive to changes in monetary policy, especially their net interest margin (NIM) since they match their interest income and expenses. Meanwhile, other banks offset changes in their NIM with other ROA components. The strategy implemented depends on the charter (domestic or foreign) and business model. For example, the largest banks do not match their interest income and expenses. Subsidiaries of foreign banks, however, are closer to matching than domestic banks.

Keywords: Monetary policy, bank profitability, deposits channel.

JEL Classification: E43, E52, G21.

*I am particularly grateful to Alberto Romero for insightful discussions and feedback. I also thank Carlos Cañón, Mariela Dal Borgo, Jorge Luis García, Calixto López-Castañón, Ana Mier, Rafael Morales and participants in the seminars of the Financial Stability Division at Banco de México for their helpful comments. All remaining errors are mine.

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1 Introduction

Bank profitability is key for the proper functioning and stability of the banking system. It allows banks to build capital internally, which is essential to provide credit and absorb shocks. It is thus important for the transmission of monetary policy (Peek and Rosengren, 2013) and for financial stability (Dell'Ariccia, Laeven, and Suarez, 2017). Through its effects on bank profitability, monetary policy can therefore influence the soundness of the banking system in particular and the stability of the financial system in general. This paper studies the effects of changes in the monetary policy rate and in the slope of the yield curve on the profitability of banks measured by the return on assets (ROA) and its components.[1]

The analysis uses bank-level data from Mexico. Its experience is relevant to the analysis for several reasons. Most countries report information about their banks quarterly. However, Mexican authorities require banks to provide granular data every month. Unlike the banking systems in advanced countries in which is common to see thousands of banks operating, Mexico has a relatively small number of banks but the heterogeneity in their business models facilitates different classifications. Third, not only there is a large presence of foreign banks in the country, they are subject to the same regulation as domestic banks because they can only operate through subsidiaries.[2] Finally, monetary policy in the country has not been constrained by the zero lower bound (ZLB) so concerns about the non-linear relationship between monetary policy and bank profitability at low interest rates (Claessens, Coleman, and Donnelly, 2018) are minimized. The analysis leverages on these characteristics.

I show that banks insulate their ROA from monetary policy changes. Two explanations have been proposed in the literature. First, the ROA components are insensitive, especially the net interest margin (NIM). According to the deposits channel of monetary policy (Drechsler, Savov, and Schnabl, 2017), banks match their interest income to their

[1] Some papers, focusing on advanced economies, use stock market returns because they provide market-based expectations on future profitability. In emerging markets, however, it is less common for banks to be listed in stock exchanges.

[2] In Mexico, foreign banks are not allowed to operate through branches.

interest expenses so that their NIM is unaffected. Second, the ROA components are sensitive but banks offset the changes in their NIM with other ROA components (Altavilla, Boucinha, and Peydró, 2018). The main finding of the paper is that these strategies are not mutually exclusive.

To understand the mechanisms through which bank profitability responds to monetary policy, it is necessary to not only study the effects on ROA but on its components and subcomponents. Such step-by-step disaggregation shows that bank-specific characteristics are important to understand the transmission. In particular, it is key to distinguish banks by business model and whether a bank is domestic or foreign. Unlike Drechsler et al. (2018) who use U.S. data, I find no evidence of a deposits channel in the aggregate but I find that some groups of banks do match their interest income to their interest expenses. Importantly, the largest banks do not engage in matching as would be expected under the deposits channel, which might be reflecting characteristics in emerging markets. In addition, within the group of largest banks, subsidiaries are closer to matching than domestic banks.

This paper also considers decomposing the slope of the yield curve when analyzing its effects on bank profitability. Since the yield curve can be decomposed into the expected future short-term interest rate and a term premium at different maturities (Cochrane and Piazzesi, 2008), the slope can be decomposed into the spread in the expectation part and the spread in the term premium. As with changes in the policy rate, I find no effects on banks' profitability due to changes in the slope of the yield curve or its components. Since the unconventional monetary policy tools undertaken at the ZLB work mainly through their influence in the yield curve (Kuttner, 2018), the null effect is consistent with the literature as it reflects that Mexico has not implemented such tools. Notwithstanding, the proposed decomposition of the slope might be relevant when studying the banking systems of advanced countries.

The rest of the paper is structured as follows. The next section reviews the literature. Section 3 describes the data. Section 4 presents the econometric models used in the analysis and discusses the results. The last section concludes.

2 Literature Review

Theoretically, the effects of monetary policy on bank profitability are ambiguous. Away from the ZLB, expansionary monetary policy is usually conducted by lowering the policy rate. On the one hand, loose financial conditions improve the quality of the credit pool, which ultimately benefits banks' ROA. On the other hand, they may compress the net interest margin when lending interest rates are more sensitive than borrowing rates, which translates into a lower ROA.

At the ZLB, unconventional monetary policy tools ultimately have an effect on the shape of the yield curve. As with the policy rate, the effects of a flatter or a steeper yield curve on the profitability of banks are also ambiguous. For example, a steepening of the yield curve has a positive effect on their profitability through maturity transformation because the spread between lending and borrowing interest rates widens, which increases their NIMs. At the same time, a steep yield curve hurts bank profitability because of losses in existing long-term assets (which may have been granted at a lower interest rate).

This theoretical ambiguity gives relevance to the topic from an empirical point of view. In fact, the topic has recently attracted a lot of attention in the literature, which has focused on advanced countries due to the potential side effects on profitability of very low interest rates for prolonged periods of time. However, the evidence on the effects of monetary policy on bank profitability is mixed.[3]

The empirical studies are not directly comparable because they analyze different sample periods, countries and profitability measures. Nevertheless, they exemplify the variety of views in the literature.

English, Van den Heuvel, and Zakrajšek (2018) find that before the Great Recession an expansionary monetary policy increased the stock prices of U.S. banks.[4] By contrast, Claessens et al. (2018) find that, for a large sample of banks from different countries, a lower interest rate decreases the NIM of banks. The effect intensifies at very low interest rates,[5] providing evidence of a non-linear relationship between monetary policy and bank

[3] English et al. (2018) attribute the mixed results precisely to the ambiguity of the theoretical effects.
[4] As mentioned before, stock prices can be considered market-based expectations of future profitability.
[5] Note that the dataset of Claessens et al. (2018) oversample large banks which are particularly affected

profitability.

Using high-frequency-identified monetary policy shocks, Ampudia and Van den Heuvel (2018) and Yuan (2019) find evidence of a reversal effect of monetary policy on the stock prices of banks from Europe and the U.S., respectively. Accordingly, before the Great Recession banks' stock prices increased following an expansionary monetary policy shock. However, their stock prices reacted in the opposite direction after the Great Recession, that is they decreased in response to an expansionary shock.

In stark contrast to the previous studies, Altavilla et al. (2018) and Drechsler et al. (2018) conclude that there is no effect on the ROA of banks from monetary policy changes. On the one hand, Drechsler et al. (2018) show that although the stock prices of banks do respond to monetary policy, they react no differently from the stock prices of non-bank firms. On the other hand, Altavilla et al. (2018) show that after controlling for the expectations of relevant macroeconomic variables, the monetary policy effect on ROA disappears. However, even though both papers arrive at the same conclusion, they differ in the mechanism.

Altavilla et al. (2018) argue that there is no overall effect of monetary policy on the profitability of banks because although the components of the ROA do react they do so in a way that the changes offset among them. Drechsler et al. (2018), on the other hand, argue that there is no effect because the components of the ROA are insensitive to changes in interest rates, especially the NIM. In particular, they show that the NIM does not react to changes in monetary policy because banks adjust their interest income to match the changes in their interest expenses. By isolating their NIM in this way, banks therefore hedge their interest rate risk. This is what Drechsler et al. (2017) referred to as the deposits channel of monetary policy.

In line with Altavilla et al. (2018) and Drechsler et al. (2018), I find that banks insulate their ROA from monetary policy changes. The main contribution of the paper is to show that although the two mechanisms seem mutually exclusive, they are not because banks within a banking system use different strategies to insulate their ROAs.

by very low rates in part due to regulatory changes. This might explain why the main results disappear when they include time fixed effects.

3 Data

This section describes the variables used in the study as well as their sources. Bank-specific variables are described first, followed by macroeconomic variables.

In Mexico, banks are required to file a variety of supervisory reports every month. This allows to conduct the study at a higher frequency than previous studies, most of which use quarterly data. The sample period goes from January 2001 to May 2019.

The analysis only considers commercial banks. Banks with less than 5 years of available data are removed from the sample. These include recently created banks[6] and those that went out of business within 5 years of existence[7] (either because they suspended operations or because they merged with another bank).

3.1 Bank-Specific Variables

Bank balance-sheet data comes from a publicly available dataset known as *Base Pública*, which is compiled by the bank supervisory agency (CNBV, *Comisión Nacional Bancaria y de Valores*) based on monthly data reported by commercial banks. The dataset contains historical information on the balance sheet and income statements of banks. In particular, the dataset contains the ROA, its components and subcomponents as well as many other bank-specific characteristics.

The ROA is a ratio that indicates how much profits a firm can generate relative to its assets. For banks, the ROA can be decomposed into income, provisions for loan losses (PROV) and operating costs (OC). Banks generate income from two sources, one of which involves interest-bearing activities. Net interest income, also known as NIM (net interest margin), is obtained by subtracting interest expenses (IE) from the interest income (II). Non-interest income (NNI) is the sum of net fees and trading income. In this paper, I refer to NIM, NNI, PROV and OC as the ROA components, and to II and IE as its

[6] Banco S3, Bank of China, Bank One, Finterra, ICBC, Keb Hana México, Mizuho Bank, Pagatodo, Sabadell, Shinhan.

[7] Atlántico was liquidated, Banco J.P. Morgan merged with J.P. Morgan, BankBoston merged with Bank of America Merrill Lynch, Banpaís and Mercantil del Norte merged with Banorte, Bicentenario's license was revoked, Citibank merged with Citibanamex, Deuno stopped operating, HSBC Bank merged with HSBC, Serfín merged with Santander.

subcomponents.

There are different ways to compute the ROA. One option is to annualize monthly profits and divide them by the value of assets in the respective month. The CNBV uses a different methodology. To account for seasonality, the CNBV divides the sum of profits over the past twelve months by the assets averaged over the same period. Since it is widely used by practitioners, I use the ROA as computed by the CNBV for comparison purposes. The components of the ROA, however, are used as annualized figures divided by the value of assets in the respective month.[8]

In the analysis, different ratios are used to control for bank-specific characteristics. These ratios control for the extent to which banks engage in lending (loans-to-assets ratio), the extent to which they finance their operations from deposits (deposits-to-liabilities ratio), their capitalization (equity-to-assets ratio), how efficiently they operate (costs-to-income ratio) and the performance of their loan portfolio (non-performing loans-to-total loans or NPL ratio).

For the whole banking system, figure 1 shows the evolution of both the ROA components and the ratios used as controls. As can be seen in panel a, the ROA of the banking system fluctuates around 1.4%. The NIM is higher than the NNI on average (4.4% vs 2%). Also note that operating costs are substantial, while provisions are relatively low on average(3.6% vs 1.08%). Panel b shows that the loans-to-assets ratio has been increasing since 2005 and that, on average, less than half of the assets of the banking system are loans granted by banks. On the other side of the balance sheet, the deposits-to-liabilities ratio indicates that, on average, slightly more than half of the liabilities of the system comes from deposits. Finally, the system as a whole is, on average, well capitalized (with an equity-to-assets ratio of 9.6%) and relatively efficient (with a costs-to-income ratio of 55% and an NPL ratio of 3%).

3.2 Monetary Policy Variables

The key variables in the analysis are the policy rate and the slope of the yield curve.

[8]Robustness checks (not reported) use the same methodology for all the variables.

Note that accounting for the level and the slope of the curve essentially captures the stance of monetary policy in the country.[9] The sample period includes both tightening and loosening cycles as well as inversions, flattening and steepening of the yield curve.

The monetary policy rate can be obtained from the policy rate statistics of the Bank for International Settlements. To account for the actual financial conditions in the market, however, I use the interest rate of the Mexican Treasury 1-month zero-coupon bond (Cetes 28D) reported by Banco de México as a proxy for the monetary policy rate.[10] For the slope of the yield curve, I use the spread between the 10-year and the 3-month implied sovereign yields reported by Bloomberg.

3.3 Macroeconomic Variables

The macroeconomic controls include global and domestic variables. The Cboe volatility index (VIX) is often used as a measure of global risk aversion and economic uncertainty, it is thus included as a proxy for global financial conditions. The end-of-month values of the VIX are obtained from Bloomberg.

The domestic variables of interest are those reflecting local economic conditions, like the aggregate price level and economic activity. The annual percentage change in the consumer price index reported by the statistical agency (Inegi, *Instituto Nacional de Estadística y Geografía*) is used as a measure of inflation. Although real gross domestic product (GDP) is the natural variable to measure economic activity, it is reported on a quarterly basis. Fortunately, IGAE (*Índice Global de Actividad Económica*) is an index created by Inegi to track production in different sectors of the economy with a monthly frequency. In fact, this index tracks part of the information used to compute the actual GDP figures. Furthermore, from the last quarter of 1999 to the first quarter of 2019, the correlation of the annual growth of GDP and that of IGAE is 0.96. Therefore, I use the year-on-year growth of IGAE as the monthly series of economic activity. Finally, the exchange rate (the value of the local currency per U.S. dollar) is the last domestic

[9] A third factor is the curvature (a 'hump' between the short and long ends of the curve) but it plays a minor role empirically.

[10] The correlation between the two variables is above 0.99.

variable considered. Its end-of-month values are obtained from Bloomberg and it is used in percentage changes calculated as the log difference of the series.[11]

3.3.1 Expectations

Since monetary policy is endogenous to both current and expected macroeconomic conditions, Altavilla et al. (2018) show the importance of controlling for the one-year ahead expectations of macroeconomic variables in order to avoid omitted variable bias. For this reason, I use data from a monthly survey (EEEESP) conducted by Banco de México among professional forecasters about their expectations for different macroeconomic variables.[12]

The survey includes questions about one-year ahead expectations but they were introduced recently and at different points in time, depending on the variable. However, questions about end-of-year expectations for the current and the subsequent year are available since the beginning of the sample. I use this information to construct longer series for the one-year ahead expectations as follows. At every month, the fraction of the remaining part of the current year and the fraction of the subsequent year until the corresponding month are multiplied by the respective end-of-year expectations of each variable; the sum of both products is the one-year ahead expectation.[13] I do this for inflation, the exchange rate, GDP and Cetes 28D. Figure 2.a shows the performance of the interpolation against the actual one-year ahead expectations reported in the survey for the overlapping periods in which the latter expectations are available. As can be seen, the interpolation tracks the actual series very closely for three out of the four variables, and decently for the remaining one.

Since there is no variable about economic activity with a monthly frequency and for which expectations are reported monthly, I use the year-on-year growth of IGAE as the

[11]The expectation for the exchange rate, obtained as explained below, is used to compute the expected return of the exchange rate also as the log difference.

[12]EEEESP stands for *Encuestas sobre las Expectativas de los Especialistas en Economía del Sector Privado*.

[13]For example, to get the one-year ahead expectation for a variable in March 2013, I sum 9/12 times its 2013 end-of-year expectation plus 3/12 times its 2014 end-of-year expectation. I thank Tjeerd Boonman for suggesting this approach. An alternative would be to use a Chow-Lin interpolation.

	Obs	Mean	SD	Min	Max
Cetes 28D	222	6.16	2.54	2.67	17.89
Slope (10Y-3M)	183	1.56	1.16	-0.49	3.63
VIX	222	19.45	8.08	9.51	59.89
IGAE Growth	221	1.95	2.46	-8.28	7.53
Inflation	222	4.39	1.13	2.13	8.96
FX Return	221	0.32	3.07	-7.36	15.92
Expected Real GDP Growth	222	2.93	1.08	-2.13	4.61
Expected Inflation	222	4.06	0.73	3.19	7.81
Expected FX Return	221	0.30	1.79	-4.84	11.54

Table 1: Summary of Macroeconomic Variables.

indicator of current economic conditions and the one-year ahead expectation of annual GDP growth as the indicator of expected economic activity.[14]

Table 1 summarizes the monetary policy as well as the current and expected macroeconomic variables. Note that there is wide variation in the policy rate proxy and in the slope of the yield curve. It is noteworthy that, on average, the expectations for inflation and the return of the exchange rate are lower than the current variables, while the opposite is true for economic activity.

4 Empirical Analysis

4.1 Econometric Model

To formally analyze the relationship between the level of the monetary policy rate and the slope of the yield curve on bank profitability, I use the following panel data model:

$$Y_{i,t} = \alpha_i + \beta_1 Lvl_t + \beta_2 Slp_t + \Omega X_t + \Phi Z_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

where $Y_{i,t}$ is the ROA, any of its components (NIM, NNI, PROV, OC) or sub-components (II, IE) for bank i in month t; α_i is a bank fixed effect, which allows for the possibility that unobserved bank-specific factors influencing the measures of bank profitability correlate with the regressors, in particular with the monetary policy variables; Lvl_t is the level

[14]Note that although GDP has a quarterly frequency, the end-of-year expectations for GDP growth are reported monthly.

of Cetes 28D as a proxy for the monetary policy rate; Slp_t refers to the term spread computed as the difference between the 10-year and the 3-month implied sovereign yields or its components[15]. The coefficients of interest are β_1 and β_2. The rest of the regressors allow for other time-varying factors. X_t is a vector of macroeconomic variables and $Z_{i,t-1}$ is a vector of bank-specific variables lagged one period. It is worth highlighting that $Z_{i,t-1}$ includes the dependent variable in order to capture adjustments of it over time. Altavilla et al. (2018) use a similar specification to study European banks.

4.1.1 Estimation

The model in (1) is a dynamic panel data model since it includes a lag of the dependent variable on the right hand side. Nickell (1981) shows that the least-squares dummy-variable estimator for dynamic panel data models with individual fixed effects is inconsistent (when the number of individuals increases) because the lagged dependent variable is correlated with the error term (due to the presence of the fixed effects). Nevertheless, he also shows that the bias decreases with the number of periods.

The well-known estimators dealing with such inconsistency make use of instrumental variables and the generalized method of moments (e.g. Arellano and Bond (1991)). Although these estimators are consistent when the number of individuals increases, they have poor performance when that number is relatively small. This is relevant because panels with a small number of individuals and a large number of periods are frequently encountered in macroeconomics, as in this paper. Bias-corrected fixed effects estimators have been proposed for these cases as an alternative. Accordingly, I use the fixed effects estimator of Bruno (2005), who develops a bias-correction for unbalanced panels, to estimate model (1).

4.2 Is ROA Sensitive to Monetary Policy?

Table 2 shows the main results. As can be seen, there is no effect on ROA of either changes in the monetary policy rate or in the slope of the yield curve. This result is in line with

[15]As it is explained below, the slope of the yield curve can be decomposed into two parts. Therefore, Slp_t in (1) can also represent a vector of slope components.

Altavilla et al. (2018) and Drechsler et al. (2018), and holds under different specifications of the model in (1). Going forward, column 4 will be the baseline specification.

Although Altavilla et al. (2018) and Drechsler et al. (2018) also conclude that ROA is insensitive to monetary policy, they differ in the mechanism. In the first case, the NIM and the other ROA components do react to monetary policy changes but they do so in a way that the effects offset each other. In the second case, the NIM does not respond to monetary policy because banks adjust their II (interest income) to offset the effects on their IE (interest expenses). Table 2 is not enough to understand which of the two mechanisms is at play.

Table 3 presents the results of the baseline specification but using the components of the ROA as dependent variables; to facilitate the comparison, the first column is equal to the baseline specification for the ROA in table 2. Since none of the ROA components respond to either the policy rate or the slope, the results seem to be in line with the mechanism in which the NIM is unaffected because II and IE offset each other. To further analyze this hypothesis, table 4 displays the baseline specification but now using the components of the NIM as dependent variables; again, the first column is equal to the baseline specification for NIM in table 3. The results support the mechanism. Accordingly, NIM does not respond because II and IE offset each other. As before, there is no effect from changes in the slope of the yield curve.

Note that ROA is very persistent, which may hint econometric problems. Note, however, that the ROA components are not as persistent as ROA itself and they are also not responding to changes in the monetary policy. Notwithstanding, this may be a consequence of lack of statistical power. That is why, it is worth highlighting that interest income and interest expenses are the least persistent of the dependent variables and that they do respond to monetary policy. Moreover, their coefficients are similar, they are within a one standard deviation of each other.

Section A in the Appendix extends the model in (1) with interactions and shows that the effects of the policy rate and of the slope on bank profitability measures depend on the banking ratios and whether the bank is domestic or foreign. However, these effects

	(1)	(2)	(3)	(4)	(5)
ROA Lagged	0.963***	0.963***	0.963***	0.953***	0.953***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Short-term Rate	0.001	0.009	0.004	0.002	0.001
	(0.021)	(0.023)	(0.026)	(0.026)	(0.025)
Slope	0.022	0.020	0.010	0.005	0.005
	(0.027)	(0.027)	(0.029)	(0.033)	(0.032)
VIX		0.002	0.001	0.002	0.001
		(0.004)	(0.004)	(0.004)	(0.004)
IGAE Annual Growth		0.011	0.004	0.009	
		(0.010)	(0.015)	(0.016)	
Inflation		-0.022	-0.021	-0.011	
		(0.027)	(0.031)	(0.028)	
RFX		-0.002	-0.005	-0.001	
		(0.006)	(0.007)	(0.009)	
Expected Real GDP Growth			0.021	0.016	0.035
			(0.038)	(0.039)	(0.023)
Expected Inflation			0.051	0.043	0.026
			(0.093)	(0.099)	(0.094)
Expected RFX			0.010	0.007	0.008
			(0.014)	(0.012)	(0.011)
Equity-to-Assets Ratio				-0.003	-0.003
				(0.003)	(0.003)
Loans-to-Assets Ratio				0.000	0.000
				(0.002)	(0.002)
Deposits-to-Liabilities Ratio				0.001	0.001
				(0.002)	(0.002)
Costs-to-Income Ratio				0.000	0.000
				(0.000)	(0.000)
NPL Ratio				-0.012**	-0.012**
				(0.005)	(0.005)
Observations	6,339	6,339	6,339	5,687	5,687
Number of Banks	50	50	50	47	47
Bank FE	Yes	Yes	Yes	Yes	Yes

Dep. variable: ROA.
Bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 2: ROA and Monetary Policy.

are concentrated among banks that represent around 20% of the banking system.

4.2.1 Slope Decomposition

The term Slp_t in model (1) refers to the slope of the yield curve computed as the difference between the 10-year and the 3-month implied sovereign yields. This section explains that Slp_t can also represent a vector of slope components.

The yield curve can be decomposed into the expected future short-term interest rate and a term premium (Cochrane and Piazzesi, 2008). The term premium is the compensation investors require for bearing the risk that the short-term interest rate does not evolve as they expect. If long-term bonds lose value when the marginal utility of investors is high (as is the case during recessions or in episodes of high inflation), those bonds would be seen as risky investments and investors will require a compensation for holding them; in those cases, they would demand a positive term premium. If, on the contrary, long-term bonds gain value in those scenarios, they will be seen as a hedge and investors will be willing to receive less than what they expect for the short-term rate, which would translate into a negative term premium.

I use the implied sovereign yields reported by Bloomberg and fit a standard affine term structure model using the normalization proposed by Joslin, Singleton, and Zhu (2011). Once the model is estimated, the decomposition can be obtained at every maturity.

One way to assess the fit of the model is to compare the expectation for the short-term rate implied by the model with a survey expectation for the same maturity. Figure 2.b compares the one-year ahead expectation for Cetes 28D from the EEEESP survey and that obtained by fitting the affine term structure model. It is worth highlighting that the series follow each other closely, especially since the estimation of the affine model only uses data from yields.

Based on this decomposition, the slope of the yield curve (the spread between long-term and short-term interest rates) can therefore be decomposed into the spread in the expectation part and the spread in the term premium for the respective maturities. Table 5 is similar to table 4 but it now includes this decomposition of the slope.

	ROA	NIM	NNI	PROV	OC
Y Lagged	0.953***	0.396***	0.268***	0.314***	0.671***
	(0.004)	(0.010)	(0.011)	(0.011)	(0.009)
Short-term Rate	0.002	0.038	0.131	0.026	0.076
	(0.026)	(0.057)	(0.080)	(0.071)	(0.088)
Slope	0.005	-0.069	0.172	-0.007	-0.002
	(0.033)	(0.089)	(0.127)	(0.113)	(0.135)
VIX	0.002	0.019*	0.039**	0.044***	0.017
	(0.004)	(0.011)	(0.016)	(0.014)	(0.017)
IGAE Annual Growth	0.009	-0.047	0.112*	-0.091	0.024
	(0.016)	(0.045)	(0.063)	(0.057)	(0.067)
Inflation	-0.011	0.002	-0.038	0.132	0.068
	(0.028)	(0.079)	(0.111)	(0.100)	(0.119)
RFX	-0.001	-0.005	0.015	-0.019	0.013
	(0.009)	(0.022)	(0.032)	(0.028)	(0.034)
Expected Real GDP Growth	0.016	0.184*	-0.218	0.090	-0.051
	(0.039)	(0.099)	(0.140)	(0.125)	(0.150)
Expected Inflation	0.043	-0.130	0.331	-0.041	0.071
	(0.099)	(0.294)	(0.416)	(0.372)	(0.449)
Expected RFX	0.007	-0.077**	0.009	0.001	0.024
	(0.012)	(0.036)	(0.051)	(0.046)	(0.055)
Equity-to-Assets Ratio	-0.003	0.021***	0.045***	0.009	0.089***
	(0.003)	(0.007)	(0.009)	(0.008)	(0.010)
Loans-to-Assets Ratio	0.000	0.049***	0.033***	0.045***	-0.008
	(0.002)	(0.006)	(0.008)	(0.007)	(0.008)
Deposits-to-Liabilities Ratio	0.001	-0.004	-0.036***	-0.007	-0.022***
	(0.002)	(0.004)	(0.006)	(0.006)	(0.007)
Costs-to-Income Ratio	0.000	-0.000	-0.001**	-0.000	0.005***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
NPL Ratio	-0.012**	0.010	0.120***	0.038**	0.041**
	(0.005)	(0.013)	(0.019)	(0.017)	(0.020)
Observations	5,687	5,924	5,924	5,924	5,924
Number of Banks	47	47	47	47	47
Bank FE	Yes	Yes	Yes	Yes	Yes

Bootstrapped errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 3: ROA Components and Monetary Policy.

	NIM	II	IE
Y Lagged	0.396***	0.114***	0.056***
	(0.010)	(0.011)	(0.012)
Short-term Rate	0.038	0.514***	0.459***
	(0.057)	(0.117)	(0.134)
Slope	-0.069	-0.041	0.018
	(0.089)	(0.186)	(0.213)
VIX	0.019*	0.049**	0.021
	(0.011)	(0.023)	(0.026)
IGAE Annual Growth	-0.047	-0.181*	-0.067
	(0.045)	(0.093)	(0.107)
Inflation	0.002	0.154	0.128
	(0.079)	(0.163)	(0.187)
RFX	-0.005	0.024	0.036
	(0.022)	(0.046)	(0.053)
Expected Real GDP Growth	0.184*	0.633***	0.285
	(0.099)	(0.205)	(0.234)
Expected Inflation	-0.130	-0.823	-0.443
	(0.294)	(0.607)	(0.696)
Expected RFX	-0.077**	0.162**	0.224***
	(0.036)	(0.075)	(0.086)
Equity-to-Assets Ratio	0.021***	-0.028**	-0.064***
	(0.007)	(0.014)	(0.016)
Loans-to-Assets Ratio	0.049***	0.077***	0.002
	(0.006)	(0.012)	(0.013)
Deposits-to-Liabilities Ratio	-0.004	-0.008	-0.003
	(0.004)	(0.009)	(0.011)
Costs-to-Income Ratio	-0.000	-0.000	-0.000
	(0.000)	(0.001)	(0.001)
NPL Ratio	0.010	-0.019	-0.029
	(0.013)	(0.027)	(0.031)
Observations	5,924	5,924	5,924
Number of Banks	47	47	47
Bank FE	Yes	Yes	Yes

Bootstrapped errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 4: NIM Components and Monetary Policy.

	NIM	II	IE
Y Lagged	0.396***	0.115***	0.056***
	(0.010)	(0.011)	(0.012)
Short-term Rate	-0.008	0.628***	0.622**
	(0.112)	(0.231)	(0.270)
Slope-Expectation	-0.168	0.208	0.364
	(0.242)	(0.498)	(0.581)
Slope-Term Premium	-0.048	-0.052	-0.014
	(0.103)	(0.212)	(0.248)
Observations	5,924	5,924	5,924
Number of Banks	47	47	47
Macro Controls	Yes	Yes	Yes
BSC Controls	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes

Bootstrapped standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 5: NIM Components and Slope Components.

The result that NIM is unaffected by the policy rate holds as well as the result that the coefficients on II and IE are within a one standard deviation of each other. Regarding the slope, there is no influence on these variables even after the decomposition. This suggests that the profitability of banks seems to be insulated from the source of changes in the yield curve, either from changes in expectations of the short rate or from changes in the term premium.

Two reasons can explain why the slope or its components have no influence on the profitability of banks. First, unconventional monetary policy tools undertaken at the ZLB work mainly through their influence in the yield curve (Kuttner, 2018). Second, Mexico has not been at the ZLB and has thus not seen the need to implement such tools. The null effects are therefore consistent with the literature. In light of this, no reference will be made to the slope in what follows.

Notwithstanding these results, the proposed decomposition of the slope might be relevant when studying the banking systems of advanced countries, several of which have implemented unconventional monetary policy tools.

4.3 Is There A Deposits Channel in Mexico?

The evidence in tables 3 and 4 is in line with the deposits channel of monetary policy proposed by Drechsler et al. (2017, 2018). According to this theory, banks hedge their interest rate risk by matching their II and IE so that their NIM is unaffected. And since the other ROA components are also insensitive (table 3), their ROA does not react to monetary policy.

An implication of the deposits channel is that banks are unexposed to interest rate risk. Two factors explain why banks are able to implement this hedging strategy: deposits represent a large fraction of banks' liabilities, and banks have market power in the deposits market. Even though deposits are short-term, these factors effectively transform them into a long-term liability. As a consequence, banks invest in long-term assets to hedge their deposit franchise. Accordingly, banks engage in maturity transformation precisely to hedge their interest rate risk.[16]

To see whether the evidence in tables 3 and 4 is robust, I test the deposits channel directly following the methodology of Drechsler et al. (2018). Since the deposit franchise is essentially an intangible asset, balance sheet variables will not capture it. That is why Drechsler et al. (2018) use the sensitivity of the changes in ROA, II and IE to the changes in the contemporaneous and lagged changes in the policy rate. They test the theory in the cross-section and in a panel. For robustness, I implement both approaches.

To test the theory in the cross-section, the model, adapted to a monthly frequency, is:

$$\Delta Y_{i,t} = \delta_i + \sum_{\tau=0}^{11} \beta^Y_{i,\tau} \Delta Cetes28_{i,t-\tau} + \nu_{i,t} \tag{2}$$

where $\Delta Y_{i,t}$ refers to the first difference of the dependent variable, $Y_{i,t} - Y_{i,t-1}$. As before, Y refers to ROA or any of its components or subcomponents. The interest rate sensitivity of variable Y for bank i is given by $\beta^Y_i = \sum_{\tau=0}^{11} \beta^Y_{i,\tau}$.

[16]Note that this contrasts with the traditional explanation in which maturity transformation exposes banks to interest rate risk because they borrow short-term and lend long-term. This view assumes perfect competition in the deposits market, while the deposits channel assumes imperfect competition. Stein (2018) explains how the deposits channel is behind the bank-lending channel of monetary policy and suggests that it might also be behind the risk-taking channel.

	β^{ROA}	β^{II}	β^{NIM}	β^{NNI}	β^{PROV}	β^{OC}
H_0	$\gamma = 0$	$\gamma = 1$	$\gamma = 0$	$\gamma = 0$	$\gamma = 0$	$\gamma = 0$
β^{IE}	-0.050	0.857**	-0.143**	-0.260	-0.095	-0.308
	(0.071)	(0.067)	(0.067)	(0.511)	(0.079)	(0.387)
Observations	50	50	50	50	50	50
R-squared	0.001	0.608	0.041	0.013	0.006	0.010

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 6: ROA Components and the Deposits Channel.

One can test the relationship between the interest expense sensitivity and the sensitivities of the other ROA components by estimating the following regression:

$$\beta_i^Y = c + \gamma \beta_i^{IE} + u_i \tag{3}$$

The deposits channel theory implies that $\gamma = 1$ when Y refers to the interest income. If the other ROA components are insensitive to changes in the policy rate, then $\gamma = 0$. The evidence in table 4 above seems to be in line with these values.

Table 6 tests the hypotheses for the ROA components after estimating equation (3). As can be seen, the coefficients of ROA, NNI, PROV and OC are not statistically different from zero. Accordingly, they are insensitive to monetary policy changes as before. However, the coefficients for NIM and II are statistically different from their hypothesized values. This is evidence against the deposits channel.

The previous approach does not allow to discard the influence of common trends. Drechsler et al. (2018) use a two-step panel approach that includes time fixed effects which allows to control for common trends. The two-step approach, adapted to a monthly frequency, is:

$$\begin{aligned} \Delta IE_{i,t} &= \alpha_i + \eta_t + \sum_{\tau=0}^{11} \beta_{i,\tau}^Y \Delta Cetes28_{i,t-\tau} + \xi_{i,t} \\ \Delta Y_{i,t} &= \lambda_i + \theta_t + \gamma \widehat{\Delta IE_{i,t}} + \omega_{i,t} \end{aligned} \tag{4}$$

	$\Delta ROA_{i,t}$	$\Delta II_{i,t}$
H_0	$\gamma = 0$	$\gamma = 1$
$\widehat{\Delta IE_{i,t}}$	0.407	3.559**
	(0.374)	(1.203)
Observations	6,974	7,307
R-squared	0.034	0.029
Number of Banks	50	50
Bank FE	Yes	Yes
Time FE	Yes	Yes

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 7: ROA, II and the Deposits Channel.

where α_i and λ_i are bank fixed effects, while η_t and θ_t are time fixed effects. Here $Y_{i,t}$ refers to ROA and II. Note that unlike the previous approach, here the estimate for IE is used instead of β_i^{IE}. The deposits channel theory also implies that $\gamma = 1$ under this approach. The results of the estimation are reported in table 7.

Table 7 has two important implications. First, the insensitivity of ROA to changes in the policy rate remains. However, the evidence against banks matching their interest income to their interest expenses becomes stronger. NIM reacts to monetary policy because interest income responds more than 1-to-1 to changes in interest expenses. Moreover, since ROA is insensitive, the other components of ROA (namely, NNI, PROV and OC) will respond in a way that offsets the effect on NIM.

So far, the finding that banks insulate their ROA from monetary policy is robust to different approaches. However, there is mixed evidence on how banks achieve it. The results from tables 3 and 4 seem to support a matching strategy between II and IE to leave NIM unchanged, and since the other ROA components are also unaffected, ROA is insulated. On the other hand, the results in tables 6 and 7 show evidence against the matching strategy, suggesting that NIM the other ROA components respond to monetary policy in a way that the changes offset each other.

To shed some light on this seemingly conflicting results, I exploit information on bank characteristics, namely the business model and the charter.

4.4 Does Business Model Play A Role?

The CNBV classifies *active* banks into mutually exclusive categories according to their core business model or a particular characteristic (e.g. size).

In Mexico, around 80% of the assets in the banking system are owned by the largest seven banks (G7). There are five subsidiaries[17] of foreign banks and two domestic[18] banks in the G7.

In the CNBV classification the non-G7 are categorized as follows. In terms of business model, four banks specialize in the foreign exchange market (FX), seven specialize in trading and investments (INV), and nine focus on granting credit to households (HH). In terms of size, five are medium-sized banks (MED) and nine are small-sized banks (SML).

4.4.1 Consolidation

Some banks started consolidating their balance sheets with special-purpose finance companies at some point during the sample period.[19] The consolidated series for these banks are therefore shorter. There are two potential solutions to deal with this case. The first option is to merge the series at the time when consolidation started; the drawback of doing this is that there might be jumps in the series. An alternative solution is to do the analysis using unconsolidated as well as consolidated series.

A closer look at the data reveals that differences from consolidation mainly occur in three of the six banks that consolidate from the G7.[20] For this reason, the distinction between consolidated and unconsolidated figures is henceforth made for G7 banks only. Therefore, even though there are non-G7 banks that consolidate, their unconsolidated series will be used since they are longer and practically the same as the consolidated ones in the periods in which they overlap.[21]

[17] BBVA, Citibanamex, HSBC, Santander, Scotiabank.

[18] Banorte, Inbursa.

[19] Some of these companies are known as Sofomes (*Sociedades financieras de objeto múltiple*). They can specialize in different parts of the banking business, like granting credit cards.

[20] HSBC does not consolidate.

[21] There is a non-G7 bank (Sabadell) that consolidates and for which there is a difference between the

	$\Delta ROA_{i,t}$						
	G7-C	G7-U	FX	INV	MED	SML	HH
$\widehat{\Delta IE_{i,t}}$	-0.156	-0.315	-0.096**	0.349	-0.000	2.091	-0.802
	(0.329)	(0.242)	(0.027)	(0.186)	(0.029)	(1.793)	(5.810)
Observations	704	1,463	546	1,512	971	1,211	1,189
R-squared	0.559	0.141	0.865	0.149	0.226	0.164	0.162
Number of Banks	7	7	4	8	5	9	9
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

$H_0 : \gamma = 0$.
Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 8: ROA Sensitivity to IE by Bank Business Model.

4.4.2 The Deposits Channel by Business Model

First, I estimate model (4) with ROA as the dependent variable for each of the CNBV groups to see whether the finding on ROA insensitivity holds. The results are presented in table 8. As it can be seen, the main conclusion holds in general. ROA is insensitive to monetary policy regardless of the business model of banks. The only exception is for FX banks but the effect is slightly less than 10 basis points in absolute value.

Next, I estimate model (4) again but now for II as the dependent variable. Table 9 shows that the evidence against matching depends on the business model. First of all, banks do not react in the same way. For example, for INV and MED banks there is no evidence against matching as well as for the G7 banks with unconsolidated series (G7-U). Second, unlike the rest of the categories, the interest income of FX and SML banks decreases when their interest expenses jump. Finally, given their importance for the banking system, the most interesting group with evidence against matching is the G7 with consolidation (G7-C). Although the estimated coefficient for the change in IE ($\hat{\gamma}$) is not as big as in table 7, it is statistically different from the value of 1 predicted by the deposits channel.

The main conclusion from tables 8 and 9 is that, in general, banks insulate their ROA

two series. However, it is no longer in the sample since it has less than 5 years of data.

	G7-C	G7-U	FX	INV	MED	SML	HH
		$\Delta II_{i,t}$					
$\widehat{\Delta IE_{i,t}}$	1.543**	1.556	-21.200*	16.410	1.339	-22.201***	7.366***
	(0.163)	(0.441)	(8.541)	(17.926)	(0.244)	(4.920)	(0.270)
Observations	766	1,477	578	1,552	989	1,277	1,272
R-squared	0.478	0.275	0.252	0.110	0.381	0.185	0.193
Number of Banks	7	7	4	8	5	9	9
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

$H_0 : \gamma = 1$.
Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 9: The Deposits Channel by Bank Business Model.

from monetary policy changes but they implement different strategies to do so depending on their business model.

4.5 Does Charter Play A Role?

This section explores if the charter (whether a bank is domestic or a subsidiary of a foreign bank) helps to explain the discrepancy regarding the evidence on the deposits channel described in section 4.3.

This section continues to use the CNBV classification. However, FX and MED groups are excluded here because there are no subsidiaries of foreign banks in those groups.

4.5.1 The Deposits Channel by Charter

To see whether the charter is a relevant factor on how banks insulate their ROA from monetary policy, I extend the two-stage framework in equation (4) by adding an interaction term in the second stage as follows:

$$\begin{aligned} \Delta IE_{i,t} &= \alpha_i + \eta_t + \sum_{\tau=0}^{11} \beta_{i,\tau}^{Y} \Delta Cetes28_{i,t-\tau} + \xi_{i,t} \\ \Delta Y_{i,t} &= \lambda_i + \theta_t + \gamma_1 \widehat{\Delta IE_{i,t}} + \gamma_2 \widehat{\Delta IE_{i,t}} * F + \omega_{i,t} \end{aligned} \quad (5)$$

		$\Delta ROA_{i,t}$			
	G7-C	G7-U	INV	SML	HH
$\widehat{\Delta IE_{i,t}}$	-0.093	-0.340	0.344	2.079	-1.006
	(0.326)	(0.251)	(0.187)	(1.796)	(5.767)
$\widehat{\Delta IE_{i,t}} * F$	-0.079**	0.036	0.009	0.041	0.106
	(0.030)	(0.030)	(0.009)	(0.067)	(0.109)
Observations	704	1,463	1,512	1,211	1,189
R-squared	0.560	0.142	0.152	0.164	0.163
Number of Banks	7	7	8	9	9
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

$Ho : \gamma_1 = 0$, $Ho : \gamma_2 = 0$.
Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 10: ROA Sensitivity to IE by Bank Business Model and Charter.

where F is a dummy variable indicating whether the bank is a subsidiary. The rest of the specification is the same as in equation (4). The coefficient γ_2 captures whether the changes in the dependent variable due to changes in interest expenses depend on the charter. If subsidiaries are no different from domestic banks, then $\gamma_2 = 0$. Table 10 reports the results for the relevant CNBV groups using ROA as the dependent variable. Once again, the insensitivity of ROA remains in general. Furthermore, the result holds regardless of the business model or whether a bank is foreign or domestic.

Table 11 displays the results using II as the dependent variable. Several things are worth mentioning. INV banks continue to be in line with a matching strategy between II and IE. In the HH group, subsidiaries are no different from domestic banks. Although subsidiaries play an important role in the G7 and SML groups, the economically relevant role is in the former. Both subsidiaries and domestic banks do not match their II and IE but the former are closer to matching than domestic banks. This means that the NIM of domestic banks is more sensitive to monetary policy relative to that of subsidiaries and, as a consequence, domestic banks adjust the other components of their ROA proportionally more to offset the effect on the NIM.

			$\Delta II_{i,t}$		
	G7-C	G7-U	INV	SML	HH
$\widehat{\Delta IE_{i,t}}$	2.574***	2.081*	15.382	-21.499***	7.687***
	(0.318)	(0.446)	(18.063)	(5.361)	(0.513)
$\widehat{\Delta IE_{i,t}} * F$	-1.076***	-0.735***	1.639	-1.247***	-0.339
	(0.181)	(0.182)	(1.186)	(0.312)	(0.540)
Observations	766	1,477	1,552	1,277	1,272
R-squared	0.498	0.286	0.200	0.205	0.193
Number of Banks	7	7	8	9	9
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

$Ho : \gamma_1 = 1$, $Ho : \gamma_2 = 0$.
Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 11: The Deposits Channel by Bank Business Model and Charter.

5 Conclusions

This paper studies the effects of monetary policy on the profitability of banks using bank-level data from an emerging economy. Away from the zero lower bound, banks insulate their return on assets from monetary policy changes. This result is robust to different approaches and specifications. The main finding of the paper is that banks implement different strategies to insulate their return on assets. Some banks match their interest income with their interest expenses so that their net interest margin is unaffected. For banks for which it is affected, they adjust their non-interest income, provisions and/or operating costs to offset the effects on the net interest margin. So far, it was implicit in the literature that these strategies were mutually exclusive. This paper shows that such strategies can co-exist within a banking system.

To understand what strategy is implemented, it is key to distinguish banks by business model and charter (home or foreign). For example, the largest banks don't match their interest income and expenses. Subsidiaries of foreign banks, however, are closer to matching than domestic banks.

The results in this paper point toward interesting lines of research. For instance, why domestic G7 banks don't match their interest income and interest expenses? Is it an intentional decision or is it because they are unable to hold enough long-term assets? If the latter, does it involve a demand or a supply explanation? Considering the maturity gap between assets and liabilities can provide further insight into the analysis.

An interesting extension of the results could be to classify banks differently. One particularly relevant option is to use funding costs, a potentially important factor in how banks insulate their ROA from monetary policy. Also, although the decomposition of the slope seemed irrelevant for bank profitability, it can be useful in other contexts. For example, the slope components might have an effect on the growth rates of different types of loans granted by banks. Finally, the analysis can be refined by directly identifying monetary policy shocks (e.g., using high-frequency data). In this case, there would be no need to control for expectations of macroeconomic variables. Moreover, this would allow to do the analysis not only for changes in the monetary policy in Mexico but also in the U.S. Does the profitability of banks respond to changes in U.S. monetary policy?

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Appendix

A Bank-Specific Characteristics

This section shows that monetary policy has varying effects on the profitability of non-G7 banks depending on their banking ratios and on whether they are subsidiaries of a foreign bank.

To study the role of bank-specific characteristics in the transmission of monetary policy to bank profitability, I estimate the following model with interactions of the level of the policy rate and the slope of the yield curve with bank characteristics:

$$Y_{i,t} = \alpha_i + \beta_1 Lvl_t + \beta_2 Slp_t + \Omega X_t + \Phi Z_{i,t-1} + \Gamma_1 \left(Lvl_t * Z_{i,t-1}\right) + \Gamma_2 \left(Slp_t * Z_{i,t-1}\right) + \varepsilon_{i,t} \tag{6}$$

where the coefficients of the interaction terms, Γ_1 and Γ_2, capture the differentiated effects of Lvl_t and Slp_t on the different profitability measures depending on bank characteristics. The rest of the specification is the same as in the main text. The estimation of the model is also performed as explained in the main text. Table 12 reports the results.

Table 12 shows that the effects of the policy rate and of the slope on the different profitability measures vary depending on the banking ratios. All ROA components react to at least one of the interactions but they do so differently. For example, for banks with a low NPL ratio, a monetary policy easing barely affects their ROA, while it increases their NNI and PROV.[22] Table 13 repeats the analysis but for the G7 banks only. For this group, the effects do not depend on the banking ratios in general. That is, the differentiated effects of monetary policy in terms of banking ratios are mainly concentrated on the non-G7 banks.

To analyze whether the differentiated effects by banking ratios further depend on the charter, I extend the model in (6) as follows:

[22] In terms of magnitude, for a bank with a 5% NPL ratio, a 25 basis point decrease in the policy rate decreases its ROA by less than a basis point and increases its NNI and PROV by 5 and 3.5 basis points, respectively.

$$
\begin{aligned}
Y_{i,t} = \alpha_i + \beta_1 Lvl_t + \beta_2 Slp_t + \Omega X_t + \Phi Z_{i,t-1} + \Gamma_1 \left(Lvl_t * Z_{i,t-1} \right) + \Gamma_2 \left(Slp_t * Z_{i,t-1} \right) \\
+ \left[\beta_1^{'} Lvl_t + \beta_2^{'} Slp_t + \Phi^{'} Z_{i,t-1} + \Gamma_1^{'} \left(Lvl_t * Z_{i,t-1} \right) + \Gamma_2^{'} \left(Slp_t * Z_{i,t-1} \right) \right] * F + \varepsilon_{i,t} \quad (7)
\end{aligned}
$$

where, as in the main text, F is dummy variable indicating whether the bank is a subsidiary. Coefficients with a prime capture the differentiated effect of the variables on the profitability measures when the bank is a subsidiary.

Table 14 shows that the varying effects of monetary policy depend on the banking ratios *and* on whether the bank is a subsidiary of a foreign bank. The components of the ROA react differently. Interestingly, the component that responds to several interaction terms is OC. In addition, NPL turns out to be a relevant ratio. Note that changes in the policy rate influence all ROA components of subsidiaries depending on their NPL ratio. For example, for subsidiaries of foreign banks with a low NPL ratio, monetary policy easing increases their NIM, PROV and OC, while decreases their NNI. As in the previous analysis with no distinction by charter, table 15 shows that these effects are concentrated on the non-G7 banks.

	ROA	NIM	NNI	PROV	OC
(Short-term Rate)x(Equity-to-Assets Ratio)	0.004**	0.012**	-0.005	0.001	0.010
	(0.002)	(0.005)	(0.008)	(0.006)	(0.007)
(Short-term Rate)x(Loans-to-Assets Ratio)	-0.002**	-0.001	-0.006*	0.009***	-0.002
	(0.001)	(0.003)	(0.004)	(0.003)	(0.003)
(Short-term Rate)x(Deposits-to-Liabilities Ratio)	0.001	-0.002	-0.003	-0.004	0.003
	(0.001)	(0.003)	(0.004)	(0.003)	(0.003)
(Short-term Rate)x(Costs-to-Income Ratio)	0.000	-0.000	-0.000	-0.000	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
(Short-term Rate)x(NPL Ratio)	-0.006*	-0.014	0.041**	0.028**	-0.000
	(0.003)	(0.012)	(0.017)	(0.013)	(0.014)
(Slope)x(Equity-to-Assets Ratio)	0.006**	0.004	0.018	-0.005	0.025**
	(0.003)	(0.009)	(0.013)	(0.010)	(0.011)
(Slope)x(Loans-to-Assets Ratio)	-0.003**	-0.001	-0.014**	0.007	-0.005
	(0.001)	(0.004)	(0.006)	(0.004)	(0.005)
(Slope)x(Deposits-to-Liabilities Ratio)	0.001	-0.002	0.003	-0.004	0.007
	(0.001)	(0.004)	(0.006)	(0.005)	(0.005)
(Slope)x(Costs-to-Income Ratio)	0.000	0.000	-0.001	0.001	-0.002***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
(Slope)x(NPL Ratio)	-0.000	-0.021	-0.002	0.032	-0.020
	(0.005)	(0.021)	(0.030)	(0.023)	(0.026)
Observations	5,687	5,924	5,924	5,924	5,924
Number of Banks	47	47	47	47	47
Macro Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Bootstrapped errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 12: ROA Components, Monetary Policy and Bank-Specific Characteristics.

	ROA	NIM	NNI	PROV	OC
(Short-term Rate)x(Equity-to-Assets Ratio)	-0.003	0.018	0.054	-0.012	0.029*
	(0.011)	(0.011)	(0.056)	(0.031)	(0.016)
(Short-term Rate)x(Loans-to-Assets Ratio)	0.003	-0.001	0.003	-0.002	-0.005
	(0.005)	(0.006)	(0.033)	(0.019)	(0.009)
(Short-term Rate)x(Deposits-to-Liabilities Ratio)	-0.003	0.009	0.015	0.011	0.007
	(0.005)	(0.006)	(0.029)	(0.016)	(0.008)
(Short-term Rate)x(Costs-to-Income Ratio)	-0.001	-0.004	0.005	-0.010	0.005
	(0.003)	(0.005)	(0.026)	(0.014)	(0.007)
(Short-term Rate)x(NPL Ratio)	0.029	0.096***	0.029	0.153	0.052
	(0.026)	(0.035)	(0.179)	(0.101)	(0.052)
(Slope)x(Equity-to-Assets Ratio)	-0.002	0.018	0.088	0.003	0.013
	(0.017)	(0.018)	(0.093)	(0.052)	(0.027)
(Slope)x(Loans-to-Assets Ratio)	0.008	-0.009	0.010	-0.039*	0.002
	(0.007)	(0.007)	(0.040)	(0.023)	(0.011)
(Slope)x(Deposits-to-Liabilities Ratio)	-0.007	0.007	0.008	0.018	-0.003
	(0.007)	(0.009)	(0.049)	(0.028)	(0.014)
(Slope)x(Costs-to-Income Ratio)	0.000	-0.007	0.007	-0.014	0.007
	(0.005)	(0.007)	(0.036)	(0.020)	(0.010)
(Slope)x(NPL Ratio)	0.051	0.059	-0.034	-0.005	0.045
	(0.035)	(0.053)	(0.281)	(0.159)	(0.080)
Observations	654	714	714	714	714
Number of Banks	7	7	7	7	7
Macro Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 13: G7: ROA Components, Monetary Policy and Bank-Specific Characteristics.

	ROA	NIM	NNI	PROV	OC
(Short-term Rate)x(Equity-to-Assets Ratio)x(F)	-0.007*	-0.007	0.003	0.023	0.048***
	(0.004)	(0.012)	(0.018)	(0.014)	(0.016)
(Short-term Rate)x(Loans-to-Assets Ratio)x(F)	0.004	-0.012*	-0.004	-0.024***	-0.023**
	(0.003)	(0.007)	(0.010)	(0.008)	(0.009)
(Short-term Rate)x(Deposits-to-Liabilities Ratio)x(F)	-0.004*	0.014**	0.003	0.003	0.023***
	(0.002)	(0.006)	(0.008)	(0.007)	(0.007)
(Short-term Rate)x(Costs-to-Income Ratio)x(F)	-0.001	-0.000	-0.000	0.000	0.007***
	(0.000)	(0.001)	(0.002)	(0.001)	(0.002)
(Short-term Rate)x(NPL Ratio)x(F)	-0.004	0.273***	-0.211***	0.130**	0.200***
	(0.015)	(0.045)	(0.067)	(0.053)	(0.058)
(Slope)x(Equity-to-Assets Ratio)x(F)	-0.009	-0.006	-0.053**	0.024	0.051**
	(0.007)	(0.018)	(0.026)	(0.021)	(0.023)
(Slope)x(Loans-to-Assets Ratio)x(F)	0.003	0.031***	-0.025*	-0.015	0.003
	(0.004)	(0.010)	(0.014)	(0.012)	(0.013)
(Slope)x(Deposits-to-Liabilities Ratio)x(F)	-0.002	0.001	0.014	0.004	0.009
	(0.003)	(0.007)	(0.010)	(0.008)	(0.009)
(Slope)x(Costs-to-Income Ratio)x(F)	-0.000	-0.000	0.001	-0.001	0.010***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
(Slope)x(NPL Ratio)x(F)	0.022	-0.159**	0.154	-0.092	0.008
	(0.023)	(0.071)	(0.105)	(0.084)	(0.092)
Observations	5,687	5,924	5,924	5,924	5,924
Number of Banks	47	47	47	47	47
Macro Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Bootstrapped errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

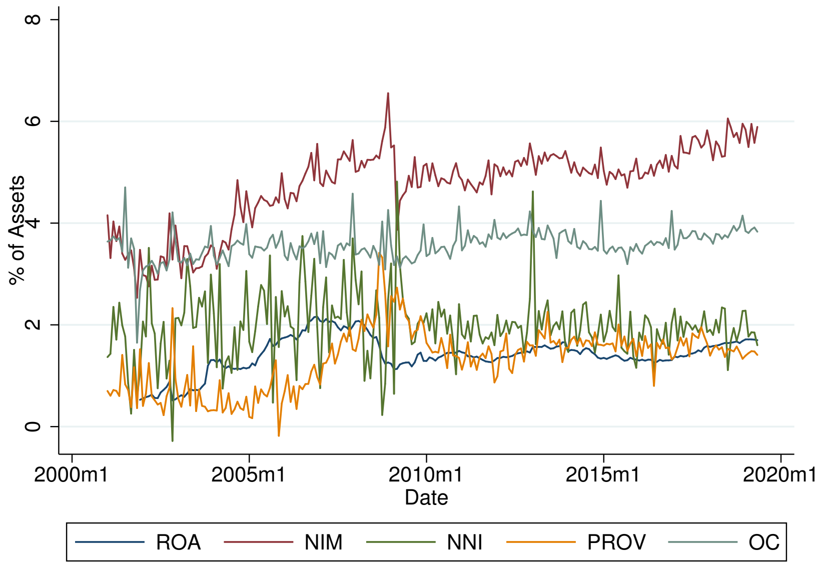
Table 14: ROA Components, Monetary Policy, Bank-Specific Characteristics and Charter.

	ROA	NIM	NNI	PROV	OC
(Short-term Rate)x(Equity-to-Assets Ratio)x(F)	0.041	0.007	0.118	0.137	-0.002
	(0.044)	(0.051)	(0.205)	(0.120)	(0.074)
(Short-term Rate)x(Loans-to-Assets Ratio)x(F)	-0.022	-0.019	-0.119	-0.014	-0.002
	(0.024)	(0.031)	(0.126)	(0.074)	(0.045)
(Short-term Rate)x(Deposits-to-Liabilities Ratio)x(F)	0.016	0.024	0.050	0.068	-0.000
	(0.019)	(0.027)	(0.112)	(0.065)	(0.040)
(Short-term Rate)x(Costs-to-Income Ratio)x(F)	0.007	-0.009	0.072	0.004	-0.001
	(0.010)	(0.015)	(0.061)	(0.036)	(0.022)
(Short-term Rate)x(NPL Ratio)x(F)	0.228	0.243	1.444	0.222	0.045
	(0.225)	(0.311)	(1.270)	(0.744)	(0.454)
(Slope)x(Equity-to-Assets Ratio)x(F)	0.066	0.033	0.033	0.022	-0.057
	(0.066)	(0.079)	(0.323)	(0.189)	(0.116)
(Slope)x(Loans-to-Assets Ratio)x(F)	-0.042	-0.023	-0.082	0.094	0.002
	(0.031)	(0.046)	(0.188)	(0.111)	(0.068)
(Slope)x(Deposits-to-Liabilities Ratio)x(F)	0.020	0.013	0.002	-0.008	-0.017
	(0.028)	(0.040)	(0.161)	(0.095)	(0.058)
(Slope)x(Costs-to-Income Ratio)x(F)	0.006	0.001	0.136	0.052	0.002
	(0.013)	(0.021)	(0.087)	(0.051)	(0.031)
(Slope)x(NPL Ratio)x(F)	0.192	0.183	1.132	0.190	-0.010
	(0.297)	(0.426)	(1.730)	(1.014)	(0.622)
Observations	654	714	714	714	714
Number of Banks	7	7	7	7	7
Macro Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

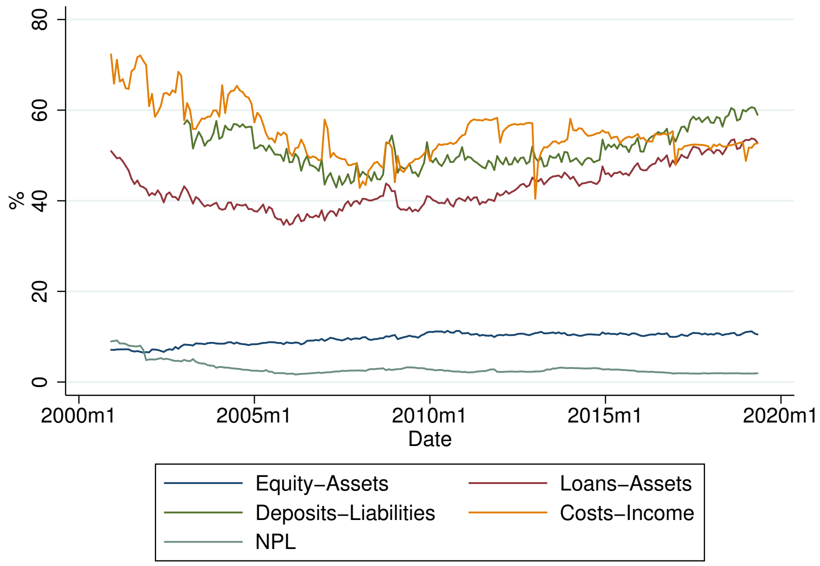
Bootstrapped standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 15: G7: ROA Components, Monetary Policy, Bank-Specific Characteristics and Charter.

B Figures

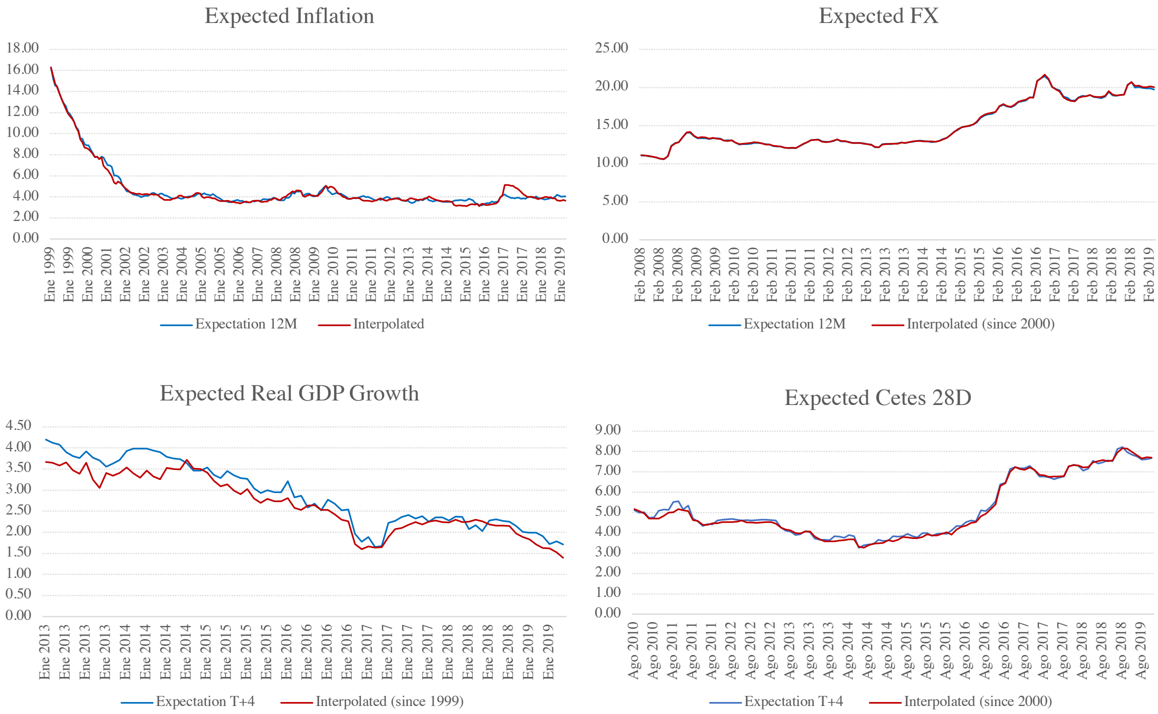


(a) ROA Components.

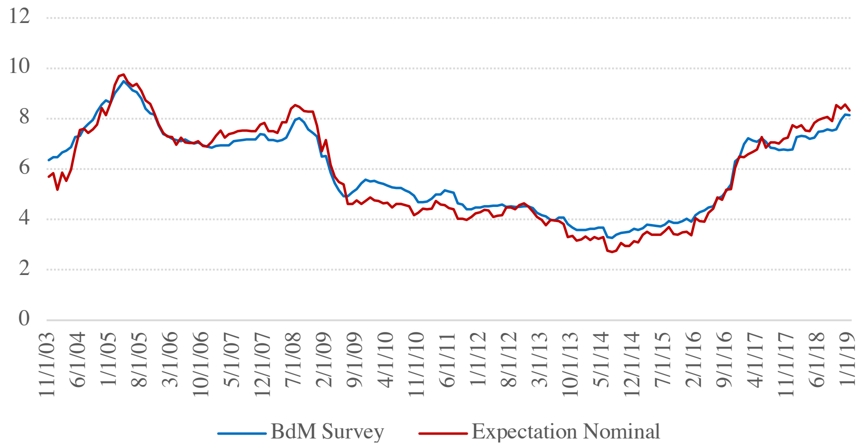


(b) Banking Ratios.

Figure 1: Banking Variables for the Banking System.



(a) 1-Year Ahead Expectations of Macroeconomic Variables.



(b) 1-Year Ahead Expectation of the Short-Term Rate.

Figure 2: Expectations of Macroeconomic Variables.