The impact of expected losses provisioning on credit growth: the case of Mexico*

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Abstract

One of the buzzwords that arrived after the great financial crisis (GCF) is macroprudential policies. Arguably many countries have been using macroprudential policies to limit the risk-taking effect on the credit cycle, to cope with vulnerabilities or even with deviations from fundamental value of assets. Different regulatory frameworks now have these policies as part of their regulatory tool-kits. Given their new widespread use, there is a need to evaluate to what extent this policies both, achieve their goal and affect other relevant variables, such as credit growth and financial intermediation. In Mexico, loan loss provisioning was given a macroprudential scope by the introduction of rules that intend to accurately calculate expected losses. In this paper we use a large dataset containing information on every commercial loan granted by banks operating in Mexico to quantify the effect of this policy on credit growth. We find that this policy had a negative and statistically significant impact on credit growth.

Keywords: Loan-loss provisioning, macroprudential policies, credit growth.
JEL Classification:

1 Introduction

The recent financial crisis gave a renewed momentum to prudential policy, specifically to macroprudential policy. Concepts such as systemic risk and financial stability have been central to the current policy development. The target of the improved framework is enhancing the resilience of the financial system as a whole and reducing externalities. However, achieving this target comes at a cost. This cost may arise in different forms: credit standards may tighten, funds may flow to an unregulated perimeter, credit may be held, growth might be reduced, etc.

*The views expressed in this article are those of the authors and so not necessarily reflect the opinion of Banco de México or its Governing Board

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A variable that is not necessarily the target of macroprudential policies but is usually affected by them is credit supply. Although the changes in credit supply only affects banks' resilience through the mix of the pool of creditors, most of the recently established pieces of regulation limit both, the resource availability of banks and their ability to allocate them. For example, LTV ratios limit a bank's ability to allocate resources while capital requirements may limit resources availability themselves. Other pieces of regulation may increase the cost of providing credit. This is the case of loan loss provisioning.

The main intention of loan loss provisioning is to equip banks to face losses that can be statistically anticipated, that is, expected losses derived from their activity as credit suppliers. Although having enough provisions to cover expected losses is desirable, calculating the amount to be provisioned for each loan is not trivial. Errors in provisions entail two important risks, either underestimation or overestimation that affect a bank's viability in different ways. If provisions are underestimated, then a bank may not be able to face the losses that could take place and hence would need to make use of capital; if provisions are overestimated, then resources that may be allocated to a more productive end will be idle.

As it was said, estimating expected losses is a non-trivial task. A backward-looking estimation of losses, based in incurred losses, may seem appealing given the simplicity of its calculation and its relative accuracy during normal times. However, during times of credit expansion, backward-looking provisioning methods considerably underestimate losses.

In Mexico, loan loss provisioning used a rather simple and backward-looking estimation technique. Table 1 displays the way provisions used to work. Each loan had to be provisioned as a function of the number of arrears in the loan. This methodology made provisions mimic the non-performing loans portfolio as it may be seen in figure 1. Using the six largest banks, this graph illustrates for the six largest banks[1], that as expected, the previous provisioning rule closely ressembles the evolution of past due loans, as can be seen on the behavior of lines before the cut-off point shown there, the point in time when the first new provisioning rule became active. And secondly, how after that point, past due loans and provisions start to deviate. With varying degress, this behavior is representative of most banks and most credit portfolios.

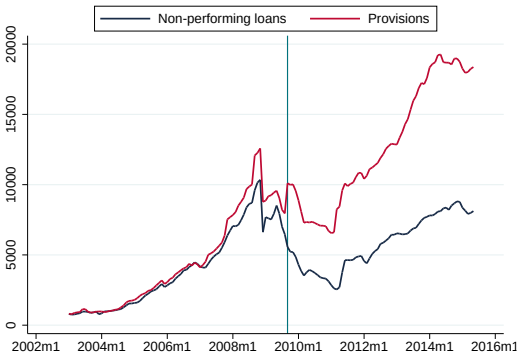
The following graph, figure 2 provides a good motivation for the change in provisioning rules. Although the previous rules, based on a backward-looking provisioning system may suffice during normal times, its nature makes them insufficient during credit expansion periods. Figure 2 displays a scatter plot for *ex post* realized losses (y-axis) and provisions (x-axis) for the consumption credit portfolio of banks operating in Mexico. The 45 degree line indicates when realized losses were under or overestimated. As it may be noticed, during periods of stability on credit growth, this methodology accurately estimates losses; however, during periods of credit expansion, losses are considerably underestimated.

To solve this, the Mexican regulator introduced a new provisioning methodology

[1]This banks account for more than 75 % of total assets in the Mexican Financial System.

Figure 1: Loan loss provisions and non-performing loans consumption credit portfolio

(a) Bank 1



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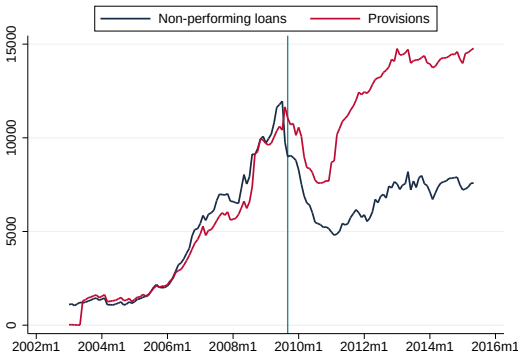

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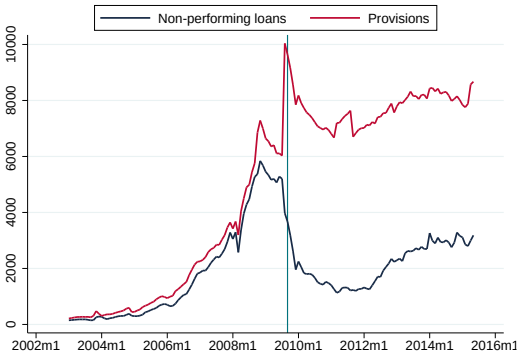

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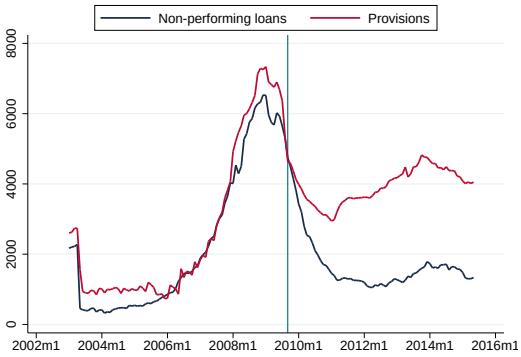

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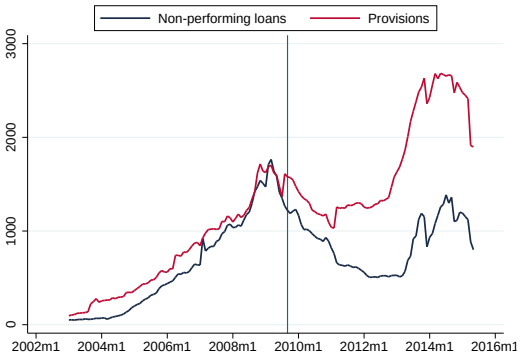


(f) Bank 6

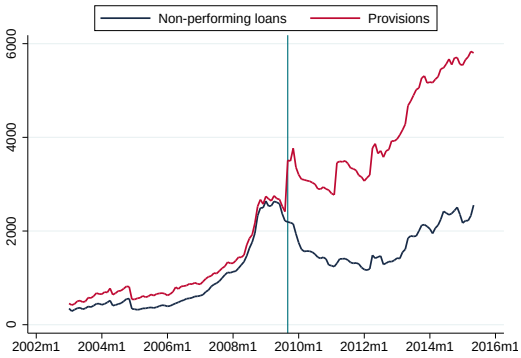


Table 1: Old provisioning rules for credit card portfolio

Arrears	Provisioning Proportion
0	0.01
1	0.1
2	0.45
3	0.65
4	0.75
5	0.8
6	0.85
7	0.9
8	0.95
$\geq$9	1

that intends to increase the accuracy of provisions[2]. It uses econometric techniques to estimate the probability of default, exposure at default, and loss given default of each credit to obtain expected losses as a product of this three factors. [Flores et al.,] gives a detailed explanation of this new methodology.Though this is in origin a microprudential policy, it is possible arguing that it is used with a macroprudential scope in mind. As has been widely discussed macroprudential policies are those aiming to mitigate systemic risk. This new set of provisioning rules contribute to this overarching goal by addressing a potential structural risk, the misestimation of credit losses, making banks constitute provisions in a more accurate and flexible way, and also allows banks to make a more efficient use of capital for both, prudential and business purposes[3]. Although it is not necessarily true that this new methodology accurately calculates losses, it is true that it has increased the amount that should be provisioned for each loan, thus making credit supply more costly. Figure 3 sheds light on this. Although not every point in the graph is over the the 45 degree line, the distance to it has substantially decreased.

To further illustrate the fact that the activation schedule of these new requirements apparently didn't target specific sectors[4], figure 4 shows the evolution of the main credit concepts. One of the features shown in this graph is one of the motivation of this work: the fact that there is not an obvious effect caused by the introduction of provisioning rules however a more detail analysis shows that there are indeed differences, if not in growth rates, at least in composition.

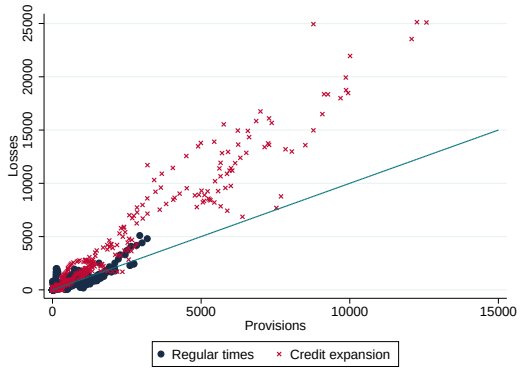
For instance, ever since this new piece of regulation has been active, the distribution of growth of loans granted to the same borrower has moved downwards. Figure 5 shows,

[2]This following international best practices. In 2009 IASB began developing new accounting rules for financial instruments IFRS-9 which substitute IAS39 including a new forward looking methodology based on expected losses to determine credit loss provisions

[3]Misestimated credit losses may be considered unexpected losses and banks account for these losses with capital

[4]The new provisioning rules were introduced in a gradual fashion: credit cards on October 2009; other consumption-related loans and mortgage on March 2011; credits granted to state and local governments October 2011; and commercial loan on December 2013

Figure 2: Losses and provisions during regular and credit expansion periods for the consumption portfolio



"Regular times" considers the period January 2003-December 2005 while "credit expansion" considers the period January 2007-December 2008

in no particular order, box-plots for these distributions for seven banks before and after the introduction of the new policy.

At the time period considered by this analysis, in Mexico were operating 45 banks, though the top 7 hold around 80% of total assests. Though still very concentrated, there are banks of different sizes granting commercial credit, though for obvious reasons relatively larger credits tend to be given by larger banks.

In this paper we use a dataset that contains information on every single commercial loan granted by banks operating in Mexico to evaluate what fraction of this decrease in credit growth may associated to this change in policy. We find a negative and significant effect of this policy when considering four subsamples of our dataset when it is divided according to currency denomination of the loan and size of the firm that engaged in the loan. In what is next this paper is divided in the following way: section 3 describes the data we use and our empirical strategy, section 4 analyzes our results and section 5.

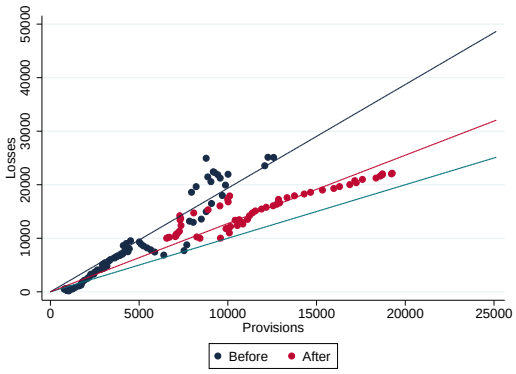
2 Literature Review

Given the renewed momentum that macroprudential policies have gained after the recent financial crisis, there is a new literature strand that is interested in exploring the effects that this type of policies might have on the economy as a whole, in particular in terms of credit supply and risk-taking. This renewed strand of the literature is of interest for both, policymakers and academics, alike. The main challenge in this kind of analysis is data availability, the lack of data may be due to the recent introduction of macroprudential policies or because that countries that have more experience in this area do not collect the data needed for the analysis.

In terms of the literature, this paper is closer to that of [Flores et al.,] in the sense

Figure 3: Losses and provision of the consumption portfolio considering the old and the new provisioning rules

(a) Bank 1



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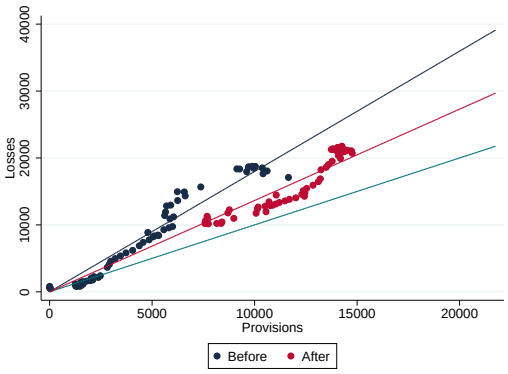

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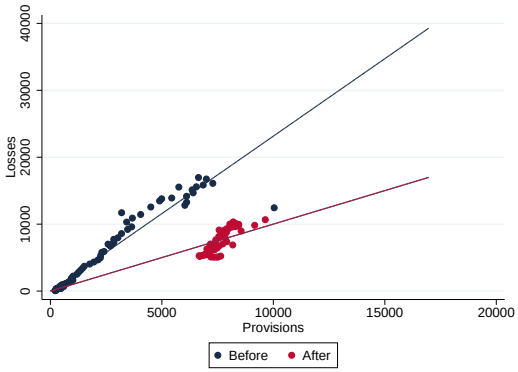

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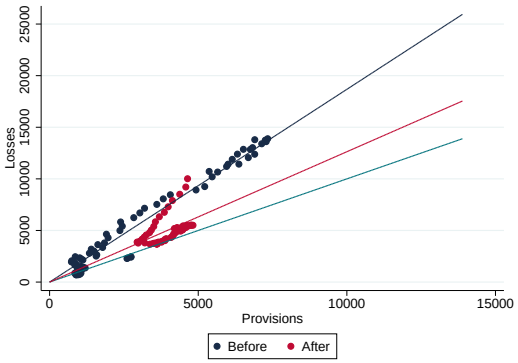

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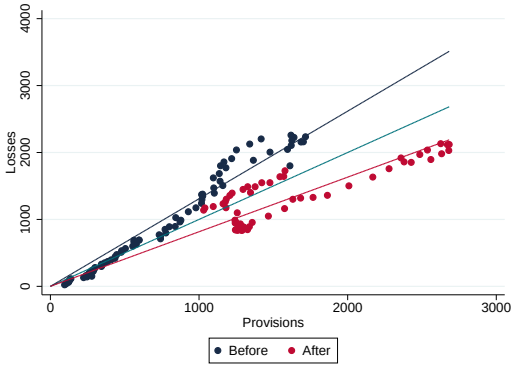

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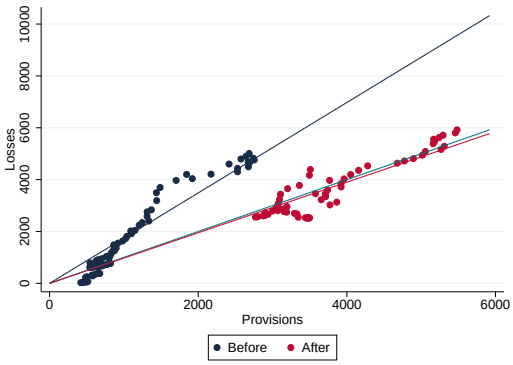


Figure 4: Evolution of commercial credit, consumption credit and mortgages

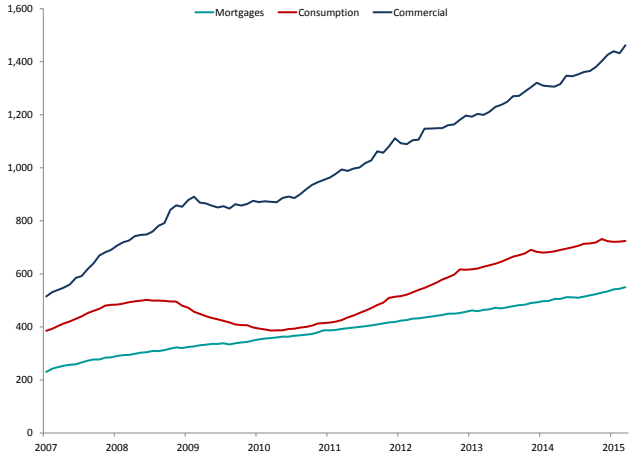
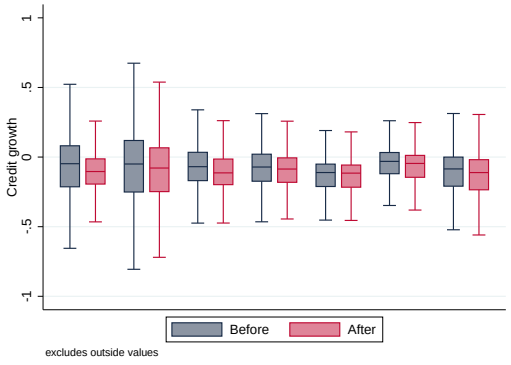


Figure 5: Credit account growth for commercial loans of selected banks



that they both study the same regulatory change, namely the introduction of Expected Losses Provisioning in Mexico. However, their study intends to relate this kind of estimations with systemic risk, while ours measures the effect of them on credit growth. [Levin Konigsberg, 2015] analyses the effect of forward looking provisions based on expecte losses in a general equilibrium context, finding this kind of measures welfare improving.

Considering the subject of the effectiveness of macroprudential policies, using a panel of countries, [Cerutti et al., 2015] find that this kind of regulations reduce credit growth. This paper uses creditor-level data to measure the effect of a specific policy and finds results in the same line. Using bank-level data, [Claessens et al., 2013] find macroprudential policies to be effective in different dimensions.

The effect of financial regulation may differ by country type. In particular, [Tovar Mora et al., 2012] find reserve requirements to have a transitional effect on credit growth in latin America.

3 Data and Empirical Strategy

To asses the impact of this change in provisioning rules on credit growth we use a panel of credit information at the bank-creditor relationship level. Our dependent variable is therefore the log-change of the total amount (the sum of the loans) owed by creditor i to bank b at time t. Notice that the same creditor i may have an active account at banks b and b' at the same time. This information is extracted from regulatory report R04C.

This report contains the current status of all loans given by commercial banks operating in Mexico to firms and individuals with commercial activity[5]. Although banks report this information on a monthly basis, we use a quarter cut of the data so we can match it with macro variables that are usually reported on a quarterly basis. Also, we leave out of our sample one percent outliers from each tail of the distribution of our dependent variable. Most of the observations that are left out from the sample are observations that yield dramatic log-changes, many of them possibly due to reporting errors[6]. Our final dataset includes over 630 thousand different creditor-bank relationships that generate on the time that our sample spans (from the third quarter of 2009 to the first quarter of 2015) around six million data points.

Our control variables are all taken from publicly available sources. We use balance-sheet information from the Mexican Supervisor, the National Banking and Securities Commission (CNBV, in Spanish) and macro variables from Banco de México's databases. Table 2 displays summary statistics for the variables we use. In the analysis that we develop on the next section we divide our sample into four sub-samples according to the currency in which loans are denominated and if they are given to large or small and medium firms[7]. Table 3 shows how observations are distributed among this categories

[5]That is, persons that get the loan on their names, but the destination of the loan is business oriented. It is important to make this distinction between typical household loans such as consumption credits and mortgages.

[6]Such as misplaced decimals.

[7]The Mexican regulation establishes how firms are to be catalogued according to their size, in a rule

while table 4 displays descriptive statistics for the dependent variable on each subsample. The negative sign on the mean has to do with the way the balance of the loans a firm owes to a bank evolves. Suppose that firm i owes one hundred pesos to bank b, it then takes an additional one hundred pesos loan, then the log-change on individual i's account will be roughly one hundred percent. If the total amount of the loan is then paid in four fifty peso payments, the log changes for this account will be -25, -33, -50, -100 yielding a negative mean.

This is an approapiate empirical setting for several reasons. The regulatory change can be considered exogenous given that it was part of a predetermined schedule of changes following an update process of regulatory practices in Mexico to standardize Mexican regulation to internationa best practices; and second, the use of individual level data allows to control for other unobserved individual characteristics that may be causing some of the changes, hence improving the quality of the estimation. Even though the time horizon considered for the analysis covers the aftermath of the crisis, the worst effects of the financiala crisis had already been realized and hence the period covers an already stable period.

Table 2: Summary Statistics

Variable	Mean	S. D.
Δpolicy_rate	-0.0681	0.1756
Δlog_gdp	0.0052	0.0276
fx	13.07	0.8253
current_acc	-5.86E+07	3.97E+07
VIX	19.0155	7.1828
log_assets	10.74	1.71
roa	0.44%	3.17%
liquidity	0.5397	0.2465
funding	0.5135	0.2709
c_ratio†	16.28	20.08

†Median shown in place of mean.

Table 3: Observations by subsample

	Large	Medium/Small
Local	144,937	5'726,194
Foreign	21,727	31,358

Our empirical strategy uses the dataset described above in a fixed effects model to evaluate the impact of tighter provisioning policies on credit growth. To this end we

based on the number of employees and firm revenue. We rely on banks reporting of these numbers.

Table 4: Dependent variable summary statistics

		Large	Medium/Small
Local	Mean	-0.053	-0.068
	S. D.	0.505	0.56
Foreign	Mean	-0.0274	-0.0331
	S. D.	0.5597	0.5332

estimate the following equations:

$$\Delta \log credit_{ibt} = \alpha_{ib} + \delta_t + \delta_t^m + \delta_t^n + X_t'\beta_{1t} + Y_{bt}'\beta_{2t} + \sum_{j=1}^{4} q_{jt} + \varepsilon_{ibt}$$

Where α_{ib} are fixed effects by creditor-bank relationship; δ is our variable of interest, a dummy variable that takes value equal to one from the moment the new provisioning rules where put in place and for the banks that follow this rules; δ_t^m and δ^n are dummy as well meant to capture the effect of the internal methodology that are used by banks number n and m respectively in our list of banks[8]. Vector X_t includes covariates that vary across time but not across bank or creditor, namely macro variables. It considers the change in policy rate, log-change in GDP, MXN/USD exchange rate, the current account and the VIX. Vector Y_{bt} contains bank balance sheet variables: liquidity, measured as the ratio of deposits and cash to assets; funding structure, measured as the ratio of deposits to liabilities; the log of assets; Return on Assets (ROA); and capital adequacy ratio. It is important to notice that the fixed effects on the model capture the long-term relationship between a creditor and bank thus containing information such as how persistent is this account for a creditor and that could be important when choosing to incur in default in a specific loan.

We also estimate how the new provisioning rules interact with some variables that become relevant in terms of analysing the effect of a change in policy. Specifically we estimate the interaction between provisioning and growth in order to asses the cyclical implication of the policy and the interaction between this policy an monetary policy to evaluate any possible impact on the transmission channels of monetary policy.

4 Results

Table 5 contains our the results for our baseline specification in local currency. The first column considers the baseline specification with our full sample, the second one uses the large firm subsample and the third one the small firm subsample. The fourth columns contains a robustness check that controls for the way that economic activity impact each type of firm. To achieve this we add to the baseline specification interaction terms between the firm's sector of economic activity[9] and GDP's sectoral growth.

[8]These banks were authorized to use their own internal models to compute their provisions.

[9]For firm's sector of economic activity we consider one of ten possible categories.

Our results indicate that the new provisioning rules have a negative and significant impact on credit growth. When the analysis is done by subsamples, the effect on medium and small-sized firms is larger than the one on large sized-firms. Antoher interesting feature of our results is that banks that use internal methodologies to calculate loan loss provisions have an advantage over those that use the regular methodology; bank n even has a positive impact from the change in provisioning rules when the large firm subsample is considered. The other controls in our specification have the expected sign. Regarding the other controls, there are a few findings worth mentioning. The lack of significance of the monetary policy control may be due to the fact that during the time period considered in our sample, there has been only loosening of monetary policy, hence not enough variability. Given the relative lack of competition on the banking sector in Mexico, monetary policy tends to have a large impact when rates are increased but no effect when these are decreased. Although the negative sign on log_assets seems counterintuitive, it is not. Large banks have less space and incentives to grow whilel smaller banks are still developing. Finally, the lack of significance on the capital ratio is due to the fact that this restriction is non-binding for any of the banks in the Mexican banking system, as most of them hold capital well above the regulatory minimum.

The results for our estimation for dollar-denominated loans are shown in table 6. In this case the effect of the policy on credit growth is smaller in magnitude and has a larger p-value. Moreover, the policy has no effect on large firms that borrow in dollars, arguably due to some inherent advantages of this kind of firms, for example, the possibility of funding abroad. Also, for this kind of loans there is evidence of advantage when using internal methodologies. When considering the complete sample, the use of internal methodologies allowed bank n to increase credit while reducing credit for the rest of the banks and having no effect on bank m. Also, the new methodology had a positive significant effect for both of the banks that use internal methodologies. Although, the coefficient for bank m is large than that of the regular provisioning rules, a test show that the difference between this two is not statistically significant.

Table 7 shows the results for estimations in which the new provisioning policy is interacted with the change on policy rate and growth. Although, the results for monetary policy suggest that the transmission mechanism not only fails to have an effect, but has the opposite effect than the desired one, this is possibly due to the fact that our sample covers only an episode where monetary policy was exceptionally loose. The interaction between the new provisioning rules and credit growth implies rather interesting results. Although there is no marginal effect from the policy through growth, there is for those banks that use their own rules. In fact, the rules implemented by this banks are countercyclical, a desired feature of macroprudential policies.

As it may be seen in tables 8, 9, and 10, our main results do not drastically change when we estimate a random effects model instead of a fixed effects one.

Table 5: Baseline estimation in local currency

	All	Large	Medium	Sectoral Growth
δ_{bt}	-0.0259***	-0.0136*	-0.0263***	-0.0294***
	(0.00646)	(0.00698)	(0.00668)	(0.00599)
δ^m_{bt}	-0.00354	-0.0123**	-0.00313	-0.00709
	(0.00712)	(0.00487)	(0.00734)	(0.00579)
δ^n_{bt}	0.0181*	0.0311***	0.0179*	0.0159*
	(0.00936)	(0.00592)	(0.00975)	(0.00895)
Δlog_gdp$_t$	-0.0487	-0.0521	-0.0498	1.082
	(0.169)	(0.142)	(0.175)	(0.966)
Δpolicy_rate$_t$	-0.00684	0.0318***	-0.00773	-0.0140
	(0.0107)	(0.0107)	(0.0110)	(0.0151)
Current_Acc$_t$	4.88e-10***	3.77e-10***	4.92e-10***	5.66e-10***
	(1.09e-10)	(7.31e-11)	(1.11e-10)	(1.23e-10)
FX$_t$	-0.0176***	-0.0197***	-0.0175***	-0.0227***
	(0.00455)	(0.00249)	(0.00467)	(0.00650)
VIX$_t$	0.00218***	0.00190***	0.00219***	0.00249***
	(0.000529)	(0.000405)	(0.000546)	(0.000583)
log_assets$_{t-1}$	-0.0766**	-0.00376	-0.0828**	-0.0626*
	(0.0322)	(0.0254)	(0.0337)	(0.0349)
c_ratio$_{t-1}$	0.00222**	0.00213*	0.00224**	0.00262**
	(0.00103)	(0.00107)	(0.00108)	(0.00115)
funding$_{t-1}$	-0.101	-0.0443	-0.102	-0.0248
	(0.158)	(0.107)	(0.159)	(0.129)
liquidity$_{t-1}$	0.0241	0.0503	0.0184	-0.0639
	(0.158)	(0.117)	(0.159)	(0.102)
roa$_{t-1}$	-0.00308	-0.00342	-0.00317	-0.00504
	(0.00251)	(0.00299)	(0.00262)	(0.00338)
Constant	1.174**	0.191	1.259**	1.085**
	(0.452)	(0.324)	(0.473)	(0.468)
Creditor-Banf Fe	Yes	Yes	Yes	Yes
Seasonal Dummies	Yes	Yes	Yes	Yes
Clustered Standard Errors	By bank	By bank	By bank	By bank
Observations	5100904	128802	4972102	5100904
R^2	0.005	0.004	0.005	0.005

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Baseline estimation in foreign currency

	All	Large	Medium	Sectoral Growth
δ_{bt}	-0.0192**	-0.0142	-0.0233*	-0.0231**
	(0.00849)	(0.0173)	(0.0125)	(0.00983)
δ^m_{bt}	-0.00393	0.0327*	-0.0270**	-0.00691
	(0.0115)	(0.0189)	(0.0118)	(0.0123)
δ^n_{bt}	0.0182*	0.0413***	0.00461	0.0154
	(0.00930)	(0.0123)	(0.0119)	(0.0103)
Δlog_gdp$_t$	-0.229	0.0618	-0.388	0.308
	(0.437)	(0.579)	(0.481)	(1.001)
Δpolicy_rate$_t$	-0.0184	0.0243	-0.0470	-0.0386
	(0.0297)	(0.0283)	(0.0465)	(0.0447)
Current_Acc$_t$	3.46e-10*	1.99e-10	4.80e-10**	3.65e-10**
	(1.84e-10)	(1.54e-10)	(2.08e-10)	(1.65e-10)
FX$_t$	-0.0179**	-0.0194**	-0.0174**	-0.0209***
	(0.00707)	(0.00904)	(0.00813)	(0.00701)
VIX$_t$	0.00314***	0.00203	0.00402***	0.00384***
	(0.000614)	(0.00132)	(0.000776)	(0.000775)
log_assets$_{t-1}$	-0.0696*	-0.0983	-0.0477	-0.0646*
	(0.0355)	(0.0577)	(0.0389)	(0.0352)
c_ratio$_{t-1}$	-0.0000602	-0.0000913	-0.000209	-0.0000608
	(0.000334)	(0.000859)	(0.000339)	(0.000333)
funding$_{t-1}$	-0.0438	-0.271	0.111	-0.00787
	(0.106)	(0.193)	(0.144)	(0.113)
liquidity$_{t-1}$	-0.0258	0.188	-0.178	-0.0776
	(0.110)	(0.157)	(0.148)	(0.111)
roa$_{t-1}$	-0.00445	-0.00855	0.00103	-0.00604
	(0.00420)	(0.00527)	(0.00730)	(0.00459)
Constant	1.105**	1.541**	0.787	1.065**
	(0.476)	(0.736)	(0.541)	(0.472)
Creditor-Bank FE	Yes	Yes	Yes	Yes
Seasonal Dummies	Yes	Yes	Yes	Yes
Clustered standard errors	By bank	By bank	By bank	By bank
Observations	44776	18770	26006	44776
R^2	0.006	0.007	0.007	0.009

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Effect by firm size and currency

	(1)	(2)	(3)	(4)
δ_{bt}	-0.0188	-0.0190***	-0.0126	-0.00273
	(0.0124)	(0.00649)	(0.0106)	(0.00788)
δ^m_{bt}	0.00333	0.00547	-0.0154	0.0142
	(0.0113)	(0.00777)	(0.0170)	(0.0125)
δ^n_{bt}	0.0326***	0.0272***	0.0297**	0.0302***
	(0.0118)	(0.00982)	(0.0116)	(0.00780)
Δlog_gdp$_t$	-0.144	-0.277	-0.277	-0.698
	(0.146)	(0.184)	(0.471)	(0.672)
Δlog_gdp$_t \times \delta_{bt}$		-0.212		-1.214**
		(0.211)		(0.476)
Δlog_gdp$_t \times \delta^m_{bt}$		-0.721***		-1.352***
		(0.228)		(0.343)
Δlog_gdp$_t \times \delta^n_{bt}$		-1.086***		-0.286
		(0.246)		(0.313)
Δpolicy_rate$_t$	-0.0327*		-0.0301	
	(0.0179)		(0.0370)	
Δpolicy_rate$_t \times \delta_{bt}$	0.0377		0.0371	
	(0.0343)		(0.0369)	
Δpolicy_rate$_t \times \delta^m_{bt}$	0.0372		-0.0602	
	(0.0276)		(0.0485)	
Δpolicy_rate$_t \times \delta^n_{bt}$	0.0838***		0.0637	
	(0.0271)		(0.0446)	
Current_Acc$_t$	5.33e-10***	5.61e-10***	3.62e-10*	4.74e-10**
	(1.22e-10)	(1.23e-10)	(1.96e-10)	(2.22e-10)
FX$_t$	-0.0200***	-0.0227***	-0.0190**	-0.0275***
	(0.00540)	(0.00530)	(0.00778)	(0.00466)
VIX$_t$	0.00232***	0.00242***	0.00319***	0.00355***
	(0.000576)	(0.000568)	(0.000665)	(0.000644)
log_activo$_{t-1}$	-0.0764**	-0.0699*	-0.0685*	-0.0607*
	(0.0317)	(0.0351)	(0.0351)	(0.0355)
c_ratio$_{t-1}$	0.00230**	0.00251**	-0.0000346	-0.0000995
	(0.00104)	(0.00116)	(0.000352)	(0.000344)
funding$_{t-1}$	-0.0764	-0.0248	-0.0596	0.0163
	(0.160)	(0.163)	(0.110)	(0.117)
liquidity$_{t-1}$	0.00747	-0.0408	-0.0307	-0.0686
	(0.161)	(0.161)	(0.108)	(0.108)
roa$_{t-1}$	-0.00425	-0.00331	-0.00501	-0.00485
	(0.00263)	(0.00305)	(0.00430)	(0.00505)
Constant	1.199**	1.141**	1.117**	1.106**
	(0.443)	(0.476)	(0.474)	(0.460)
Creditor-Banf Fe	Yes	Yes	Yes	Yes
Seasonal Dummies	Yes	Yes	Yes	Yes
Clustered Standard Errors	By bank14	By bank	By bank	By bank
Observations	5100904	5100904	44779	44779
R^2	0.005	0.005	0.006	0.007

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Concluding Remarks

Macroprudential policies have gained and important momentum in the policy circles. Their main objective is to face systemic risk and to enhance the financial systems resilience. However, fulfilling this objective comes at a cost as macroprudential may affect, intentionally or as an unintended consequence, other financial and macroeconomic variables when dealing with systemic risk. In this paper we contribute to assessing the effect of a specific piece of macroprudential regulation on credit growth.

Specifically, we examine the effect of the use of expected losses provisioning in Mexico on credit growth. To achieve this we use a large dataset, with over five million observations, of commercial loans extended by banks operating in Mexico. We find that the implementation of this policy indeed decreased credit growth, and that the effect of this decrease is larger in peso-denominated loans than in dollar-denominated ones.

Another interesting finding has to do with banks authorized to use their own techniques via internal models to estimate loan loss provisions. We find that in general the use of internal models allow banks to decrease less, or even increase, credit growth as compared to the effect of the methodology established in the regulation. Also, we do not find any differenced effect of the policy in different parts of the cycle, however we do find that internal methodologies are countercyclical, a desirable feature on a macroprudential policy.

Future research should consider if this specific policy attains its goal of mitigating systemic risk in order to make a complete cost-benefit evaluation of the policy. Moreover, other provisioning systems should be assessed in the same spirit as this one. Final, different pieces of regulation interact at the national and international level. A complete research regarding what is the aggregate effect of macroprudential policies and if there exist spillover effects should be considered.

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Apendix: Random effects estimation

Table 8: Random effects estimation in local currency

	All	Large	Medium	Sectoral Growth
δ_{bt}	-0.0167**	-0.00598	-0.0170**	-0.0164***
	(0.00774)	(0.00833)	(0.00787)	(0.00579)
δ^m_{bt}	0.0118	-0.00624	0.0119	0.0127
	(0.00880)	(0.00460)	(0.00902)	(0.00829)
δ^n_{bt}	0.0102	0.0270***	0.00952	0.0108
	(0.00908)	(0.00516)	(0.00948)	(0.00861)
Δlog_gdp$_t$	-0.180	-0.0890	-0.181	-0.415
	(0.134)	(0.138)	(0.139)	(0.982)
ΔPlicy_rate$_t$	-0.0104	0.0297***	-0.0115	-0.0106
	(0.0105)	(0.00939)	(0.0108)	(0.0147)
Current_Acc$_t$	1.65e-10*	8.58e-11	1.68e-10*	1.75e-10*
	(9.56e-11)	(7.74e-11)	(9.72e-11)	(1.01e-10)
FX$_t$	-0.00626***	-0.00908***	-0.00625***	-0.00640
	(0.00218)	(0.00194)	(0.00223)	(0.00391)
VIX$_t$	0.000972***	0.000706**	0.000986***	0.00121***
	(0.000273)	(0.000345)	(0.000282)	(0.000400)
log_activo$_{t-1}$	0.0176***	0.00219	0.0184***	0.0181***
	(0.00593)	(0.00222)	(0.00609)	(0.00593)
icap$_{t-1}$	-0.00218	0.000809	-0.00234*	-0.00230
	(0.00134)	(0.000909)	(0.00140)	(0.00150)
fondeo$_{t-1}$	-0.0695	0.0136	-0.0634	-0.0525
	(0.108)	(0.0545)	(0.111)	(0.108)
liquidity$_{t-1}$	-0.0754	0.00815	-0.0867	-0.0940
	(0.131)	(0.0612)	(0.134)	(0.130)
roa$_{t-1}$	-0.000605	-0.00321	-0.000598	-0.000513
	(0.00353)	(0.00295)	(0.00359)	(0.00375)
Constant	-0.129*	-0.00820	-0.134*	-0.124
	(0.0745)	(0.0460)	(0.0760)	(0.0905)
Observations	5100904	128802	4972102	5100904
R^2				

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Random effects estimation in foreign currency

	All	Large	Medium	Sectoral Growth
δ_{bt}	0.00144	-0.00126	0.00436	0.000665
	(0.0105)	(0.0191)	(0.0127)	(0.0111)
δ^m_{bt}	0.00738	0.0432**	-0.0115	0.00507
	(0.00822)	(0.0168)	(0.0110)	(0.00883)
δ^n_{bt}	0.0349***	0.0494***	0.0280***	0.0346***
	(0.00849)	(0.0167)	(0.0107)	(0.00895)
Δlog_gdp$_t$	-0.435	-0.197	-0.574	-0.958
	(0.455)	(0.632)	(0.444)	(0.790)
ΔPolicy_rate$_t$	-0.0166	0.0246	-0.0445	-0.0323
	(0.0267)	(0.0267)	(0.0432)	(0.0445)
Current_Acc$_t$	2.92e-12	-5.59e-11	4.77e-11	-4.47e-11
	(1.80e-10)	(1.72e-10)	(1.90e-10)	(1.60e-10)
FX$_t$	-0.00311	-0.00785	0.000127	-0.00218
	(0.00542)	(0.00782)	(0.00701)	(0.00481)
VIX$_t$	0.00151***	0.00101	0.00185**	0.00212**
	(0.000584)	(0.00112)	(0.000904)	(0.000837)
log_activo$_{t-1}$	-0.00268	-0.00264	-0.00245	-0.00261
	(0.00337)	(0.00593)	(0.00576)	(0.00336)
icap$_{t-1}$	0.0000484	-0.000371	0.000280	0.000121
	(0.000288)	(0.000743)	(0.000251)	(0.000288)
fondeo$_{t-1}$	-0.0217	-0.154**	0.0631	-0.0184
	(0.0618)	(0.0742)	(0.0746)	(0.0640)
liquidity$_{t-1}$	0.0527	0.223*	-0.0614	0.0455
	(0.0881)	(0.118)	(0.0962)	(0.0892)
roa$_{t-1}$	0.000659	0.000706	0.00218	0.000478
	(0.00448)	(0.00441)	(0.00746)	(0.00475)
Constant	-0.0269	0.0349	-0.0721	-0.0883
	(0.0848)	(0.152)	(0.0984)	(0.113)
Observations	44779	18771	26008	44779
R^2				

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Ransom effects estimation by firm size and currency

	(1)	(2)	(3)	(4)
δ_{bt}	-0.0128	-0.0115	0.00748	0.0136
	(0.0123)	(0.00765)	(0.0123)	(0.0129)
δ^m_{bt}	0.0143	0.0177**	-0.00279	0.0193*
	(0.0104)	(0.00820)	(0.0122)	(0.0108)
δ^n_{bt}	0.0197*	0.0171**	0.0440***	0.0461***
	(0.0102)	(0.00730)	(0.0122)	(0.0110)
Δlog_gdp$_t$	-0.232*	-0.348**	-0.471	-0.790
	(0.124)	(0.145)	(0.484)	(0.679)
Δlog_gdp$_t \times \delta_{bt}$		0.0135		-0.882*
		(0.125)		(0.481)
Δlog_gdp$_t \times \delta^m_{bt}$		-0.463***		-0.934***
		(0.141)		(0.362)
Δlog_gdp$_t \times \delta^n_{bt}$		-0.724***		0.00958
ΔPolicy_rate$_t$	-0.0238		-0.0262	
	(0.0179)		(0.0327)	
ΔPolicy_rate$_t \times \delta_{bt}$	0.0217		0.0358	
	(0.0309)		(0.0323)	
ΔPolicy_rate$_t \times \delta^m_{bt}$	0.0128		-0.0658	
	(0.0223)		(0.0406)	
ΔPolicy_rate$_t \times \delta^n_{bt}$	0.0547**		0.0558	
	(0.0217)		(0.0401)	
Current_Acc$_t$	1.88e-10*	1.97e-10**	1.87e-11	7.74e-11
	(1.06e-10)	(9.75e-11)	(1.83e-10)	(2.15e-10)
FX$_t$	-0.00745**	-0.00908***	-0.00391	-0.00933*
	(0.00290)	(0.00190)	(0.00599)	(0.00488)
VIX$_t$	0.00104***	0.00108***	0.00156**	0.00174***
	(0.000300)	(0.000281)	(0.000615)	(0.000647)
log_activo$_{t-1}$	0.0178***	0.0176***	-0.00237	-0.00266
	(0.00599)	(0.00579)	(0.00342)	(0.00341)
icap$_{t-1}$	-0.00215	-0.00208	0.0000816	0.0000711
	(0.00133)	(0.00136)	(0.000298)	(0.000295)
fondeo$_{t-1}$	-0.0640	-0.0599	-0.0189	-0.00871
	(0.109)	(0.110)	(0.0608)	(0.0638)
liquidity$_{t-1}$	-0.0813	-0.0862	0.0465	0.0393
	(0.131)	(0.131)	(0.0867)	(0.0884)
roa$_{t-1}$	-0.000943	-0.000266	0.000318	0.000693
	(0.00365)	(0.00364)	(0.00450)	(0.00472)
		(0.132)		(0.357)
Constant	-0.115	-0.0929	-0.0182	0.0546
	(0.0777)	(0.0732)	(0.0893)	(0.0683)
Observations	5100904	5100904	44779	44779
R^2				

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$