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Sumit Agarwal, Ricardo Correa, Bernardo Morais, Jessica Roldán, and Claudia Ruiz-Ortega

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Related Exposures to Distressed Borrowers and Bank Lending[1]

Sumit Agarwal Ricardo Correa Bernardo Morais Jessica Roldán Claudia Ruiz-Ortega

Abstract

We study how banks' exposure to a large set of related and suddenly-distressed borrowers impacts their commercial lending and risk taking. Using Mexican credit registry data, we examine the effect of the 2014 collapse in energy prices. After this shock, energy-exposed banks—regardless of their ex-ante financial health—raise further their exposure to the energy sector by expanding lending at looser credit terms to borrowers with higher expected losses, while recapitalizing through retained earnings. The shock is transmitted to non-energy firms—despite price controls on retail-energy products—via a contraction in bank lending, especially to bank-dependent borrowers.

JEL codes: E52, E58, G01, G21, G28.

Keywords: credit exposure, bank lending, financial stability, commodity prices, emerging markets.

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1. Introduction

Banks with strong regulatory ratios may fail if they experience simultaneous losses from a large group of related counterparties, even in the absence of large individual exposures (Financial Stability Institute, 2019; Bergman et al., 2020). Despite its importance, regulation on related exposures (e.g., sectoral, or geographical) remains limited, and there is scarce evidence on the actions that banks take to contain a very large shock hitting a large set of their commercial borrowers.[2] Banks with substantial exposure to a sectoral shock may not have the option of recognizing losses, even if well capitalized, as a sudden charge-off of related assets could trigger financial stresses (Morris and Shin, 2002; Bouvard, Chaigneau, and de Motta, 2015). In this scenario, banks may be forced to extend financing to a troubled sector, further increasing their portfolio concentration, while tightening credit supply to other sectors. While specialized banks have been shown to internalize negative spillovers of sectoral downturns supporting sectors facing transitory shocks (Blickle, Parlatore, and Saunders, 2023; Giannetti and Saidi, 2019), we highlight a material downside of large, related exposures and the importance of monitoring and potentially regulating them.[3]

To study the consequences of banks' concentrated loan portfolios, we exploit an outsized and exogenous sector-specific shock. We use credit registry data from Mexico, an important oil producer, to analyze the effect of the 2014 collapse in global energy prices on the lending decisions of banks with varying ex-ante exposures to energy borrowers.[4,5] We start by showing that in a scenario where a large share of energy firms defaults due to this energy price shock, banks with higher exposure to the sector would have a decline in their (ex-ante healthy) capital ratios to levels well below regulatory minimum requirements. It follows that more energy-exposed lenders

[2] Regulations on large exposures "set prudent limits on exposures to *a single borrower*" (Basel Committee on Banking Supervision, 2014). However, these regulations do not provide concrete guidelines addressing other concentrated exposures.
[3] Recent bank failures in the U.S. highlight the importance of related exposures, both on the assets and liabilities side (Georg, Pierret, and Steffen, 2023). Concentrated exposures affected banks' liquidity and solvency positions prompting regulators to enact measures to limit any potential contagion to the rest of the financial system.
[4] In late 2014, prices of West Texas Intermediate (the main global oil benchmark) collapsed from almost 100 USD per barrel to about 40 USD per barrel over just a few months. Although the price drop was driven by factors external to Mexico, the drop led to a weakening of the creditworthiness of energy companies reflected in the increase in their credit default swap premiums.
[5] We follow an approach similar to that used in the Basel Committee on Banking Supervision (2014) large exposure framework and define the ex-ante energy exposure of a bank as the ratio of its loans to firms in energy-related sectors over its Tier-1 capital in the month prior to the oil price shock. This ratio reflects the fraction of a bank's core capital at risk if distressed energy borrowers were to suddenly fail.

respond to the shock by *increasing* short-term lending at looser terms (e.g., lower interest rates) to their distressed energy borrowers. This behavior is consistent with banks postponing the recognition of losses given the regulatory and market-funding implications of severe and simultaneous write-downs (Bischof, Laux and Leuz, 2021). Energy-exposed banks—while increasing capitalization through retained earnings—shift lending away from borrowers in otherwise healthy sectors with negative impact on real outcomes, highlighting a potential "dark side" of bank specialization. Importantly, our results are not driven by other factors documented to affect bank lending, such as banks' ex-ante financial health, informational advantage (on firms or on the sector), large individual exposures, pre-committed credit lines, or political economy considerations.

There are three main advantages of using our setting to explore this topic. First, the collapse in global energy prices was an unexpected shock, unrelated to domestic fundamentals, that substantially deteriorated the financial health of firms in the energy sector. This allows for a clear identification of a period with increased correlated borrower distress. Second, during the period studied, the energy-price shock was not transmitted to other sectors in Mexico via changes in domestic energy prices, as retail prices—gasoline, diesel, natural gas, and electricity—were all set by the government and remained unchanged.[6] This helps us mitigate concerns of direct spillovers of the shock on the demand for credit from other sectors.[7] Third, the energy sector represents an important fraction of total commercial lending in Mexico (roughly 12 percent), with large variation across banks, helping uncover the impact of the shock on concentrated loan portfolios.

We start by analyzing the effect of the collapse in energy prices on banks' balance sheets and market indicators. We show that although banks of varying exposures were statistically similar prior to the shock (i.e., in the levels and pre-trends of our main outcomes of interest such as capital ratios), the financial performance of banks with ex-ante larger energy exposures deteriorates substantially after the shock. A one-standard-deviation increase in a bank's energy exposure prior

[6] Additionally, due to the country's longstanding practice of hedging against oil-price movements, the fiscal budget was shielded from oil price fluctuations in the short term.

[7] This concern is a key challenge when studying the bank-lending transmission of a sector-specific shock, as a shock in one sector can be passed directly to other sectors through mechanisms external to the bank-lending channel (Carvalho, 2015; Berg, Reisinger, and Streitz, 2021). Furthermore, while price controls maintained the retail price of energy products in Mexico unchanged, they likely had a negative impact on the international competitiveness of non-energy exporters, potentially causing a contraction in their credit demand. In subsection 5.3.2. we conduct robustness tests to help us rule out that this and other related mechanisms are driving our results.

to the shock leads to a 10.4 percent increase in the bank's credit default swap (CDS) spreads following the shock, and a 3.2 percent contraction in its stock prices. Ex-ante more energy-exposed banks also experience greater on-balance-sheet risk as a result of the shock, measured by significantly higher risk-weighted assets and delinquency rates. Despite the increase in risk and worsening financial performance, regulatory capital ratios of more exposed banks remain above the minimum requirements after the shock. To maintain these ratios, exposed banks increase their capital levels via lower distributions of earnings while keeping commercial lending volumes unchanged.[8] Importantly, we find that ex-ante more exposed banks reallocate their lending into the troubled energy sector and away from other sectors. This reallocation favoring energy borrowers happens despite the worsening financial conditions of energy firms, as evidenced by their higher CDS spreads. These broad findings indicate that while ex-ante healthy banks with large-related exposures to a distressed sector take measures to support their capital ratios, they simultaneously take on additional risk by reallocating their commercial lending into the troubled sector.

We then use credit registry data to identify the impact of the energy-price shock on the supply of bank lending. This more granular data allows us to control exhaustively for time-varying changes in the demand for credit, uncovering the mechanism behind the increased lending to the troubled sector by energy-exposed banks (Khwaja and Mian, 2008; Degryse et al., 2019). After the shock, energy firms obtain larger loans from banks with ex-ante higher energy exposures. The purpose of these loans is mainly to finance borrowers' working capital needs and are issued at lower interest rates and longer maturities, suggesting that stressed energy borrowers are kept afloat by their more exposed lenders. For instance, a one-standard-deviation increase in the ex-ante energy exposure of a bank is associated with working capital loans that are 17 percent larger, with 1.5 percent lower lending rates and 6 percent longer maturity. To understand the motives behind the loosening of credit conditions by energy-exposed banks to borrowers in the energy sector, we examine bank and borrower heterogeneity. We find that the looser credit terms (e.g., volume, interest rate, and maturities) are limited to energy firms with pre-existing loans from their lenders at the time of the shock and are more pronounced for energy borrowers with larger outstanding loans and in worse financial condition (proxied by ex-ante lower credit ratings). Consistent with

[8] Energy-exposed banks increase their capitalization using retained earnings (via a reduction in dividends and stock repurchases) rather than tapping external sources through seasoned equity offerings.

Diamond and Rajan (2000), the shock implicitly increases the bargaining power of stressed firms, particularly those borrowing from banks with large energy exposures, as their threat of default is more credible and potentially more damaging. Exposed banks may have weak incentives to push back, as they try to prevent the realization of material sudden losses, while slowly increasing their capital levels (Goldstein and Leitner, 2018; Bischof, Laux and Leuz, 2021).

One possible explanation for our results is that the expansion of lending to distressed energy borrowers is driven by ex-ante low-capitalized banks with large energy exposures (Faria-e-Castro et al., 2024; Blattner, Farinha and Rebelo, 2023). However, all commercial banks in our study have statistically similar capital ratios *prior to the shock*—all significantly above the minimum regulatory requirements—with a very weak correlation between banks' energy exposures and capital ratios.[9] We also conduct a series of checks to verify that our results are not driven by alternative explanations. First, informational advantages could explain the increase in the supply of credit to distressed firms by exposed lenders. If banks more exposed to a sector have stronger relationships with their borrowers, they may have better information that allows them to finance such clients in bad times (Bolton et al., 2016; Liberti and Sturgess, 2018; Iyer et al., 2022; Paravisini, Rappoport, and Schnabl, 2023).[10] Our results confirm that while firm-bank relationships matter for the average bank, more exposed banks inject liquidity to their existing energy borrowers regardless of the strength of their relationships. In other words, energy firms are not only financed by their largest lender at the time of the shock (measured by value of outstanding loans) *but also* by their lender with larger ex-ante exposure to energy. This suggests that the increase in credit to energy borrowers is not only driven by relationship lending but by incentives of energy-exposed banks to contain losses from existing borrowers. Second, and related with the above explanation, we also find that our results are not driven by the positive side of bank specialization—which would provide banks with superior information to support troubled borrowers in periods of stress without negative consequences for their own solvency or that of other borrowers (Acharya, Hasan, and Saunders, 2006; Iyer et al., 2022; Loutskina and Strahan,

[9] Furthermore, our results remain statistically and economically significant when controlling for banks' ex ante capital ratios.

[10] A related concern is that our results could be driven by debt-overhang problem. In this case, the existing debt discourages banks with little exposure to a borrower from extending credit to it, as existing debt holders would largely reap potential earnings (Myers, 1977). Thus, banks with ex-ante larger outstanding loans to specific energy borrowers would have greater incentives to finance them. We find that this explanation is not driving our results since they hold when controlling for their exposure to a particular borrower.

2011).[11] Third, the increased lending is in the form of new working capital loans issued to energy borrowers, and as such, our results are not driven by credit line drawdowns from previous loan commitments (Ivashina and Scharfstein, 2010). Finally, we show that the credit provision of more exposed banks to borrowers with larger outstanding loan balances is not driven by easier coordination of loan modifications (Roberts and Sufi, 2009; Roberts, 2015), by large individual exposures (Galaasen et al., 2021), by political economy considerations (Ongena, Popov, and van Horen, 2019) or by an increase in the financing costs of banks (Schnabl, 2012).[12] Altogether, our evidence is more consistent with the conjecture that more exposed banks subsidize short-term financing to their ailing borrowers to prevent sudden generalized defaults in their balance sheets.

Next, we use credit registry data to examine the lending dynamics of energy-exposed banks to non-energy firms. Price controls on retail-energy products mitigate the direct effects of the oil price shock on credit demand of borrowers. However, other contemporaneous shocks triggered by the oil price collapse may have differentially affected the credit demand of non-energy firms and the lending decisions of more energy-exposed banks. To address these potential confounding effects, we thoroughly control for time-varying changes in the demand for credit and for time-invariant assortative matching by saturating our specifications with firm*month and firm*bank fixed effects. Our loan-level estimates confirm that banks ex-ante more exposed to the energy sector contract their credit to non-energy firms after the shock, especially loans issued to small non-energy borrowers for investment purposes. More concretely, an increase of one standard-deviation in a bank's ex-ante energy exposure leads to a reduction in the volume of loans for investment projects to firms in non-energy sectors of 10.6 percent, especially among small and bank-dependent borrowers. We interpret these findings as evidence that the contraction of lending to non-energy firms is driven by a supply-side adjustment of the credit portfolio of energy-exposed banks.[13] Finally, using firm-year level data, we find that non-energy firms are unable to smooth

[11] Likewise, our results do not appear to be explained by an internalization of negative spillovers of industry downturns (Benmelech and Bergman, 2011; Favara and Giannetti, 2017; Giannetti and Saidi, 2019). First, our findings are only present for energy firms with an existing relationship with their bank and not for other firms in the energy sector. Second, our measure of related exposures remains significant after controlling for a common proxy for bank specialization, namely, banks' loan market share of the affected sector.

[12] One alternative mechanism for our findings is that explicit or implicit government support to the energy sector in Mexico may encourage banks to finance distressed energy borrowers at lax terms throughout the shock. We conduct a series of tests and show that our evidence is not consistent with this explanation.

[13] In additional tests, we corroborate the supply-driven nature of the credit contraction to non-energy firms and rule out that the bank lending contraction is driven by alternative explanations including changes in demand (external or internal), deteriorated public finances or implicit government guarantees.

the lending contraction from their more energy-exposed lenders, and that the credit crunch they experience leads to lower real outcomes. More concretely, a one-standard-deviation increase in the average energy-exposure of banks in a municipality is associated with a decline of 5 percent and 6.7 percent in the liabilities and revenues of non-energy firms.

Related Literature

Our paper contributes to the literature studying the relationship between banks' credit concentration and their risk taking and lending decisions. One strand of this literature shows that bank diversification can help limit the exposure and amplification of idiosyncratic shocks (Diamond, 1984; Goetz, Laeven, Levine, 2016; Galaasen et al., 2021; Doerr and Schaz, 2021; Paravisini, Rappoport, and Schnabl, 2023). Another set of studies find that specialization can benefit banks and borrowers by reducing information frictions (Winton 1999; Acharya et al., 2006; Laeven and Levine 2007; Loutskina and Strahan, 2011; Beck et al., 2022; Giometti and Pietrosanti, 2022). Our work is more closely related to studies examining how sectoral concentration of banks influences their lending during sectoral downturns (Giannetti, and Saidi, 2019, Iyer et al., 2022). These studies argue that specialized lenders provide liquidity to the distressed sector, due to the internalization of negative spillovers and due to informational advantages, that allow them to achieve higher returns from ex-ante more profitable firms. Furthermore, Iyer et al. (2022) also show that the negative sectoral shocks are transmitted to the rest of the economy through specialized banks, as these banks tighten (syndicated) credit to other industries, thereby increasing the vulnerability of the overall economy to systemic risk. However, while results in these studies are partly driven by relatively mild market corrections, we focus on an extreme sectoral shock (i.e., the 2014 oil price collapse) using the universe of commercial bank loans in Mexico (i.e., a setting characterized by energy price controls). In particular, we document an overlooked downside of concentrated lending: banks with large exposures to a sector—when facing an extreme negative sector-specific shock—may be forced to prop-up borrowers *representing larger expected losses* within the struggling sector *at looser lending terms*, taking increased sectoral risk while cutting lending to borrowers in healthier industries. We show that this behavior can undermine financial stability and reduce aggregate productivity by diverting resources away from more productive sectors that were otherwise little affected by the shock.[14]

This paper is also related to the literature studying the behavior of distressed banks. One set of papers documents that financially distressed banks reduce risk and leverage by increasing equity and by rebalancing credit portfolios away from high risk-weighted assets (Ben-David, Palvia, and Stultz, 2019; Bidder, Krainer, and Shapiro, 2021). However, the timely disclosure of such actions comes with trade-offs, as early loan loss recognitions can have regulatory implications and may signal weakness, potentially triggering bank runs (Bischof, Laux, and Leuz, 2021). For low-capitalized banks the incentives to delay or underreport loan losses and adjust lending to comply with capital requirements have been documented extensively (see Faria-e-Castro et al., 2024; Blattner, Farinha and Rebelo, 2023). We add to this literature by showing that large, related exposures to a sector influence the credit supply and risk-taking decisions of seemingly healthy banks in periods of sectoral distress. Instead of absorbing losses by reducing their capital ratios, banks with large sectoral exposures target their ratios and take on more risk (i.e., lending more to troubled firms) to avoid an increase in delinquencies. These actions propagate the shock to firms in otherwise vigorous sectors.

Lastly, we contribute to the extensive literature studying the effects of commodity price shocks on financial markets and economic growth (Agarwal, Duttagupta, and Presbitero 2019; Blanchard and Gali 2010; Alesina, Campante, and Tabellini 2008; Gilje, Loutskina and Strahan, 2016; Deaton 1999). These papers examine how commodity price shocks affect the real economy, and how banks propagate these shocks via lending reallocation. We add to these studies by showing banks more exposed to commodities increase their exposure further (i.e., by evergreening loans), reallocating lending away from other sectors thereby amplifying commodity-price shocks. We highlight the importance of monitoring banks' sectoral exposures, and in particular, their exposures to commodities. Not only do commodity prices tend to be more volatile than prices in the manufacturing or service sectors (Jacks et al., 2011), but the financial health of the majority of

[14] Our findings—that banks with concentrated exposures are forced to prop-up distressed borrowers—only occur following extreme sectoral shocks. They are not present in relatively (more frequent) milder shocks studied in Giannetti, and Saidi (2019) and Iyer et al., (2022). Thereby, suggesting the existence of non-linearities in outsized shocks that is obscured when analyzing the universe of sectoral downturns.

firms in these sectors is to a great extent determined by commodity prices, leading to an environment with highly correlated returns during stress episodes.

2. Institutional Background

In this section we describe the collapse in international energy prices that occurred in 2014, as well as the Mexican energy industry and the Mexican financial sector.

2.1. Oil-Price Collapse in 2014

In the second half of 2014, the global price of crude oil began a sharp decline. Between September and December 2014, the monthly average price of the Mexican Mayan crude oil fell 40 percent, from 88 dollars per barrel to around 52 dollars per barrel (Panel A of Figure 1).[15,16] This sharp decline in oil prices was largely unexpected by energy experts and by the market overall. For example, in its April 2014 Annual Energy Outlook (i.e., prior to the price drop) the U.S. Energy Information Administration noted that it expected WTI oil prices to gradually pick up to about $109/barrel through 2025 (EIA, 2014).[17] The initial decline in prices was driven by an unexpected slowdown of the global economy, due to the cumulative effects of positive oil supply shocks in some Middle East countries, and due to technological advances (e.g., fracking techniques) in the United States (Baumeister and Kilian, 2016). The largest decline in prices, which happened in November 2014, coincided with the OPEC announcement that it would not reduce its oil output to arrest the slide in global prices, sending benchmark crude prices even lower. Following the collapse in energy prices, the expectation of market participants at the time was for prices to remain at low levels. For instance, in April 2016, the EIA in its Annual Energy Outlook expected prices to "gradually pick up to 60 dollars per barrel by 2025" (EIA, 2016).

The energy industry was severely hit worldwide by this collapse in oil prices. The CDS spreads of energy firms in emerging countries, including Mexico, spiked from around 100 basis points (bps) in the third quarter of 2014 to 400 bps in late 2015 (Panel A of Figure 1). At the same

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[15] Crude oil products are traded on various oil bourses based on established chemical profiles, delivery locations, and financial terms. The price of Mexican oil is denoted *Mayan*.

[16] During the same period, the price of the more commonly traded West Texas Intermediate (WTI) fell 37 percent from 93 dollars to 59 dollars.

[17] The *Commodity Markets Outlook* of the World Bank also forecasted in April 2014 that "nominal oil prices are expected to average 103 dollars per barrel in 2014 (down from 104 dollars per barrel in 2013) and decline to 99 dollars per barrel in 2015" (World Bank, 2014).

time, the need for liquidity in the sector intensified, as indicated by the overall increase in the leverage of oil-producing firms across advanced and emerging economies (Figure A1 in the Appendix).

To put into perspective the severity and the effects of the 2014 oil price shock, Figure A2 in the Appendix plots the evolution of real WTI oil prices (Panel A), equity prices of listed energy firms in Latin America (Panel B), and CDS spreads of Pemex and Mexico's sovereign debt (Panel C). The yellow and orange bars in the panels display episodes of moderate and large oil price contractions, respectively. In the spirit of Giannetti and Saidi (2019), we define moderate oil price contractions as six-month real oil price reductions between 10 and 30 percent. Large price shocks, which we define as six-month price contractions greater than 30 percent, are rarer and significantly more extreme. In fact, during this period, there are only two broad events with large oil price contractions—the Global Financial Crisis (GFC), when WTI prices fell 71 percent peak to trough, and the oil price shock we study, with a peak to trough drop of 72 percent.

As the figure shows, moderate and large oil price shocks have markedly different effects on the equity prices and credit quality of energy firms. After moderate oil price shocks, energy firms experience an equity price decline of 9 percent, while large shocks resulted in a 47 percent drop (Panel B).[18] Crucially, large oil price shocks had an outsized impact on the credit quality of energy borrowers, as shown in Panel C. During moderate corrections, Pemex's CDS spreads remained roughly stable. However, during large shocks, CDS spreads for Pemex spiked by 130 basis points, with a peak-to-trough increase of 230 basis points.[19] Using a simple linear model to estimate the implied probability of default from the CDS spreads, and assuming a loss-given-default of 35 percent (Doing Business), we find that the market-implied probability of default for energy firms rose by nearly 7 percentage points during large negative price shocks, from 1 percent

[18] Since there were no publicly listed Mexican energy firms, we proxy for the evolution of equity prices of the energy sector in the region using the average value of the stock prices of the three largest firms in the region. Petrobras, Enel and YPF. We believe this comparison to be valid as both sets of firms have similar profiles of financial stress during the period.

[19] In the paper, we focus on the large energy-price shock of 2014, instead of the GFC period, as the financial stress during the GFC was generalized, with sovereign CDS spreads (right panel of Figure RA1) similar to the spreads of Pemex. Instead, the effect on CDS spreads was more pronounced to energy firms during the event we study. Therefore, we argue that our event study, in a context of regulated retail-energy prices, identifies more cleanly the impact of a large sectoral shock on bank lending and on its propagation across non-impacted sectors.

in the pre-shock period. This estimate is likely conservative, given that Pemex, as a state-owned enterprise, benefits from implicit government guarantees on its debt.

In summary, this evidence highlights the potential non-linear impact of extreme negative sectoral shocks on banks with concentrated bank lending. Furthermore, the downside risks of sectorally concentrated bank loan portfolios are likely to be extremely underplayed if stress tests do not contemplate these "once in a decade" shocks.

2.2. Oil Production and Energy Policy in Mexico

In 2014, Mexico was the 10th biggest oil producer in the world, and the fifth biggest outside the Middle East. Mexican oil production is mainly concentrated in two states, Campeche and Tabasco, with production in other states marginal both in absolute number of barrels produced and in the share of state-level GDP.[20] In Mexico, as in many oil exporters in the developing world, the main entity responsible for producing and refining crude oil, as well as for the retail sales of the derived products from oil, is a state-owned company: *Petróleos Mexicanos* (Pemex). Despite being a state-owned company, Pemex's CDS spreads shot up immediately after the collapse in oil prices from roughly 100 basis points in mid-2014 to more than 400 basis points by late 2015 (Figure 1). This movement in financial markets suggests that at the time of the energy price shock, financial markets priced-in a substantial increase in the probability of delinquency of Pemex's liabilities. Despite Pemex's importance in the extraction and distribution in Mexico's energy market, it only represented around 10 percent of total bank lending volume to Mexican energy borrowers in late 2014. This is because more than 85 percent of Pemex's liabilities at the time of the price shock were in the form of bonds, the vast majority of which were issued in foreign currencies and held by foreign entities (Petróleos Mexicanos, 2015). In addition to Pemex, there are hundreds of private companies, foreign and domestic, serving the energy sector across all levels of the Mexican supply chain. More concretely, there are 439 energy firms in our dataset, 412 privately owned, borrowing from Mexican banks.[21] The description of all energy-related sectors (5-digit NAICS) is

[20] Oil production and extraction in Campeche and Tabasco represented 68 percent and 41 percent of state GDP in 2013, respectively. These numbers contrast with those for other producers such as Veracruz, Chiapas, and Tamaulipas where the oil sector represented only 3.3 percent, 2.6 percent, and 2.5 percent of the states' GDP, respectively.

[21] All results in this paper hold if we exclude from the analysis all the state-owned energy firms.

provided in Panel B of Table A1 in the Appendix, and the sectoral distribution of loans to energy firms is displayed in Figure A3 in the Appendix.

Retail prices for energy products in Mexico were historically determined nationally by the Ministry of Finance. Due to such price controls, energy retail prices in the country—including the price of gasoline, diesel, natural gas, and electricity—remained mostly unchanged during our sample period, shielding consumers and non-energy firms from the late 2014 oil price drop (Panel B of Figure 1).[22] In addition to price controls on retail energy products, Mexico has hedged oil-price risk for decades through the largest hedging program in the world (Ma and Valencia, 2018; World Bank, 2018). More concretely, the Mexican Treasury conducts yearly purchases of put options with strike price close to the oil price assumed in the annual fiscal budget. Other strategies used by the Mexican government to limit the impact of oil price fluctuations on the national budget include stabilization funds to avoid unplanned public budget cuts by covering any shortfalls from differences between actual vs projected federal government revenues (OECD, 2009). All these strategies combined made fiscal expenditures relatively insulated throughout the period we study from fluctuations in oil prices.

2.3. Mexican Financial Sector

The Mexican financial sector was bank dominated and relatively small compared with other similar emerging market economies (IMF, 2016). Assets in the sector represent 90 percent of GDP in 2015, with over half being commercial banking assets.[23] The commercial banking sector is highly concentrated and the seven largest banks—commonly denominated as G7—are all fully owned by financial groups, accounting for about 80 percent of total bank assets. The sector has a large foreign presence, but most activity remains local. Five of the G7 banks are foreign subsidiaries of large global financial groups and account for about 65 percent of commercial banks' assets. All banks keep the bulk of operations in Mexico, with funding depending on domestic savings used mostly towards domestic lending and government securities.

[22] These price controls on energy products likely affected the international competitiveness of non-energy exporters, indirectly altering their demand for credit. In Section 5, we rule out that this mechanism explains the documented contraction in lending to non-energy firms after the shock.
[23] While the non-bank sector remains small, activities of development banks reached 10 percent of financial sector assets by end-2015.

All commercial banks were subject to the same regulations during the time of our analysis, and all credit institutions were subject to the Basel III standards implemented in early 2013.[24] Tier1 capital ratio averaged 15.2 percent with all banks comfortably meeting the minimum requirement of 8.5 percent (see solid dots in Figure IA1 in the Internet Appendix). Similarly, all banks met the minimum 60 percent liquidity coverage ratio requirement (BIS, 2015). FX risk exposures were low and foreign currency loans accounted for only 13 percent of total loans. Finally, non-performing loans represented only 2.9 percent of total loans, returns on equity averaged 17 percent, with the spread between lending and deposit rates remaining high and stable at around 10 percentage points.[25]

Although energy companies generally hold tangible assets that can retain value in bankruptcy, the costs of financial distress are critical in determining the material losses banks might incur on their concentrated exposures. In our context, these costs are particularly relevant. Doing Business data (World Bank, 2016) show that insolvency proceedings in Mexico are significantly more expensive and time-consuming than in the U.S., with lower recovery rates. This is suggestive that Mexico's financial distress costs can offset the value of tangible assets of energy borrowers.' Additionally, information from the Federal Reserve's FR Y-14 show that banks experience similar delinquency costs when lending to Mexican energy and non-energy firms, but that delinquency costs are a touch higher when banks lend to energy firms in the Mexico than in the United States.

Using the sectoral credit composition of banks reported publicly by the bank regulator (CNBV), we motivate the potential impact of a generalized delinquency in the energy sector on the regulatory capital ratios of banks. More specifically, we plot in Figure IA1 the actual Tier-1 capital ratios of banks (solid dots) against their energy exposure prior to the shock and analyze how these capital ratios would be affected (hollow dots) in a simulated scenario where all energy loans become delinquent (i.e., resulting in capital losses). While this example is extreme, it shows

[24] There was no phase-in of standards, and all banks already satisfied Basel III constraints by a healthy margin in 2012 (IMF, 2012).

[25] Apart from the banking sector, capital markets in Mexico are small and used exclusively by the largest corporations (see for example IMF, 2012; Carabarin, de la Garza, and Moreno, 2016). Shadow banking has grown as an alternative form of financing over the last decade, albeit from a very low base. Even though Mexico is a bank-dominated economy, we also analyze the extent to which firms substitute with other sources of liabilities.

that bank exposure to the energy sector can lead to a very sharp reduction in capital ratios into levels well below regulatory requirements, even for banks with ex-ante healthy capital buffers.[26]

3. Data

We use data from four sources, from 2013 to mid-2016.[27] Our first data set contains monthly balance sheet information of the 28 private commercial banks, representing more than 98 percent of Mexican commercial bank lending.[28] We merge this data set with information from Bloomberg on the stock prices and CDS spreads of available banks. Panel A of Table 1 presents summary statistics for the commercial banks in our sample, with the definitions of each variable listed in Panel A of Table A1 in the Appendix. The first row displays the exposure of banks to borrowers in energy-related sectors as a share of their Tier-1 capital. We classify borrowers as belonging to an energy-related sector according to their 5-digit North American Sector Classification System (NAICS) codes. Panel B of Table A1 in the Appendix displays the energy-related sectors as well as their descriptions. The ratio of exposure to capital of the average bank is 9.3 percent, with banks in the bottom decile having no exposure to the energy sector, and banks in the top decile having an exposure above 20 percent. Our measure of exposure follows the Basel Committee's assessment of exposure to related entities, defined as the credit volume of a bank to related entities as a share of its Tier-1 capital. By relating a bank's core capital to total lending to energy borrowers, it helps us identify banks that are more severely affected by the collapse in oil prices. Panel A also exhibits other bank statistics such as Tier-1 capital ratio, total loans, CDS spreads, stock prices, delinquency rates, and concentration ratios.

The second data set, which we refer to as the loan-level data, consists of the universe of commercial loans in Mexico, obtained from regulatory reports sent monthly by every commercial bank to the regulator. The reports are mandatory, updated electronically, and include detailed

[26] This example does not take into account neither potential losses of non-energy borrowers serving the energy sector, nor possible spikes in funding costs (e.g., "due to bank runs") or the deterioration of other regulatory ratios.

[27] We end our sample in June 2016 to restrict from our analysis a series of reforms to the energy sector that took place afterwards. One such reform was a staggered fuel price liberalization to phase out the state-set gasoline prices, which allowed the maximum price for gasoline to rise by as much as 20 percent by January 2017. Other measures included the removal of entry restrictions of private companies importing and selling gasoline, with the first non-Pemex gasoline station opening in the country in July 2016.

[28] To ensure the comparability of our results across banks, and given our focus on corporate lending, we exclude from our analysis banks specializing in consumer lending as well as niche banking. Around 97 percent of the number of loans in our data are denominated in Mexican pesos. We restrict our analysis to loans in domestic currency. Including loans in foreign currency does not alter our results in any significant way.

characteristics of all new and continuing commercial loans. All loans, regardless of their size, are reported.[29] Each loan has an identifier of the issuing bank, as well as the borrower's identifier, location, sector, and number of employees. The data set includes information on the interest rate, outstanding amount, type of financing (i.e., whether the loan is for working capital or investment purposes) and start and end dates (maturity) of each loan. Given that some borrowers have more than one loan issued by the same bank at a given point in time, we adopt a similar approach as La Porta et al. (2003) and aggregate individual loans at the firm-bank-month level. Loan characteristics, such as the interest rate, fraction of the loan covered by collateral, and loan maturity, are firm-bank-month averages, weighted by outstanding loan amount. This approach puts greater weight on larger loans, ensuring that our results are economically meaningful.

Overall, our loan-level dataset contains 1,496,459 loans to firms in the energy and non-energy-related sectors. The summary statistics for our sample are shown in Panels B and C of Table 1, with the variable definitions listed in Panel A of Table A1 in the Appendix. Panel B of Table 1 reports the loan characteristics of firms operating in energy-related sectors as described in section 2.2. Although the average bank loan of an energy firm is around 90 million Mexican pesos (roughly 5.6 million USD), the median loan size is of only 1.6 million Mexican pesos (90,000 USD). Interest rates in the energy sector average 11.4 percent, with loans in the bottom decile having rates as low as 4.4 percent and loans in the top decile 18 percent. The maturity of loans is on average around two years, with loans in the bottom decile having maturities of around two months, whereas the top decile has maturities of four years. These short maturities are consistent with most loans being destined for working capital. On average energy firms have 2.3 bank relations with the median firm having 2 bank relations. The loan characteristics of firms operating in non-energy sectors are exhibited in Panel C of Table 1. The average loan size is of around 6.2 million Mexican pesos, but the median loan is approximately 0.5 million Mexican pesos. The average loan size for working capital is worth 5.5 million pesos while the average loan size destined to investment is worth 11.7 million pesos. Finally, non-energy firms have fewer bank relations than their energy counterparts. On average these firms have 1.8 bank relations on average with the median firm having 1 bank relation.

[29] Unlike most credit registries, the Mexican registry does not have a minimum loan size for inclusion in the dataset. For example, in Germany the threshold is 1.5 million euros while in Italy it is 75,000 euros. This implies that loans to small and even medium firms may not be included in those credit registers.

To link the bank lending of non-energy firms with their real effects, we aggregate the loan-level information at the firm-year level. We proxy for the exposure of a non-energy firm to the energy sector using the average energy exposure, weighted by loan volume, of its lending banks.[30] If firm-bank relations are persistent then the exposure of a non-energy firm to the energy sector depends on the exposure of its banks.[31] If firms could switch banks at no cost, then their past banking relationships should not impact their current or future real activity following the drop in oil prices, as they could smooth the shock by switching to other banks or to other sources of financing. However, if switching banks is costly, then having a strong relationship with a bank highly exposed to the energy sector can have important effects on real outcomes. Overall, we find that the average firm had an exposure of around 12.2 percent in September of 2014, one month prior to the sharp decline in energy prices. We also create a similar measure of exposure of non-energy firms at the municipality level. We construct the variable $MuniExposureEnergy_{m,Sep14}$ as the average exposure to the energy sector in September 2014—weighted by loan value—of the banks serving a municipality *m*.[32] Given that lending tends to be local (Degryse and Ongena 2005), this measure allows us to capture variation in the exposure of firms to the shock via the exposure of banks operating in their municipalities. After aggregating all loans at the firm-year level we find that on average firms have outstanding loans valued at around 10.3 million Mexican pesos, with the median firm having total loans valued at around 0.7 million Mexican pesos.

For the analysis on real outcomes, we use a third dataset, Orbis. Orbis is a *firm-year*-level data set compiled by *Bureau van Dijk*, containing information on the balance sheets and income statements of a large set of Mexican firms. The data set reports information on assets and revenues of firms as well as their liabilities. The vast majority of firms in Orbis, around 98 percent, are non-listed firms.[33] As we show in Panel D of Table 1, the median liabilities of firms are around 187 million Mexican pesos, with median assets and revenues of around 503 million Mexican pesos and 182 million Mexican pesos, respectively.

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[30] In all our exercises using studying the impact of the energy shock on non-energy firms, we exclude the two main energy-producing states Campeche and Tabasco. Results remain unchanged if we exclude the three other minor producers Veracruz, Chiapas, and Tamaulipas.
[31] We find that bank-firm relationships are indeed sticky, with only 9 percent of firms switching their main bank from one year to the next.
[32] In Mexico, there are 2,448 municipalities, with an average population of around 400,000.
[33] As shown by Morais et al. (2019), this sample of firms is representative of the universe of sectors and locations in Mexico, albeit somewhat skewed toward larger firms.

4. Empirical Strategy

We now describe the empirical strategy we follow to identify the impact of the collapse in oil prices in late 2014 on the financial health of banks with varying ex-ante exposure to energy. We then discuss how we map this methodology to more granular data at the loan and firm level, allowing us to investigate the impact of the oil price shock on the reallocation of credit across sectors and subsequent real effects.

4.1. Bank-Level Data

Monthly bank-level data displayed in Figure 2 suggests that the oil price shock hit the balance sheets of banks ex-ante more exposed to energy-sector borrowers, as the conditions of these clients deteriorated considerably. In the figure, we divide banks into two groups based on the median exposure to the energy sector at the time of the shock in September 2014: below the median (banks with ex-ante low exposure) and above the median (banks with ex-ante high exposure). For each group, we plot banks' average CDS spreads (Panel A), stock prices (Panel B) and share of loans to energy borrowers (Panel C) from January 2013 to June 2016.

Panels A and B show that even though stock prices and CDS spreads had similar trends across both groups of banks up to the price shock, these trends diverged immediately afterwards. Banks with larger energy exposure saw their CDS spreads increase 100 basis points after collapse in energy prices, whereas the CDS of the remaining banks only increased 50 basis points. Similarly, the stock prices of banks with high exposure declined by more than 10 percent through mid-2016, whereas the stock prices of banks with low exposure remained mostly unchanged. As Panel C shows, the variation across banks in the share lent to energy borrowers was constant across both types of banks until September 2014. Prior to the shock, the lending shares to energy firms were on average 10 (3.8) percent for banks above (below) the pre-shock median exposure. However, after the price shock, banks that were more exposed ex-ante increased even more their lending share to the sector ex-post, reaching 30 percent by mid-2016, while the share of lending to the energy sector by less exposed banks only increased to around 8 percent.

Exploiting the cross-bank variation in energy exposure prior to the price shock, we adopt a difference-in-differences approach to assess the impact of the price collapse on the performance and lending dynamics of banks. Equation 1 displays our baseline specification, where the treatment variable $Energy_{b,Sep14}$ is continuous and corresponds to the ex-ante exposure of banks to the energy sector, calculated as the September 2014 ratio of loans to energy-sector borrowers over a bank's Tier-1 capital.

$$Y_{b,m} = \alpha + \beta Energy_{b,Sep14} * Post_m + \gamma_m + \gamma_b + \varepsilon_{b,m} \qquad (1)$$

Our eight outcomes of interest for bank *b* at month *m* are denoted by $y_{b,m}$ and consist of the bank's CDS spreads, stock prices, total commercial lending (in logs), exposure to the energy sector, delinquency ratios, risk-weighted assets (in logs), Tier-1 capital ratio and Tier-1 capital (in logs). We regress these outcomes on the interaction of $Energy_{b,Sep14}$ and a dummy variable—$Post_m$—that equals one after September 2014 and zero otherwise. We also include fixed effects at the bank and month levels to absorb all time-invariant characteristics of banks, as well as aggregate variations across time. Finally, standard errors are double clustered at the bank and month levels.

One assumption behind the difference-in-difference approach is that the outcomes of interest would have followed parallel trends across banks regardless of the banks' exposures to the energy sector in the absence of the oil-price shock.[34] While this assumption cannot be tested, we examine if the outcomes of banks of varying pre-shock exposures followed similar trends prior to the price shock. The raw data displayed in Figure 2 suggests that banks below and above the median exposure to the energy sector followed parallel trends on our key outcomes of interest prior to the shock, and only afterwards, a gap begins opening between these two groups of banks. We conduct this test more formally using the specification outlined in equation 2 for the period covering January 2013 to September 2014 (i.e., prior to the energy price shock).

$$Y_{b,m} = \alpha + \beta Energy_{b,Sep14} * Trend_m + \gamma_b + \gamma_m + \varepsilon_{b,m} \qquad (2)$$

In equation 2, $y_{b,m}$ corresponds to the outcomes of interest for bank *b* at month *m*, and the variable $Trend_m$ consists of a linear trend over time. As before, $Energy_{b,Sep14}$ captures bank *b*'s September 2014 exposure to the energy sector. The coefficient β tests for the parallel trend assumption in outcome *y* across banks of varying exposures to the energy sector in the pre-shock

[34] This assumption is more plausible when the outcomes across banks of varying ex-ante exposure prior to the shock are similar. In Table A2 in the Appendix, we split banks into two groups given their exposure to energy borrowers above/below the median in September of 2014 and compare the mean outcomes between the two groups prior to the oil price shock. The only difference between these groups of banks is the average exposure to energy of banks which, by construction, is larger in the high-exposed group relative to the low-exposed group. In all other outcomes (e.g., delinquency rates) banks are statistically similar across both groups.

period. We include fixed effects at the bank level γ_b and at the month level γ_m. The results of this test are displayed in Panel A of Table IA1 in the Internet Appendix. We find no statistically significant differences in the trends of our main outcomes across banks of varying energy exposures in the period prior to the oil price collapse, lending credibility to our identification strategy.[35]

4.2. Loan-Level Data

Using the universe of bank loans to firms in Mexico, we investigate more granularly whether the oil price shock led to the provision of liquidity to energy borrowers and whether there was a reallocation of credit across sectors. One key advantage of analyzing loan-level data is that we can identify if our results are driven by changes in the demand rather than in the supply of credit. Furthermore, since the dataset includes loan terms, we can also investigate if the credit provided by more exposed banks was not only in the form of larger loan volumes but also via looser credit terms. We use the specification summarized in equation 3 to examine the evolution of bank lending to both energy and non-energy sectors.

$$Y_{f,b,m} = \alpha + \beta Energy_{b,Sep14} * Post_m + X_{b,m} + \gamma_{f,b} + \gamma_{i,s,m} + \varepsilon_{f,b,m} \quad (3)$$

This specification relies on a difference-in-difference methodology, with varying intensity of treatment, where we compare loan outcomes of energy firms before and after the oil price collapse given banks' exposure to the energy sector prior to the oil-price shock. The dependent variables, $y_{f,b,m}$ correspond to the total loan volume, as well as the loan volume destined to working capital, extended to firm *f* by bank *b* in month *m* (all in logs). Additionally, we also examine other credit margins (interest rate and maturity) obtained by firm *f* from bank *b* in month *m.*

As described earlier, the variable $Energy_{b,Sep14}$ captures the exposures of banks to energy borrowers in September 2014 (prior to the oil price collapse) as a share of Tier-1 capital, and its interaction with the $Post_m$ dummy allows us to assess the relative reaction of banks of varying ex-

[35] We additionally analyze the monthly evolution of a bank's exposure to energy borrowers using the following specification: $y_{b,m} = \alpha + \sum \beta_m Month_m * Energy_{b,Sep14} + X_{b,m} + \gamma_b + \varepsilon_{b,m}$. The covariates $Month_m$ are monthly dummies interacted with bank *b*'s exposure to the energy sector in September 2014. Thus, the β_m coefficients measure the monthly variation in the exposure to energy firms across banks of varying exposures in September of 2014. The coefficients, plotted in Figure 3, provide further validity to our identification strategy: the loan exposure to energy borrowers across banks of varying exposures follows statistically similar trends in the pre-shock period, and only after the oil price collapse, banks more energy-exposed begin growing their exposures to the distressed sector.

ante exposures to the sector. The term $X_{b,m}$ represents a vector of time-varying characteristics of bank b in month m, which include total assets as well as capital and liquidity ratios. We also include a series of fixed effects that help isolate the variation in banks' exposure to the energy sector from other unobserved heterogeneity in the data. Specifically, we saturate our specification with fixed effects at the firm*bank level $\gamma_{f,b}$ to help us control for sticky firm-bank relationships as well as all unobserved, time-invariant, firm (i.e., sector, location, ownership) and bank heterogeneity. Additionally, we include state*sector*month fixed effects to absorb time-varying changes in the demand for credit at the industry level of each state in Mexico. Finally, in some specifications we include firm*month fixed effects to exhaustively control for all time-varying changes in the credit demand of a firm (e.g., changes in its risk, investment opportunities and balance sheet characteristics), as we examine the loan margins obtained by a given firm in a given month from different banks of varying ex-ante energy exposures.[36] The error term, $\varepsilon_{f,b,m}$, is clustered at the bank and month levels.

To examine if more exposed banks reallocated credit away from non-energy borrowers, we use the same specification on the sample of non-energy borrowers and focus on three outcomes of interest: total lending volume, lending volume to finance borrowers' working capital, and lending volume to finance investment projects (all in logs).

We again test for the validity of our identification strategy by examining if the outcomes of loans extended by banks of varying exposures followed parallel trends prior to the collapse in oil prices. We perform this test using the specification outlined in equation 4.

$$Y_{f,b,m} = \alpha + \beta Trend_m * Energy_{b,Sep14} + X_{b,m} + \gamma_{f,b} + \gamma_{i,m} + \gamma_{s,m} + \varepsilon_{f,b,m} \tag{4}$$

The results for the sample of energy and non-energy sector borrowers are displayed in Panels B and C of Table IA1 in the Internet Appendix. Overall, they show that the loan outcomes of interest

[36] While the inclusion of firm*month fixed effects helps us control exhaustively for changes in the demand for credit of firms, one concern is that the sample is restricted to firms that have loans with more than one bank at a given month, which tend to be larger and older firms. This concern is reduced as our estimates remain economically similar when we instead saturate our specifications with state*sector*month fixed effects. An additional concern when using firm*month fixed effects is that changes in the credit demand of energy firms may be more pronounced among specialized banks (e.g., Paravisini, Rappoport, and Schnabl, 2023). In the next section, we conduct a series of robustness checks to rule out this concern.

for borrowers in the energy and non-energy sectors followed a parallel trend across banks of different energy exposures prior to the shock.

5. Results

We will now discuss our findings. We first summarize the effect of the oil price collapse at the bank-month level. We then discuss our more granular evidence on the reallocation of credit across sectors as well as on the subsequent real outcomes.

5.1. Bank-level outcomes

Table 2 displays the results of Equation 1 on our outcomes of interest. Estimates in the first two columns document that the financial distress of ex-ante more energy-exposed banks increases substantially after the oil price shock, as indicated by their higher CDS spreads (column 1) and lower stock prices (column 2).[37] More concretely, a one standard-deviation increase in ex-ante bank exposure to energy is associated with a 10.4 percent increase in CDS spreads and a 3.2 percent decline in stock prices. In terms of their lending response, estimates in columns 3 and 4 indicate that while banks with larger energy exposures make no substantial adjustment in their total commercial credit portfolio, they expand their exposures to the energy sector following the shock. For each one standard-deviation increase in ex-ante energy exposure, there is an increase in ex-post exposure to the sector of around 1.2 percentage points. After the oil price shock, more exposed banks also experienced a more severe deterioration of their credit portfolio. Such deterioration is in the form of higher delinquency rates and risk-weighted assets. As estimates in columns 5 and 6 show, for each one-standard-deviation increase in a bank's exposure to the energy sector, there is a 0.15 percentage point increase in its delinquency rate (roughly 6.3 percent) and a 2 percent increase in risk-weighted assets. Furthermore, our evidence suggests that one way in which banks with larger exposures to the stressed energy borrowers respond to the shock is by deleveraging. More concretely, estimates in columns 7 and 8 indicate that after the shock, more exposed banks improve their regulatory capital ratios by increasing their Tier-1 capital, more than offsetting the rise in risk-weighted assets. That is, a one-standard-deviation increase in the ex-ante

[37] One possible reason driving the increased financial distress of more exposed banks are higher funding costs. To test this, we run equation 1 using funding costs and funding sources as outcomes of interest. The results on funding costs are, summarized in Table IA2 in the Internet Appendix, indicate that banks with larger exposures to the energy sector did not face higher funding costs after the energy price collapse. This is due in large part due to their reliance on deposits (on average 90 percent of sources of funding) which tend to be less sensitive to market fluctuations.

exposure to the energy sector of a bank is associated with an increase of its Tier-1 capital of 3.3 percent (column 7) and an increase in its capital ratio of about 0.16 percentage points (column 8). Overall, we find that banks are able to improve their capital ratios by raising their Tier-1 capital at a faster rate than the increase in risk-weighted assets. Finally, we analyze the sources of financing of the Tier-1 capital. More concretely, we focus on two equity components in the banks' balance sheet: *Paid-in* and *Earned Equity* as well as earnings. Paid-in equity is mainly composed by the initial capital and capital obtained from selling additional shares of the bank (i.e., external funding sources). *Earned* equity is mainly formed by retained earnings and is an internal funding source. Therefore, we study whether more energy exposed banks increase their Tier1 capital using external or internal funding sources. Results of this exercise are displayed in Table IA3 in the Internet Appendix. As estimates show, the increase in Tier-1 capital by energy-exposed banks is financed by retained earnings rather than by new equity issuance. Importantly, and as shown in column 4, the increase in *Earned Equity* occurs despite the reduction in earnings, suggesting that banks reduce their distribution of earnings (e.g., decreasing dividends) to prop-up their balance sheet.

Altogether, these results indicate that more exposed banks grow their exposure to the energy sector following the shock. The greater energy exposure is not driven by a capital contraction—since more exposed banks increase their capital—but by a credit reallocation to the distressed energy sector given that the total commercial lending of more exposed banks does not change relative to other banks after the shock. Our findings suggest that banks more exposed to the energy sector respond to the shock not only by reallocating their credit to the energy sector, but also by increasing their Tier-1 capital, which allows them to contain the shock and preserve their regulatory capital ratios. We next use loan-level data to examine if the credit provided to the energy sector is driven by a credit supply adjustment, and to identify the mechanisms behind increased lending to troubled energy firms.

5.2. Loan-level Outcomes of Energy Borrowers

5.2.1. Benchmark Results

In this section we rely on granular credit registry data containing all loans issued by commercial banks to firms in Mexico. We first examine changes in the supply of credit to borrowers in the energy sector following the collapse in oil prices. Table 3 displays the estimates of equation 3 on the sample of loans to energy firms. Our first two outcomes of interest correspond to the lending value in total as well as in loans destined to working capital (both in logs) by bank *b* to firm *f* in month *m*. The next two outcomes consist of the average interest rate (percent) and months to maturity (in logs) of outstanding loans extended to firm *f* by bank *b* in month *m*. We control for time-varying changes in the demand for credit by including fixed effects at the state*sector*month level. In some specifications, we further saturate our specification with firm*month fixed effects, which allow us to fully control for time varying changes in the credit demand of a firm.

Estimates in column 1 corroborate that, after controlling for variation in the demand of credit, banks with higher ex-ante exposure to the energy sector issue larger loans to energy borrowers after the price shock. A one-standard-deviation increase in the ex-ante energy exposure of a bank is associated with a 6 percent rise in the loan volume to energy firms. This effect doubles when we use firm*month fixed effects (column 2). Consistent with increased short-term liquidity needs of distressed energy firms after the shock, estimates in columns 3 and 4 show that the increase in credit supply is mainly driven by loans for working capital. A one-standard-deviation increase in ex-ante bank's exposure to the energy sector leads to an increase in the size of loans for working capital to the sector of around 17 percent. Again, this result is robust to the inclusion of fixed effects at the firm*month level, indicating that after the shock, an energy firm borrowing from multiple banks receives larger credit amounts from its more energy-exposed lender.

In Figure 4 we display the monthly coefficients of two firm-bank-month regressions where the dependent variables are the total loan volume (left panel), and loan volume extended to working-capital loans (right panel). Each panel shows the coefficients of monthly dummies interacted with banks' ex-ante energy exposure, along with their 95 percent confidence intervals, based on our benchmark firm-bank-month regression including firm-bank and firm-time fixed effects. The evolution of outcomes for energy borrowers corroborates that banks with higher ex-ante exposure to the energy sector began issuing larger loans, primarily in the form of working capital, to borrowers in the energy sector after the energy price shock.

In addition to issuing loans of larger size to firms in the shocked sector, we find evidence suggestive of a strategy of loan evergreening, whereby banks subsidize their troubled clients with loans at laxer terms. Estimates in columns 5 to 8 indicate that more exposed banks relax the credit terms (e.g., interest rates and maturity) of loans issued to energy borrowers. Compared to less exposed banks, banks with higher ex-ante energy exposure lower the interest rates on loans to the distressed firms significantly more after the shock (Columns 5 and 6). For example, an increase of one standard-deviation in ex-ante exposure is associated with a 0.17 percentage point decrease in lending rates (roughly 1.5 percent). Therefore, it does not appear that more exposed banks are extracting larger interest rates from distressed borrowers. Furthermore, as columns 7 and 8 indicate, banks with higher ex-ante energy exposure expand the maturity of loans issued to energy borrowers after the shock. More concretely, a one standard-deviation increase in ex-ante exposure leads to a 6 percent rise in loan maturity (roughly 1.5 months). Overall, these findings show that borrowers operating in a sector impacted by a negative shock obtain relatively larger liquidity from banks with ex-ante larger exposures to the sector. One possible explanation is that lenders with larger exposures face larger losses if their distressed borrowers default. Therefore, they have greater incentives to keep afloat these borrowers and delay costly defaults that, at their pre-shock capital levels, would hurt their regulatory ratios and their financial stability. The graphical results with monthly coefficients are displayed in Figure IA2 in the Internet Appendix and corroborate that the loosening of credit conditions only occurred gradually after the energy price shock. The fact that average interest rates of more exposed banks appear to only decline a few months after the shock is partly driven by our definition of loan terms. In particular, we calculate the interest rate of a firm-bank pair in a given month as the average rate of all outstanding contracts weighted by loan volume. Since most loans have interest rates that remain constant over their term, the weighted average interest rates only adjust gradually as either loans are repaid, new loans are issued, existing loans are renegotiated, or variable interest rates adjust.[38] If more exposed lenders inject credit to their stressed clients to prevent them from defaulting, we should expect the credit expansion to be greater among borrowers representing larger expected losses (i.e., firms in the energy sector representing greater potential losses to their balance sheets, either due to larger outstanding loans, greater ex-ante default risk, or firms with loans close to maturity). Implicitly, the shock increases the bargaining power of such borrowers, particularly when their lenders have large energy exposures, as their threat of default is not only more credible but also potentially more costly for banks.

[38] We find that the interest-rate reaction of newly *originated* loans is almost immediate (not shown).

We start by examining if the credit provided is greater among borrowers with larger outstanding loans, as these represent a larger share of the balance sheets of more exposed banks and as such carry a higher threat of default for lenders (Fee and Thomas, 2004; Bhattacharya and Nain, 2011). For confidentiality reasons, we present in Figure A4 in the Appendix a scattered plot where we group borrowers into bins given the size of their outstanding loans prior to the shock. We compare the growth of loans of a bank to a firm in the post-shock months (from October 2014 through June 2016) to the outstanding amount of a firm with such bank in the pre-shock month (September 2014). The figure suggests that the credit supplied is concentrated in energy borrowers that prior to the shock had larger outstanding loans with their banks.[39] The plot shows that on average, the growth of loans is positive for energy borrowers with an ex-ante outstanding debt above 10 million pesos (roughly 600,000 dollars). In contrast, banks appear to reduce additional credit to borrowers with ex-ante lower loan balances after the shock. To investigate more rigorously this possibility, we introduce in equation 3 the variable $LargeBorrower_{f,b,Sep14}$, which is an indicator that the outstanding loan balance of borrower f with bank b in September 2014 is above 10 million pesos.[40,41] The results are summarized in Panel A of Table 4. The middle-lines in columns 1 and 2 show that on average, energy firms with ex-ante larger outstanding loans receive a credit amount about 40 percent larger than that received by other firms in the sector after the shock. What is more, the increase in credit supply is substantially larger by ex-ante more exposed banks (i.e., a one-standard-deviation increase in the ex-ante energy exposure of a bank is associated with an additional 10 percent increase in the credit volume to firms with ex-ante larger outstanding loans). Columns 3 and 4 corroborate that this credit supplied is in the form of working-capital loans, consistent with a strategy to alleviate the short-term financing needs of distressed borrowers with large outstanding loans. Finally, estimates in columns 5 through 8 indicate that of all energy borrowers, those with ex-ante larger loan balances obtain substantially laxer credit terms by more exposed banks—in the form of lower interest rates and larger maturity of new loans.

We now evaluate if indeed energy borrowers with larger risk of default benefit relatively more from the credit supply expansion. We construct the variable $RiskyBorrower_{f,b,Sep14}$ as a measure of ex-ante risk of a borrower. This measure is an indicator that captures if the rating that

[39] Furthermore, the positive slope in the plot indicates that the credit growth increased more for borrowers with larger outstanding debt prior to the shock.
[40] Larger borrowers, represent roughly 90 percent of total bank lending to the energy sector.
[41] All our results in this section go through when the state-owned energy firms are dropped from the sample.

bank *b* assigned to the loan extended to firm *f* in September of 2014 is not the highest.[42] These internal ratings are calculated using a methodology established by the bank regulator (CNBV). We introduce this variable in equation 3 to investigate if the credit supplied after the shock varies across energy borrowers of varying ex-ante risk. Results of this exercise are displayed in Panel B of Table 4. They confirm that banks ex-ante more exposed to the sector are more likely to extend greater loan volumes after the shock to their ex-ante riskier energy borrowers. More concretely, focusing on specifications with firm*month fixed effects we find that total loans (loans to working capital) extended to ex-ante riskier borrowers by a bank with an average exposure to the energy sector increase 21 (52) percentage points more than to firms with perfect internal rating. Besides the credit supplied, ex-ante riskier energy borrowers also obtain better terms from their more exposed lenders, in the form lengthier loan duration at similar interest rates.[43] Finally, we evaluate whether banks more exposed to the energy sector expand relatively more their lending to firms with loans closer to maturity. Results of this experiment are displayed in Table A3 in the Appendix. They indicate that borrowers with loans maturing within 18 months (roughly median maturity) following the energy-price shock receive larger loans (especially for working capital) with lower interest from banks with larger exposure. More concretely, a one standard-deviation increase in ex-ante bank-exposure to the energy price shock is associated with a 2 percent increase in loan volume for these borrowers. This result is consistent with the observed increase in maturity observed in Table 3.

The event study Figure 5 further shows that the issuance of larger loan volumes to energy firms by more exposed banks occurs only after the shock and is more pronounced among borrowers representing larger expected losses and absent on the remaining energy-sector borrowers.

So far, our findings indicate that energy firms with outstanding loans prior to the shock receive loans of larger size and at looser credit terms (e.g., interest rate and maturities) from their

[42] While in the data we cannot identify underreporting of loan losses (Blattner, Farinha and Rebelo, 2023) we use this measure as a proxy for firms that prior to the shock were closer to hitting non-performance.

[43] The correlation between the $RiskyBorrower_{f,b,Sep14}$ and $LargeBorrower_{f,b,Sep14}$ indicators is -0.03, which suggests that both effects can be occurring simultaneously. In Table IA4. Panel A in the Internet Appendix we display the results of a specification including both variables and the results in both panels of Table 4 hold. Furthermore, as a robustness check, in Panel B of Table IA4 we show that loans by borrowers of more exposed banks actually perform relatively worse.

more exposed lenders after the shock. These results are more pronounced for energy borrowers with larger outstanding loans, in worse financial condition and with loans closer to maturity. This suggests that more exposed banks may prevent the realization of large sudden losses in their balance sheets (Bischof, Laux, and Leuz, 2021) by providing short-term financing to borrowers with larger and looming expected losses. As a further validation of this interpretation, we examine if the credit expansion of energy-exposed banks is greater when their credit portfolios are concentrated in fewer, albeit larger, distressed borrowers. To do this, we calculate the Herfindahl index for each bank, which measures a bank's concentration of its energy portfolio in September 2014 ($Herfindahl_{b,Sep14}$). A larger Herfindahl index indicates that the lending portfolio to the energy sector of a bank is concentrated in fewer borrowers. The unconditional correlation between the banks' exposure to energy and the Herfindahl index is -0.4 which suggests banks with higher exposure to energy have a *lower* concentration of their portfolio of energy loans. Therefore, energy-exposed banks evergreen loans to weak borrowers even in the absence of large individual exposures to energy. We then introduce the Herfindahl variable in equation 3. Our results, summarized in Table IA5 of the Internet Appendix show that more exposed banks extend larger loan volumes (particularly destined to working capital) to their stressed energy borrowers.[44] Moreover, and consistent with our interpretation that the oil price shock increases the bargaining power of large, distressed energy firms borrowing from energy-exposed lenders, the credit increase by more exposed banks is more pronounced the more concentrated their credit portfolios are in fewer borrowers.[45]

Next, we analyze the role that bank capital has on this evergreening-like behavior. Some papers documented that loan evergreening is predominantly conducted by weakly capitalized banks in need of meeting their regulatory requirements (Peek and Rosengren, 2005; Giannetti, Simonov, 2013; Acharya et al., 2019; Acharya et al., 2021; and Chari, Jain, and Kulkarni, 2021;

[44] For clarity of exposition, in these robustness checks (Tables IA5-IA10) we focus on total loan volume and volume of loans destined to working capital. Results on other margins (i.e., interest rate and maturity) are qualitatively similar and available upon request.

[45] Including the Herfindahl index in equation 3 also helps us rule out that the credit provision of more exposed banks to borrowers with larger outstanding loan balances is driven by easier coordination of loan modifications with fewer important borrowers (Roberts and Sufi, 2009). This because even after controlling for the concentration of banks' portfolio of energy loans, more exposed banks extend larger short-term loan volumes to their stressed energy borrowers.

Blattner, Farinha and Rebelo, 2023).[46] Therefore, one possible explanation to our findings is that our measure of energy exposure may be capturing weakly capitalized banks. We argue that bank capital is unlikely to be the main driver of our results for two reasons. First, the capital ratios of all banks in our sample were well above the minimum regulatory requirement of 8.5 percent in the period immediately prior to the energy price shock with a very weak correlation between banks' energy exposure and capital ratio.[47] Second, when we include in equation 3 the capital ratio of banks in September 2014—results displayed in Table A4 in the Appendix—we find that the effect of energy exposure remains roughly unchanged and that its effect is economically and statistically more important. Overall, our findings do not appear to be driven by "weak banks" with recognized low capitalization. We show that even seemingly well-capitalized banks may distort their lending and target their capital ratios in anticipation of an increase in non-performing loans.

5.2.2. Additional Tests and Robustness Checks

An alternative mechanism that can explain the loosening of credit supply by more exposed lenders is information. Previous studies have shown that banks that have stronger and longer relationships with their borrowers develop an informational advantage that allows them to finance such clients in bad times (Bolton et al., 2016, Liberti and Sturgess, 2018). This informational advantage may be at play if lenders more exposed to the energy sector have stronger relationships with energy firms. To assess if borrowers obtain looser credit standards from the lender with whom they have a stronger relationship, we introduce in equation 3 the variable $FirmExposure_{f,b,Sep14}$, which corresponds to the fraction of total outstanding loans of firm f that were obtained from bank b in September 2014. The results of this exercise are displayed in Table IA6 in the Internet Appendix. The estimates confirm that firm-bank relationships matter, with energy borrowers obtaining greater financing on average from lenders with whom they have stronger relationships at the time of the shock.[48] However, we find that more exposed banks inject liquidity to energy borrowers regardless of the strength of their relationships. If anything, after controlling for the

[46] Furthermore, the correlation between banks' exposure to energy and capital ratio is essentially zero (0.03). Moreover, we show in Table A2 in the Appendix, the capital ratios of banks below and above the ex-ante median exposure to the energy sector are statistically similar.

[47] As Figure IA1 in the Internet Appendix shows, banks with high energy exposure had healthy capital ratios prior to the shock.

[48] Our results remain unchanged if we use an alternative measure of strength of firm-bank relation defined by an indicator that firm-bank relation existed at the start of our sample period in January 2013.

strength of the firm-bank relationship, the credit supplied to distressed borrowers by banks with larger energy exposure increases. In other words, borrowers are not only financed by their largest current lender (measured by value of outstanding loans) *but also* by their lender with larger ex-ante exposure to energy. More concretely, estimates in columns 1 and 3 indicate that for the average energy borrower, a one standard-deviation increase in its bank's ex-ante exposure to energy is associated with an increase in the size of overall loans and working capital loans of 12 and 42 percent, respectively.[49]

While the variable $FirmExposure_{f,b,Sep14}$ measures the *depth* of the relationship between a firm and a bank, other variables can also capture how well banks know their borrowers. To examine the information channel more thoroughly, we follow Agarwal et al. (2018) and evaluate the predictive power of both the length (i.e., the number of years) and scope (i.e., the number of loans) of a firm-bank relationship on the credit terms extended by the bank to the firm after the energy shock. In results not shown, we find that the only dimension of the firm-bank relationship associated with an increase in bank lending is *Depth (*i.e., defined as $FirmExposure_{f,b,Sep14}$), which is also more closely related to our measure of bank exposure to expected losses. We do not observe an increase in bank lending for borrowers with longer relationships or for those with a larger number of products contracted with the bank. These latter two measures are more related with firm-bank relation and less so with bank exposure to credit loss.

Another explanation for our findings is that our measure of exposure captures the specialization of banks, as defined in extant studies, to the energy sector.[50] In this case, more exposed banks may have superior information that allows them to finance the sector in crisis times (Acharya, Hasan, and Saunders, 2006; Loutskina and Strahan, 2011). To test this conjecture, we create the variable $SpecializationEnergy_{b,Sep14}$, defined as the share of loans to the energy sector over the total commercial loan volume of bank *b* in September 2014. Results of this exercise are

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[49] A related concern is that our results are driven by debt-overhang problem (Myers, 1977). In this case, the existing debt of an energy firm could discourage banks with little exposure to it from extending credit, as existing debt holders would largely reap potential earnings. Thus, banks with ex-ante larger outstanding loans to specific energy borrowers would have greater incentives to finance them. We find that this explanation is not driving our results since they hold when controlling for their exposure to a particular borrower.

[50] While exposure and specialization are similar concepts there are some differences. Specialization of the commercial loan portfolio does not take into account bank capitalization nor other non-commercial assets. A very specialized bank may not have large exposures if it has a very large capital buffer, or if it has material non-commercial assets in its portfolio.

displayed in Table IA7 in the Internet Appendix. After controlling for this measure of banks' ex-ante credit specialization in the energy sector, we still find that banks with larger ex-ante energy exposures are significantly more likely to inject relatively more credit to the energy borrowers. Furthermore, we do not find any relation between this measure of banks' specialization and subsequent lending to energy firms.

An alternative possibility for our findings, is that lenders more exposed to energy provide liquidity to the sector as they internalize the negative spillovers of industry downturns (Benmelech and Bergman, 2011; Favara and Giannetti, 2017; Giannetti and Saidi, 2019). We test for this possibility by introducing the variable $EnergyMktShr_{b,Sep14}$, which is the market share of total bank lending to the energy sector that was extended by bank *b* in September 2014. The results of this exercise, displayed in Panel A of Table IA8 in the Internet Appendix, indicate that the loosening of credit terms is essentially driven by the exposure of the bank to the energy sector rather than by the market share of the bank in the industry. We also test whether banks only loosen their credit terms to their current borrowers (i.e., energy firms with which they have outstanding loans at time of the shock) or if they loosen credit to larger borrowers overall. If banks internalize the negative spillovers to the industry, they should also extend credit to new borrowers in the sector. More concretely, we test two specifications. In the first, we test specification 3 but without firm-bank fixed effects (i.e., abstracting from current firm-bank relation). In the second specification, we limit the sample to borrowers without firm-bank relation prior to the energy-price shock. Results of this test are displayed in Panel B of Table IA8 in the Internet Appendix.[51] They show that banks with higher ex-ante exposure to energy do not increase relatively more their lending to new borrowers. These results suggest that our main results are not driven by banks superior information regarding the energy sector or by internalizing the negative spillovers of sectoral defaults.[52]

Another plausible explanation for our results is that the increased supply of credit to the energy sector is driven by credit line drawdowns from previous loan commitments (Ivashina and Scharfstein, 2010), and not by more exposed banks increasing credit supply to distressed energy borrowers. We test this possibility by comparing term loans relative to drawdowns in credit lines.

[51] Exercises are quantitatively similar if we limit the sample to borrowers already in the credit registry at the time of the shock to energy prices.

[52] We also use a linear probability model to verify that the probability of firms without an existing firm-bank relation at the time of the energy price shock does not depend on the energy exposure of banks at the time of the shock.

The results of this exercise, displayed in Table IA9 in the Internet Appendix, confirm that the liquidity provision to energy borrowers is in the form of new loans issued by ex-ante more exposed banks, rather than by credit line drawdowns.

Finally, we examine whether political-economy considerations drive our results. State-owned companies in the Mexican energy sector tend to be large borrowers and are likely to have strong political connections, which could potentially help them access financing in bad times. Alternatively, banks may be encouraged to continue funding distressed energy borrowers (especially the largest ones) at lax terms due to explicit or implicit government support to the sector. While such political-economy explanation may result in expanded credit access to large energy borrowers after the oil price shock, our evidence is not fully consistent with it. First, the spike in CDS spreads of energy producers in Mexico after the price shock (Panel A of Figure 1) suggest that market participants anticipated energy firms in Mexico to have large financial distresses. Second, after the shock, energy firms obtain laxer financing from *their more exposed banks*, not from all banks, suggesting that lenders with larger existing exposures had greater incentives to rescue these borrowers. Third, banks with large exposures to energy do not extend credit to new energy borrowers, but to those energy borrowers with an outstanding debt with them. If energy loans were guaranteed by the government, banks should extend credit to energy firms regardless of whether they had outstanding credit with them or not. Fourth, the political-economy explanation is less likely in our context, as all commercial banks in our sample are privately owned, rather than state-owned who tend to ease financing to politically connected firms (Khwaja and Mian, 2005).[53]

Nevertheless, as a robustness check, we test whether the credit supplied to distressed energy borrowers is mainly driven by domestic banks, as these banks tend to be more politically connected (Dinç, 2005). Our results, displayed in Panel A of Table IA10 in the Internet Appendix, indicate that regardless of foreign or domestic ownership, banks with ex-ante larger energy exposures inject more credit to their energy borrowers after the shock. We also examine an alternative measure of moral suasion by the government, $GovShr_{b,Sep14}$, calculated as the share of lending of a bank to government entities in September 2014. This measure captures that when a

[53] In results not shown, we confirm that our results carry through after dropping from the sample all the state-owned energy firms.

large share of a bank's business is channeled to the government, it might be more likely to persuade the bank to extend credit to a nationally important sector of the economy (Ongena, Popov, and van Horen, 2019). We test for this possibility by rerunning specification 3, including a variable of the exposure of commercial lending of a bank to the government. Results of this specification are displayed in Panel B of Table IA10. Again, our main finding that a bank's exposure to the energy sector is an important driver of subsequent lending to energy firms holds when we control for bank exposure to the government.

Altogether, our evidence suggests that banks more exposed to the energy sector (proxied by the ratio of bank lending to energy over their Tier-1 capital) follow a strategy resembling evergreening, whereby after the price shock, they issue loans of larger size at laxer terms to their large and risky distressed energy borrowers that in case of default, carry larger losses in their balance sheets.

5.3. Loan-level Outcomes of non-Energy Borrowers

In this section, we use loan level data to identify more granularly the credit contraction to non-energy firms by ex-ante more exposed banks.

5.3.1. Benchmark Results

Based on the specification displayed in equation 3, we analyze the following three outcomes of interest: total lending volume, lending volume to working capital, and lending volume to investment projects (all in logs).[54]

The benchmark results from this exercise are displayed in Table 5. All regressions include firm*bank and state*sector*month fixed effects, and in the regressions summarized in columns 2, 4, and 6 we also include firm*month fixed effects to fully control for time-varying changes in the demand for credit of non-energy firms.[55] The first two columns in the table show that, as a result

[54] To rule out that our results are driven by changes in the demand of credit caused by a slowdown in the energy sector, we drop from our sample loans issued by banks to borrowers operating in Tabasco and Campeche, the two states concentrating the vast majority of the oil production in the country.

[55] Firm-time fixed effects help absorb changes in the credit demand of non-energy firms if these shocks are equally spread across all banks that lend to a firm (i.e., Paravisini, Rappoport, and Schnabl, 2023). This approach is likely to hold in our context as the stabilization measures used by the central government (e.g., energy price controls, hedging program, stabilization funds) effectively shielded non-energy firms from the oil price shock. One concern, however, is if the oil price shock is correlated with the demand of credit in specific markets (e.g., firms in tradable sectors that are more exposed to external demand). In the next section, we conduct a series of checks to rule out this concern.

of the collapse of oil prices, banks more exposed to the energy sector reduced relatively more the amount of credit to non-energy firms. More concretely, an increase of one standard-deviation in a bank's ex-ante energy exposure leads to a reduction in the loan volume to firms in non-energy sectors of 5.8 percent. We decompose this result to understand which type of loans contracted the most. Estimates in column 3 indicate that working capital loans—used by firms to finance their short-term operational needs—contract by 5.3 percent for each standard-deviation increase in a bank's ex-ante energy exposure. When saturating the specification with firm*month fixed effects, the contraction in the volume of working capital loans drops to 2.6 percent but is no longer statistically significant (column 4). The next two columns present the estimates for investment loans, which tend to be longer term and typically associated with increases in firm productivity (Ponticelli and Alencar, 2016). Estimates in column 5 show that a one-standard-deviation increase in the ex-ante exposure of a bank is associated with a reduction in the volume of investment loans to non-energy borrowers of 5.8 percent. This contraction is even larger when we include in the specification firm*month fixed effects: a one standard-deviation increase in bank exposure to energy is associated with a 10.6 percent reduction in the size of loans for investment issued to non-energy borrowers (column 6). The dynamics behind the contraction in total loan volumes to non-energy firms are illustrated in the event study Figure 6. Notably, the decline in lending is observed several months after the onset of the shock. As Figure IA3 in the Internet Appendix shows, this evolution is similar for both working capital and investment loans. A possible explanation is that extended lines of credit or term loans with long maturity cannot be easily withdrawn. Indeed, when we divide the sample based on the outstanding maturity of loans at the time of the shock (Figure IA4 in the Internet Appendix), we find an earlier credit contraction among short-term loans (maturity less than 18 months), and a delayed decline in lending among loans of longer terms (maturity of 18 months or more).

We next investigate whether the contraction of credit is heterogeneous across borrowers. More concretely, we test whether smaller firms are relatively more impacted by contractions in credit supply (Gertler and Gilchrist, 1994; and Beck et al., 2018). Following Beck and Demirgüç-Kunt (2006), we define small firms as those with less than 50 workers in 2014. The estimates of equation 3 for each sample of borrowers are displayed in Table 6. After controlling for time-varying changes in the demand for credit, saturating our specifications with fixed effects either at the state*sector*month or firm*month level, we find that the contraction of credit by more exposed banks is more pronounced among small firms in non-energy sectors. For this subsample of borrowers, an increase of one standard-deviation in ex-ante bank exposure to the energy sector leads to a contraction in the volume of lending of around 6.9 percent, whereas for larger firms the impact on total lending volume is less than 3 percent and not statistically significant. This more pronounced contraction in lending among small non-energy borrowers is also illustrated in the event study displayed in Figure IA5 in the Internet Appendix. Overall, the results confirm that to expand credit to their energy borrowers, more exposed banks contract their lending to small firms in non-energy sectors, and especially for investment projects.

5.3.2. Additional Tests and Robustness Checks

While retail energy prices in Mexico were controlled during our sample period (Panel B of Figure 1), the sharp decline in global energy prices could have impacted the bank lending in non-energy sectors through other channels such as disruptions caused by reduced energy production. To check whether our estimates capture a contraction in credit supply to non-energy borrowers by more energy-exposed banks, we run a series of tests to comprehensively tackle these threats to identification. First, to address the possibility that the decline in activity in the energy sector may have affected the demand for credit from the suppliers to the energy sector, we use the Input-Output table provided by the Mexican national statistics institute (INEGI). With this information, we flag the main sectors supplying intermediate goods to energy production. We classify a sector as supplying the energy sector if more than 10 percent of its sales are purchased by the energy sector.[56] Panel A of Table IA11 in the Internet Appendix lists the top 20 sectors supplying inputs to the energy sector. We then run equation 3 on the sample of non-energy borrowers from sectors that do not supply intermediate goods to the energy sector. The results from this exercise, displayed in Panel B of Table IA11 in the Internet Appendix, are quantitatively similar to our benchmark estimates, corroborating that the contraction in bank lending is not driven by a decline in credit demand due to the shock to the energy sector.

Another possible concern is that these results are driven by changes in the external demand of the United States—a major oil producer that represents 90 percent of the value of Mexican exports—or by reduced competitiveness of Mexican exporters who, unlike their competitors, do

[56] Our results remain unchanged if we choose different thresholds such as 5 percent or 20 percent.

not benefit from reduced energy prices given the energy price controls.[57] To test for these possibilities, we classify firms in our sample into two groups: firms headquartered in northern versus southern states. Since states in the north of Mexico have substantially more economic relations with the U.S. (INEGI, 2014) as well as a larger share of exports to GDP (39 percent compared to 12 percent), it is likely that firms headquartered in these states are more affected by changes in the demand of the United States. We run equation 3 separately for each group of firms. Estimates in Panel A of Table IA12 in the Internet Appendix rule out that the credit contraction is greater among non-energy firms from Northern states. Instead, the credit contraction by more exposed banks was similar for both groups of borrowers. We now test whether our results are driven by the loss of competitiveness from Mexican exporters or by variation in the terms of trade. To address for these possibilities, we follow Mian and Sufi (2014), classifying firms into two groups: tradable versus non-tradable. The estimates of equation 3 for each group of firms are displayed in Panel B of Table IA12. The results confirm a similar credit crunch for the two groups of firms following the oil price shock, lending credibility to our interpretation that the drop in credit is due to a contraction in credit supply by more exposed banks and not by changes in the relative demand for credit from exporters.

A similar concern is the potential negative effect of the exchange rate depreciation on importers' demand for credit. Using the Mexican Input-Output Matrix from the National Statistics Agency (INEGI), we run a test where we classify sectors by their import dependence, measured as the share of imported inputs relative to total production costs. We display the results of this test in Panel C of Table IA12. Restricting the sample to non-energy borrowers in below-median import-dependent sectors (i.e., firms likely to be less exposed to the shock) yields results consistent with our main findings, albeit of an economic magnitude roughly a third smaller. This suggests that while contemporaneous changes in the price of imports might have negatively impacted the credit demand of non-energy firms, we still find that energy-exposed banks reduce lending to this set of firms after the oil shock relative to other banks.

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[57] A related concern is that the reduction in energy prices might have led to pressures in the Mexican foreign exchange rate impacting the terms of trade and the relative demand of tradable and non-tradable sectors. The Mexican peso suffered an increase in its average depreciation rate following the collapse in energy prices. For example, relative to the U.S. dollar in the year leading up to the collapse in energy prices (from September 2013 to August 2014) the Mexican peso depreciated roughly 2 percent. From September 2014 to August 2015 the peso depreciated roughly 22 percent.

Finally, and even though historically the Mexican government has relied on a series of strategies to limit the impact of energy price fluctuations on its national budget, the credit contraction may be contaminated by a fiscal consolidation in the form of public spending cuts. We rule out this explanation in two ways. First, we show that fiscal expenditures and federal transfers made to states with larger energy exposure after the shock do not vary relative to other states (Panel A of Table IA13 in the Internet Appendix).[58] Second, we follow Belo, Gala, and Li (2013) and classify sectors according to their dependence on government spending.[59] We then limit our sample to non-energy borrowers in sectors with a dependence on government spending below the median and run equation 3. The results of this exercise, displayed in Panel B of Table IA13, remain quantitatively similar to our benchmark findings.

5.4. Real Effects of Firms in non-Energy Sectors

In this section we investigate whether non-energy firms are able to smooth the lending contraction from their more energy-exposed lenders by switching to alternative sources of financing. To do so, we aggregate the loan-level data at the firm-month level and create the variable $Energy_{f,Sep14}$ as the weighted average of the energy exposure of all banks that were lending to firm f in September 2014. We use this variable as a measure of firm-level exposure to the oil price shock based on the bank relationships of each firm in September 2014. We then relate this variable to the total lending obtained by a firm after the oil-price shock.[60] We find that indeed, non-energy firms more exposed to the energy sector (via the energy exposure of their lenders) experience greater contractions in their overall bank lending after the shock (Table IA14). More concretely, a one-standard-deviation increase in firms' exposure to the energy sector is associated with a 4.2 percent decline in total volume of loans and a 12 percent decline in loans destined to investment projects.

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[58] For this exercise, we run regressions at the state-year level where the regressor of interest is a measure of a state's exposure to the energy sector. We calculate this measure as the average exposure to the energy sector in September 2014 of all banks operating in state *s*, where the weights of each bank are proportional to the bank's total loan volume.
[59] We thank Belo, Gala, and Li for kindly sharing their data.
[60] We run the equation: $y_{f,m} = \alpha + \beta Energy_{f,Sep14} * Post_m + \gamma_f + \gamma_{s,i,m} + \varepsilon_{f,m}$, where $Energy_{f,Sep14}$ is the weighted average of the energy exposure of all banks that lend to firm f in September 2014. Fixed effects at the firm and state*industry*month level are denoted by γ_f and $\gamma_{s,i,m}$. Given that banking relationships are sticky over time (Ongena and Smith, 2001), the assumption behind this specification is that the impact of the oil price shock on a firm is proxied by the bank relations the firm had at the time of the price shock. If changing banks is frictionless, the coefficient β should not be statistically different from zero.

Having established that non-energy firms experience a lending contraction by their more exposed banks, we then ask if the credit crunch impacts their real outcomes. To do so, we run regressions at the firm-year level akin to equation 3.[61] Our first outcomes of interest are the total credit volume, as well as the credit volume for working capital and for investment that each firm obtains every year based on the credit registry data. The next outcomes of interest come from Orbis and correspond to the annual total liabilities, assets, and revenue of firms.[62] The coefficient of interest in these regressions is given by the interaction of two variables. The first one is a dummy variable that equals one from the years 2014 onwards and zero otherwise. The second variable proxies for the exposure of a firm to the oil shock via its banks and corresponds to the average exposure to the energy sector in September 2014 of banks operating in the municipality where firm *f* is headquartered. To account for the size of banks within a municipality, this variable is weighted by the total loan volume of each bank. To control for time-invariant unobserved firm heterogeneity (such as location), as well as time-varying borrower fundamentals, we include in the regressions firm and state*year fixed effects.

The results of this exercise are displayed in Table 7.[63] The first three columns summarize our estimates on the credit registry outcomes. Overall, we find that an increase of one standard-deviation in the ex-ante exposure to energy by banks in the municipality where a firm is headquartered reduces the total lending of the firm by 3.4 percent, which compared with the loan-level results, suggests that firms are able to smooth part of the shock. Consistent with our previous findings, the estimates are larger for the financing of investment projects. Estimates in column 3 show that loans for investment decline 15.1 percent for each standard-deviation increase in the exposure of a municipality. These findings suggest that non-energy firms are unable to completely smooth the credit contraction from their more exposed lenders. Estimates in columns 4 through 6

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[61] Our specification is: $y_{f,y} = \alpha + \beta MuniExposureEnergy_{m,Sep14} * Post_y + \gamma_f + \gamma_{s,y} + \varepsilon_{f,y}$, where $y_{f,y}$ corresponds to the real outcome (in logs) of firm *f* in year *y*. The regressor $MuniExposureEnergy_{m,Sep14}$ corresponds to the average energy exposure in September 2014 of banks operating in the municipality *m* (in which firm *f* is headquartered) weighted by the value of outstanding loans. $Post_y$ is an indicator variable that equals one from years 2014 onwards and zero otherwise. Fixed effects at the firm and state*year level are denoted by γ_f and $\gamma_{s,y}$. Standard errors are doubled clustered at the firm and year level.

[62] Orbis information (liabilities, assets, and revenues) tends to refer to the month of December. Therefore, we select the December value for the credit registry outcomes (total loans, loans for working capital, and loans for investment) of each firm-year pair.

[63] We confirm that prior to the oil price collapse, our outcomes of interest at the firm-year level exhibit statistically similar trends across municipalities with varying bank-energy exposures. The results of this test are displayed in Table IA15 in the Internet Appendix.

further show a negative impact of the credit contraction on other firm outcomes—in particular, in the liabilities and revenues of firms. An increase of one standard-deviation in a municipality's energy exposure reduces the average liabilities and revenues of firms headquartered in the municipality by around 5 and 6.7 percent, respectively.

6. Conclusions

Banks with large exposures to a sector may be forced to evergreen loans to distressed borrowers in the sector in the event of a negative sectoral shock, restricting lending to otherwise healthy borrowers with important negative real effects. We use credit registry data from Mexico—a country with price controls on retail energy products—and exploit the 2014 collapse in global energy prices along with variation in the ex-ante energy exposure across banks. We document that banks with larger exposures to the energy-sector respond to the price shock by increasing short-term lending at lower interest rates and longer maturities to their stressed energy borrowers. This short-term lending resembles an evergreening strategy, whereby more exposed banks subsidize credit to their largest and most troubled borrowers that represent larger expected losses. Our results suggest that this strategy allows more exposed banks to postpone the recognition of losses and avoid severe and simultaneous write-downs that reduce capital ratios. While more exposed banks eventually increase their capital, their exposure to the troubled sector increases, as they shift their lending away from borrowers in otherwise healthy sectors, thereby amplifying a sector-specific shock to the rest of the economy. The credit contraction to non-energy firms is more pronounced for investment loans issued to smaller borrowers. Non-energy borrowers are unable to smooth the lending contraction from their more energy-exposed lenders, with the credit crunch they experience translating in lower real outcomes.

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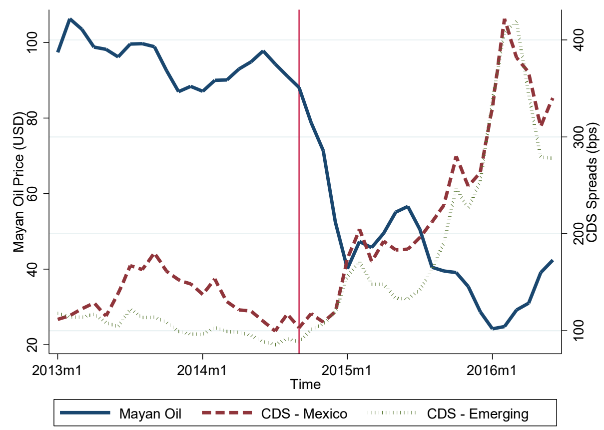
Figure 1 – Oil Prices and CDS Spreads of Energy Producers

Panel A displays the movements in oil prices—Mexican Mayan Crude Oil — in dollars as well as the movements in the CDS spreads of energy firms in Mexico and energy firms in other emerging economies. Panel B plots the state-controlled retail prices of energy and gasoline in Mexico. The vertical line marks the month (September 2014) when oil prices began plummeting. The sample period spans from January 2013 to June 2016.

Panel A – Oil Prices and CDS Spreads of Energy Producers



Panel B. State-Controlled Retail Energy Prices in Mexico

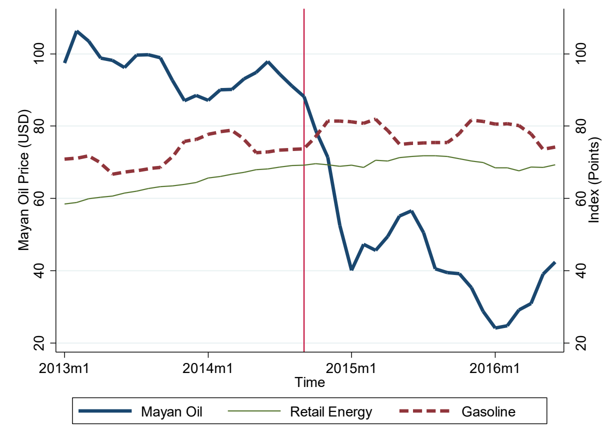
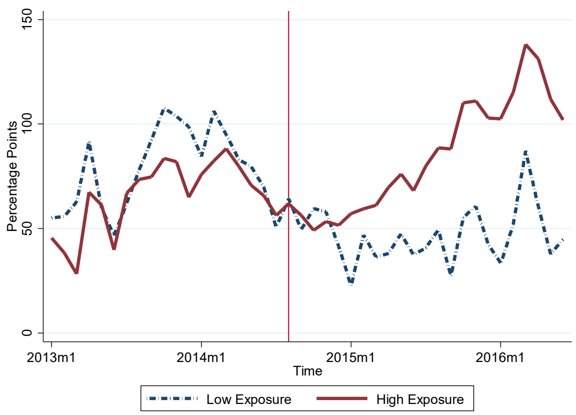


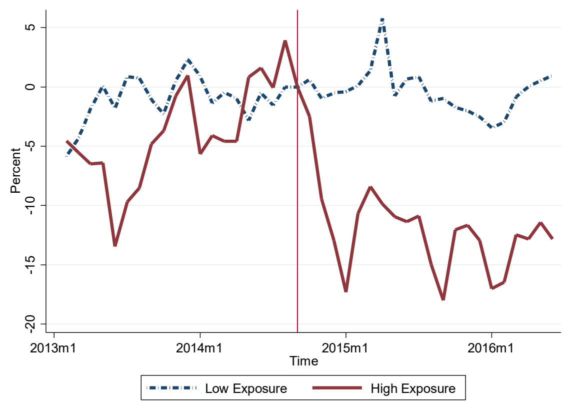
Figure 2 – CDS Spreads, Stock Prices, and Share of Loans to Energy Sector Given Banks' Ex-Ante Exposure to Energy

This figure displays the evolution of CDS spreads, stock prices and share of lending to the energy sector of Mexican banks. We split banks into two groups relative to the median exposure to the energy sector prior to the oil price shock, defined as the value of total loans outstanding to the energy sector over Tier-1 capital in September 2014. Panels A and B show the evolution of CDS spreads and stock prices of banks below and above the median ex-ante exposure to the energy sector. Panel C displays the share of loans destined to firms in the energy sector to total loans by banks below and above the median ex-ante exposure to the energy sector. The vertical line marks September 2014. The sample period is from January 2013 to June 2016.

Panel A. CDS spreads of banks



Panel B. Stock prices of banks



Panel C. Share of loans to energy sector

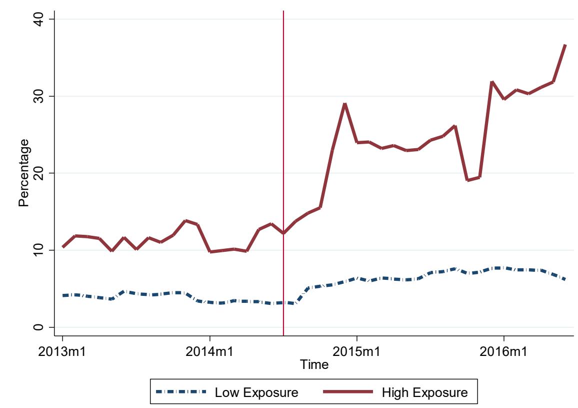


Figure 3 – Evolution of Bank Exposure to the Energy Sector

This figure displays monthly coefficients of a bank-month regression where the dependent variable is the share of loans to the energy sector over total commercial loans by bank *b* in month *m*. The coefficients displayed are the interaction of month indicator variables with the ex-ante exposure to the energy sector of banks, defined as the value of total loans outstanding to the energy sector over Tier-1 capital in September 2014. Therefore, the coefficients represent the relative changes in banks' exposure to the energy sector, given their exposure in September 2014. The regression includes bank and month fixed effects. The omitted period in the sample is September 2014. Standard errors are doubled clustered at the bank and month levels. Vertical bars represent the confidence intervals of the coefficients at the 95 percent significance level. The vertical red line marks the date when oil prices began plummeting. The sample period is from January 2013 to June 2016.

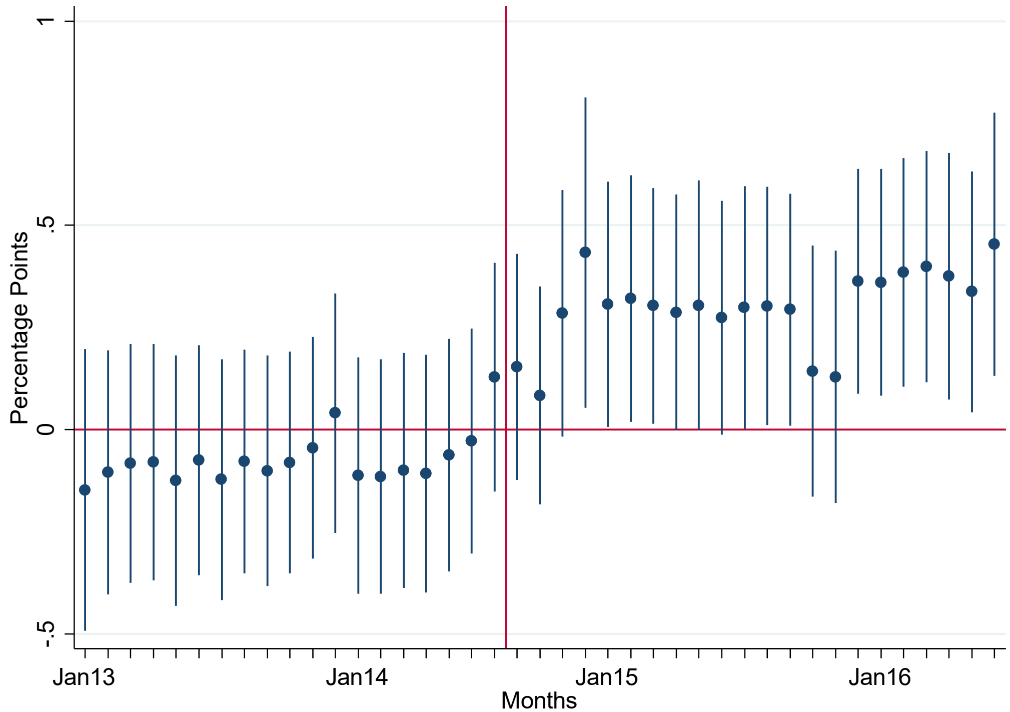


Figure 4 –Bank Lending to Energy Firms given Bank Exposure to the Energy Sector – Total Lending and to Working Capital

This figure displays monthly coefficients of two firm-bank-month regressions where the dependent variables are the total loan volume (left panel) and loan volume extended to working-capital loans (right panel) extended to firm *f* by bank *b* in month *m*. Both dependent variables in logs. The coefficients displayed are the interaction of month indicator variables with the ex-ante exposure to the energy sector of banks, defined as the value of total loans outstanding to the energy sector over Tier-1 capital in the month energy-price contraction starts. The regression includes firm-bank and firm-month fixed effects. Standard errors are doubled clustered at the bank and month levels. Vertical bars represent the confidence intervals of the coefficients at the 95 percent significance level. The vertical black line marks the start of the sharp contraction in oil prices. The sample period is from January 2013 to June 2016.

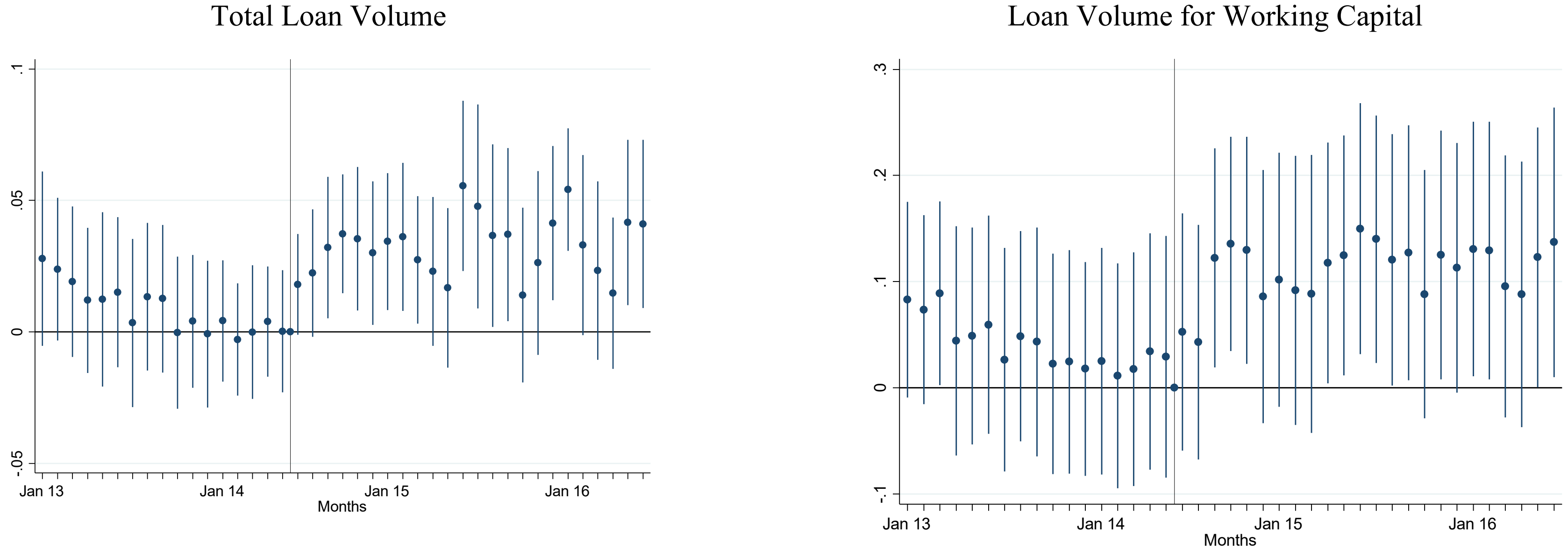
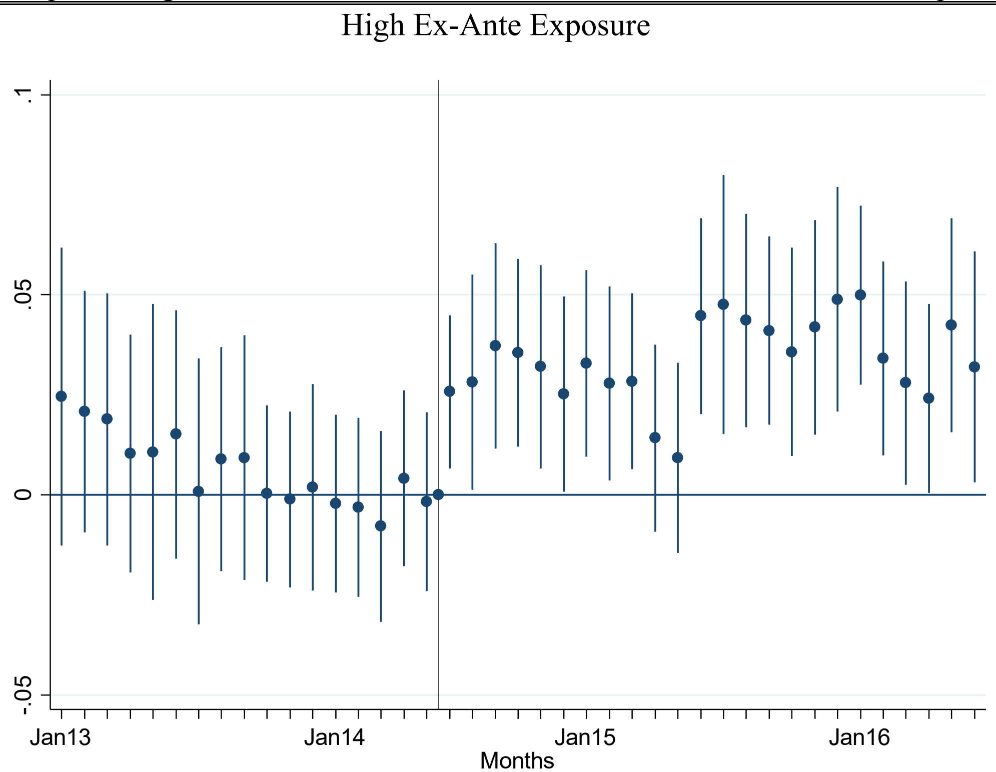


Figure 5 –Bank Lending Volume to Energy Firms given Bank Exposure to the Energy Sector – Exposure to Borrower Prior to Shock

This figure displays monthly coefficients of a firm-bank-month regression where the dependent variable is the total loan volume (in logs) extended to firm *f* by bank *b* in month *m*. The left (right) panel displays borrowers with outstanding loan balances above (below) 10 million pesos at the start of the energy-price shock and with a non-perfect credit rating (i.e., internal credit rating worse than A). The coefficients displayed are the interaction of month indicator variables with the ex-ante exposure to the energy sector of banks, defined as the value of total loans outstanding to the energy sector over Tier-1 capital in the month the energy-price contraction starts. The regression includes firm-bank and firm-month fixed effects. Standard errors are doubled clustered at the bank and month levels. Vertical bars represent the confidence intervals of the coefficients at the 95 percent significance level. The vertical black line marks the start of the sharp contraction in oil prices. The sample period is from January 2013 to June 2016.



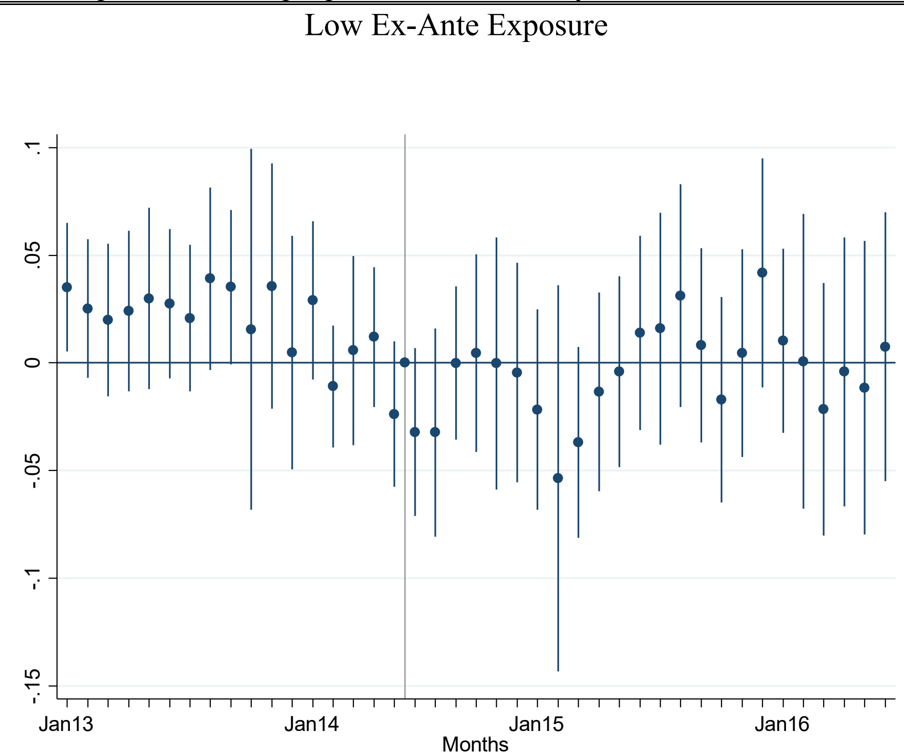


Figure 6 – Bank Lending to Non-Energy Firms given Bank Exposure to the Energy Sector

This figure displays monthly coefficients of a firm-bank-month regression where the dependent variable is the loan volume (in logs) extended to firm *f* by bank *b* in month *m*. The coefficients displayed are the interaction of month indicator variables with the ex-ante exposure to the energy sector of banks, defined as the value of total loans outstanding to the energy sector over Tier-1 capital in the month the energy-price contraction starts. The regression includes firm-bank and firm-month fixed effects. Standard errors are doubled clustered at the bank and month levels. Vertical bars represent the confidence intervals of the coefficients at the 95 percent significance level. The vertical black line marks the start of the sharp contraction in oil prices. The sample period is from January 2013 to June 2016.

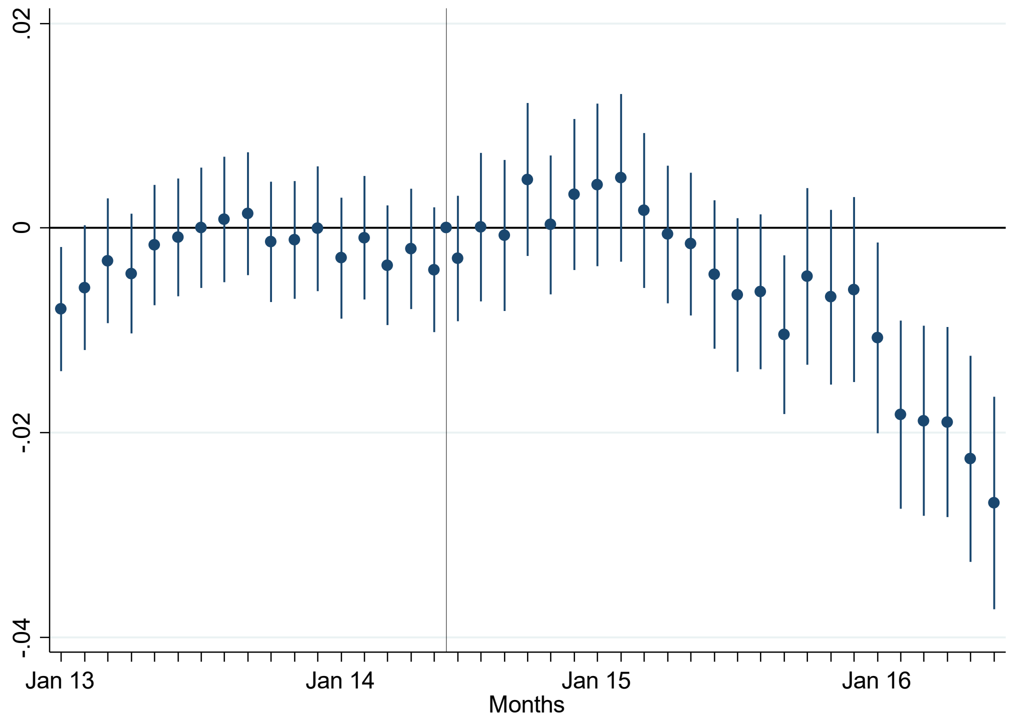


Table 1 – Summary Statistics

This table reports the summary statistics of our sample for January 2013 to June 2016. All variable definitions are provided in Panel A of Table A1.

	# Obs	Average	p10	Median	p90	Std dev
Panel A. Variables at the bank-month level						
$Energy_{b,Sep14}$ (%)	612	9.3	0	5.6	21.7	8.8
$CDS_{b,m}$ (basis points)	272	410	321	425	492	71
$Stock Price_{b,m}$ (index)	350	3.4	0.7	3.9	5.2	1.6
$Capital_{b,m}$ (%)	612	15.4	12.5	15.3	18.5	2.2
$Capital_{b,Sep14}$ (%)	612	15.3	12	15.3	18.7	2.5
$Loans_{b,m}$ (logs)	612	21.8	19.6	21.3	24.2	1.8
$Energy_{b,m}$ (%)	612	10.9	0	6.4	32.1	12.1
$Delinquency_{b,m}$ (%)	612	2.4	0.4	2.1	4.7	2.2
$RWA_{b,m}$ (logs)	612	24.2	22.4	23.7	26.7	1.6
$Tier1Cap_{b,m}$ (logs)	612	20.9	20.1	21.9	25.1	6.1
$Liquidity_{b,m}$ (%)	612	8.1	2.8	7.6	13.7	5.5
$ROA_{b,m}$ (%)	612	1.0	0.1	1.0	1.9	0.9
$Cost of Funds_{b,m}$ (%)	612	2.9	1.5	3.1	4.3	1.1
$Assets_{b,m}$ (billions of pesos)	612	342	14	111	1,129	451
$Herfindahl_{b,Sep14}$	612	0.52	0.21	0.33	0.97	0.35
Panel B. Loan-level variables in energy-related sectors						
$Loans_{f,b,m}$ ('000)	23,746	89,790	96	1,560	126,930	307,605
$Working Capital_{f,b,m}$ ('000)	23,746	78,848	25	1,218	96,521	285,116
$Interest Rate_{f,b,m}$ (%)	23,746	11.4	4.4	11.8	18	10.7
$Maturity_{f,b,m}$ (months)	19,392	25.2	2.4	20.4	52	25.7
$RiskyBorrower_{f,b,m}$	23,746	0.31	0	0	1	0.47
$FirmExposureBank_{f,b,m}$	23,746	0.61	0	0.8	1	0.41
$BankRelations_{f,m}$	23,746	2.31	1	2	5	1.91
Panel C. Loan-level variables of firms in non-energy sectors						
$Loans_{f,b,m}$ ('000)	1,472,713	6,225	48	511	5,179	58,224
$Working Capital_{f,b,m}$ ('000)	1,472,713	5,509	46	500	4,511	54,745
$Investment_{f,b,m}$ ('000)	1,472,713	11,782	53	1,159	20,000	71,286
$FirmExposureBank_{f,b,m}$	1,472,713	0.81	0.3	0.9	1	0.34
$BankRelations_{f,m}$	1,472,713	1.75	1	1	3	1.06
Panel D. Firm-year-level variables						
$Energy_{f,Sep14}$ (%)	69,479	12.2	5	13.6	16.5	5.2
$MuniExposureEnergy_{f,Sep14}$ (%)	69,479	12.2	9.3	12.7	14.5	2.2
$Loans_{f,y}$ ('000)	69,479	10,337	69	732	7,962	117,140
$Working Capital_{f,y}$ ('000)	69,479	8,902	67	696	6,894	105,158
$Investment_{f,y}$ ('000)	69,479	15,757	57	1,511	26,872	93,249
$Liabilities_{f,y}$ (millions)	1,650	10,466	29	187	6,947	15,655
$Assets_{f,y}$ (millions)	1,170	27,607	74	503	32,739	47,695
$Revenue_{f,y}$ (millions)	1,650	6,056	15	182	13,431	15,245

Table 2 – Evolution of Bank-Level Indicators given Banks' Ex-ante Exposure to Energy

This table displays the coefficients of a series of regressions at the bank-month level analyzing the impact of banks' ex-ante exposure to the energy sector on their financial variables after the collapse in oil prices. Dependent variables are listed in columns. $CDS_{b,m}$ is the CDS spread (in logs) of five-year maturity bonds of bank *b* in month *m*. $Stock\ Price_{b,m}$ is the stock price (index relative to September 2014) of bank *b* in month *m*. $Loans_{b,m}$ is the total value (in logs) of commercial lending of bank *b* in month *m*. $Energy_{b,m}$ corresponds to the total lending of bank *b* to firms in the energy sector as a share of its Tier-1 capital in month *m* (percent). $Delinquency_{b,m}$ is the share of delinquent corporate loans of bank *b* in month *m*. $RWA_{b,m}$ is the value (in logs) of risk-weighted assets of bank *b* in month *m*. $Tier1Cap_{b,m}$ is the Tier-1 capital (in logs) of bank *b* in month *m*. $Capital_{b,m}$ is the Tier-1 capital ratio of bank *b* in month *m*. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. $Post_m$ is an indicator variable that equals one from October 2014 onwards and zero otherwise. Standard errors are doubled clustered at the bank and month levels. Detailed variable definitions are provided in Panel A of Table A1. The sample period is from January 2013 to June 2016. *** p<0.01, ** p<0.05, * p<0.1.

	$CDS_{b,m}$	$Stock\ Price_{b,m}$	$Loans_{b,m}$	$Energy_{b,m}$	$Delinquency_{b,m}$	$RWA_{b,m}$	$Tier1Cap_{b,m}$	$Capital_{b,m}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Energy_{b,Sep14}$*$Post_m$	0.016*	-0.005***	-0.003	0.192***	0.024***	0.003***	0.005***	0.024***
	(0.009)	(0.002)	(0.002)	(0.022)	(0.007)	(0.001)	(0.001)	(0.008)
Observations	272	350	612	612	612	612	612	612
R-squared	0.706	0.996	0.992	0.884	0.896	0.996	0.921	0.771
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SD($Energy_{b,Sep14}$)	6.5	6.3	6.5	6.5	6.2	6.5	6.5	6.5

Table 3 – Loans to Energy Sector given Banks' Ex-Ante Exposure to Energy

This table displays the coefficients of a series of regressions at the firm-bank-month level analyzing the impact of banks' ex-ante exposure to the energy sector on lending outcomes of borrowers in the energy sector after the collapse in oil prices. $Loans_{f,b,m}$ is the total lending value (in logs) to firm *f* by bank *b* in month *m*. $Working\ Capital_{f,b,m}$ (in logs) is the total lending value destined to working capital. $Interest\ Rate_{f,b,m}$ is the average interest rate charged to firm *f* on outstanding loans extended by bank *b in* month *m*. $Maturity_{f,b,m}$ are the average months (in logs) of the duration of outstanding loans extended to firm *f* by bank *b* in month *m*. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. It is calculated as the value of loans extended to the energy sector over the Tier-1 capital of a bank. $Post_m$ is an indicator variable that equals one from October 2014 onwards and zero otherwise. All regressions include monthly bank controls (total assets (in logs), capital, and liquidity ratios). Standard errors are doubled clustered at bank and month levels. Detailed variable definitions are provided in Panel A of Table A1. The sample period is from January 2013 to June 2016. The sample is restricted to firms in energy-related sectors, which are described in Panel B of Table A1 in the Appendix. *** p<0.01, ** p<0.05, * p<0.1.

	$Loans_{f,b,m}$		$Working\ Capital_{f,b,m}$		$Interest\ Rate_{f,b,m}$		$Maturity_{f,b,m}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Energy_{b,Sep14}*Post_m$	0.01**	0.02***	0.03***	0.04***	-0.03***	-0.03***	0.01***	0.02***
	0.000	0.000	(0.010)	(0.010)	0.000	(0.010)	0.000	0.000
Observations	23,746	11,361	23,746	11,361	23,746	11,361	19,392	8,709
R-squared	0.93	0.95	0.92	0.91	0.97	0.97	0.81	0.83
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Sector*Month FE	Yes	-	Yes	-	Yes	-	Yes	-
Firm*Month FE	No	Yes	No	Yes	No	Yes	No	Yes
SD($Energy_{b,Sep14}$)	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6

Table 4. Panel A – Loans to Energy Sector given Banks' Ex-Ante Exposure to Energy (by Borrower's Ex-Ante Outstanding Debt)

This table displays the coefficients of a series of regressions at the firm-bank-month level analyzing the impact of banks' ex-ante exposure to the energy sector on lending outcomes of borrowers in the energy sector with varying ex-ante outstanding debts after the collapse in energy prices. $Loans_{f,b,m}$ is the total lending value (in logs) to firm *f* by bank *b* in month *m*. $Working\ Capital_{f,b,m}$ (in logs) is the total lending value destined to working capital. $Interest\ Rate_{f,b,m}$ is the average interest rate charged to firm *f* on outstanding loans extended by bank *b in* month *m*. $Maturity_{f,b,m}$ are the average months (in logs) of the duration of outstanding loans extended to firm *f* by bank *b* in month *m*. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. It is calculated as the value of loans extended to energy sector over Tier-1 capital. $Post_m$ is an indicator variable that equals one from October 2014 onwards and zero otherwise. $LargeEnergyBorrower_{f,b,Sep14}$ is an indicator of borrowers with outstanding loan balances above 10 million pesos (roughly 600,000 dollars) in September 2014. These three regressors are all demeaned. All regressions include monthly bank controls (total assets (in logs), capital, and liquidity ratios). Standard errors are doubled clustered at bank and month levels. Detailed variable definitions are provided in Panel A of Table A1. The sample period is from January 2013 to June 2016. The sample is restricted to firms in energy-related sectors, which are described in Panel B of Table A1 in the Appendix. *** p<0.01, ** p<0.05, * p<0.1.

	$Loans_{f,b,m}$		$Working\ Capital_{f,b,m}$		$Interest\ Rate_{f,b,m}$		$Maturity_{f,b,m}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Energy_{b,Sep14}$*$Post_m$	0.008**	0.015***	0.031***	0.036***	-0.026***	-0.023***	0.009**	0.017***
	(0.004)	(0.005)	(0.007)	(0.009)	(0.005)	(0.006)	(0.004)	(0.004)
$LargeEnergyBorrower_{f,b,Sep14}$*$Post_m$	0.421***	0.375***	0.397***	0.470***	-0.290***	-0.325***	0.232***	0.015
	(0.108)	(0.089)	(0.111)	(0.094)	(0.072)	(0.105)	(0.045)	(0.049)
$Energy_{b,Sep14}$*$LargeEnergyBorrower_{f,b,Sep14}$ *$Post_m$	0.011*	0.012*	0.012	0.037**	-0.020*	-0.004	0.020**	0.030***
	(0.005)	(0.007)	(0.013)	(0.014)	(0.011)	(0.014)	(0.008)	(0.009)
Observations	23,567	11,143	23,567	11,143	23,567	11,143	19,392	8,709
R-squared	0.934	0.952	0.921	0.918	0.970	0.973	0.810	0.837
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Sector*Month FE	Yes	-	Yes	-	Yes	-	Yes	-
Firm*Month FE	No	Yes	No	Yes	No	Yes	No	Yes
SD($Energy_{b,Sep14}$)	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7

Table 4. Panel B – Loans to Energy Sector given Banks' Ex-Ante Exposure to Energy (by Borrower's Ex-Ante Risk)

This table displays the coefficients of a series of regressions at the firm-bank-month level analyzing the impact of banks' ex-ante exposure to the energy sector on lending outcomes of borrowers in the energy sector of varying ex-ante risk after the collapse in energy prices. $Loans_{f,b,m}$ is the total lending value (in logs) to firm *f* by bank *b* in month *m*. $Working\ Capital_{f,b,m}$ (in logs) is the total lending value destined to working capital. $Interest\ Rate_{f,b,m}$ is the average interest rate charged to firm *f* on outstanding loans extended by bank *b in* month *m*. $Maturity_{f,b,m}$ are the average months (in logs) of the duration of outstanding loans extended to firm *f* by bank *b* in month *m*. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. It is calculated as the value of loans extended to energy sector over Tier-1 capital. $Post_m$ is an indicator variable that equals one from October 2014 onwards and zero otherwise. $RiskyBorrower_{f,b,Sep14}$ is an indicator that the internal bank rating of the loan extended to firm *f* by bank *b* in September of 2014 is not the highest. These three regressors are all demeaned. All regressions include monthly bank controls (total assets (in logs), capital, and liquidity ratios). Detailed variable definitions are provided in Panel A of Table A1. The sample period is from January 2013 to June 2016. The sample is restricted to firms in energy-related sectors, which are described in Panel B of Table A1 in the Appendix. Standard errors are doubled clustered at bank and month levels. *** p<0.01, ** p<0.05, * p<0.1. The correlation between $RiskyBorrower_{f,b,Sep14}$ and $LargeBorrower_{f,b,Sep14}$ is -0.03.

	$Loans_{f,b,m}$		$Working\ Capital_{f,b,m}$		$Interest\ Rate_{f,b,m}$		$Maturity_{f,b,m}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Energy_{b,Sep14}*Post_m$	0.005	0.019*	0.010	0.019*	-0.024*	-0.024**	0.006	0.018*
	(0.009)	(0.011)	(0.017)	(0.011)	(0.012)	(0.011)	(0.006)	(0.009)
$RiskyBorrower_{f,b,Sep14}*Post_m$	-0.210**	-0.068	-0.170*	-0.110	0.158**	-0.075	-0.091	-0.14
	(0.087)	(0.090)	(0.097)	(0.098)	(0.069)	(0.067)	(0.063)	(0.090)
$Energy_{b,Sep14}*RiskyBorrower_{f,b,Sep14}*Post_m$	0.061***	0.077***	0.068***	0.064**	0.022	0.015	0.018*	0.033*
	(0.013)	(0.026)	(0.022)	(0.027)	(0.029)	(0.029)	(0.011)	(0.017)
Observations	23,746	11,361	23,746	11,361	23,746	11,361	19,392	8,709
R-squared	0.944	0.956	0.945	0.956	0.978	0.982	0.854	0.856
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Sector*Month FE	Yes	-	Yes	-	Yes	-	Yes	-
Firm*Month FE	No	Yes	No	Yes	No	Yes	No	Yes
$SD(Energy_{b,Sep14})$	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7

Table 5 – Loans to Non-Energy Sectors given Banks' Ex-Ante Exposure to Energy

This table displays the coefficients of a series of regressions at the firm-bank-month level analyzing the impact of banks' ex-ante exposure to the energy sector on lending outcomes of borrowers in non-energy sectors after the collapse in oil prices. All dependent variables are in logs. $Loans_{f,b,m}$ is the total lending value to firm *f* by bank *b* in month *m*. $Working\ Capital_{f,b,m}$ and $Investment_{f,b,m}$ are total lending value destined to working capital and investment, respectively. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. It is calculated as the value of loans extended to energy sector over Tier-1 capital. $Post_m$ is an indicator variable that equals one from October 2014 onwards and zero otherwise. All regressions include monthly bank controls (total assets (in logs), capital, and liquidity ratios). Standard errors are doubled clustered at bank and month levels. Detailed variable definitions are provided in Panel A of Table A1. The sample period is from January 2013 to June 2016. The sample is restricted to firms outside the energy-related sectors (described in Panel B if Table A1) and to firms operating in non-oil producing states (i.e., borrowers in Campeche and Tabasco are dropped from the sample). *** p<0.01, ** p<0.05, * p<0.1.

	$Loans_{f,b,m}$		$Working\ Capital_{f,b,m}$		$Investment_{f,b,m}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$Energy_{b,Sep14}$*$Post_m$	-0.011***	-0.011***	-0.010***	-0.005	-0.011***	-0.020***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.005)
Observations	1,472,713	668,115	1,472,713	668,115	1,472,713	668,115
R-squared	0.793	0.893	0.814	0.889	0.858	0.911
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State*Sector*Month FE	Yes	-	Yes	-	Yes	-
Firm*Month FE	No	Yes	No	Yes	No	Yes
SD($Energy_{b,Sep14}$)	5.3	5.3	5.3	5.3	5.3	5.3

Table 6 – Loans to Non-Energy Sectors given Banks' Ex-Ante Exposure to Energy (by Borrower's Size)

This table displays the coefficients of a series of regressions at the firm-bank-month level analyzing the impact of banks' ex-ante exposure to the energy sector on lending outcomes of small and large borrowers in non-energy sectors after the collapse in oil prices. We follow Beck and Demirgüç-Kunt (2006) and classify borrowers as *Small* if they had fewer than 50 employees in 2014 and *Large* otherwise. All dependent variables are in logs. $Loans_{f,b,m}$ is the total lending value to firm *f* by bank *b* in month *m*. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. It is calculated as the value of loans extended to energy sector over Tier-1 capital. $Post_m$ is an indicator variable that equals one from October 2014 onwards and zero otherwise. All regressions include monthly bank controls (total assets (in logs), capital, and liquidity ratios). Standard errors are doubled clustered at bank and month levels. Detailed variable definitions are provided in Panel A of Table A1. The sample period is from January 2013 to June 2016. The sample is restricted to firms outside the energy-related sectors (described in Panel B of Table A1) and to firms operating in non-oil producing states (i.e., borrowers in Campeche and Tabasco are dropped from the sample). *** p<0.01, ** p<0.05, * p<0.1.

	$Loans_{f,b,m}$			
	Small Borrowers		Large Borrowers	
	(1)	(2)	(3)	(4)
$Energy_{b,Sep14}$*$Post_m$	-0.013***	-0.013***	-0.005	-0.004
	(0.003)	(0.003)	(0.004)	(0.004)
Observations	1,296,304	552,992	171,886	115,123
R-squared	0.773	0.876	0.866	0.917
Bank Controls	Yes	Yes	Yes	Yes
Firm*Bank FE	Yes	Yes	Yes	Yes
State*Sector*Month FE	Yes	-	Yes	-
Firm*Month FE	No	Yes	No	Yes
SD($Energy_{b,Sep14}$)	5.3	5.3	5.3	5.3

Table 7 – Real Outcomes of Non-Energy Firms given Municipalities' Ex-ante Bank Exposure to Energy

This table displays the coefficients of a series of regressions at the firm-year level analyzing the impact of the ex-ante exposure to the energy sector of banks in a municipality on real effects of non-energy firms headquartered in the municipality after the collapse in oil prices. All dependent variables are in logs. $Loans_{f,y}$ is the value of bank loans of firm *f* in year *y*. $Working\ Capital_{f,y}$ and $Investment_{f,y}$ are the value of the bank loans of firm *f* in year *y* to working capital and investment, respectively. $Liabilities_{f,y}$ is the value of total liabilities of firm *f* in year *y*. $Assets_{f,y}$ is the value of firm *f*'s assets in year *y*. $Revenue_{f,y}$ is the value of firm *f*'s sales in year *y*. $MuniExposureEnergy_{mun,Sep14}$ is a measure of exposure of banks in a municipality to the energy sector. It is measured as the average bank exposure to the energy sector in September 2014 of banks operating in municipality *mun,* weighted by the loan value. $Post_y$ is an indicator variable that equals one from 2014 onwards and zero otherwise. The sample is restricted to firms outside the energy-related sectors (described in Panel B of Table A1) and to firms operating in non-oil producing states (i.e., borrowers in Campeche and Tabasco are dropped from the sample). Standard errors are doubled clustered at the firm year level. Detailed variable definitions are provided in Panel A of Table A1. The sample period is from 2012 to 2016. *** p<0.01, ** p<0.05, * p<0.1.

	$Loans_{f,y}$	Working $Capital_{f,y}$	$Investment_{f,y}$	$Liabilities_{f,y}$	$Assets_{f,y}$	$Revenue_{f,y}$
	(1)	(2)	(3)	(4)	(5)	(6)
$MuniExposureEnergy_{mun,Sep14}*Post_y$	-0.007*	0.003	-0.032*	-0.020*	-0.005	-0.027**
	(0.004)	(0.005)	(0.012)	(0.012)	(0.003)	(0.014)
Observations	69,479	69,479	69,479	1,627	1,629	1,630
R-squared	0.844	0.824	0.834	0.993	0.999	0.982
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
State*Year FE	Yes	Yes	Yes	Yes	Yes	Yes
SD($MuniExposureEnergy_{mun,Sep14}$)	4.8	4.8	4.8	2.5	2.5	2.5

Appendix

Figure A1 – Evolution of Oil Prices (WTI) and Leverage of Energy Firms

This figure displays the movements in oil prices—Mexican Mayan Crude Oil — in dollars along with the quarterly average leverage ratio of all global energy producing firms from 2013Q1 to 2016Q2, measured as total debt over total assets. The vertical line marks the quarter when oil prices began plummeting. The sample period spans from January 2013 to June 2016. Data on energy producing firms was obtained from S&P Capital IQ.

Figure A2. – Corrections of Oil Prices and Equity Prices and CDS Spreads of Energy Firms

This figure displays the evolution of energy prices along with financials of energy producers during events of moderate and large energy-price declines. Yellow (orange) shaded areas represent periods of 10 to 30 percent (>30 percent) corrections in 6-month growth rate of real WTI prices. Panel A displays the evolution of real WTI oil prices over time. Panel B plots the evolution of the average equity prices of Latin American energy listed firms (index in logs). Panel C displays the evolution of CDS spreads of Pemex and of Mexican sovereign debt.

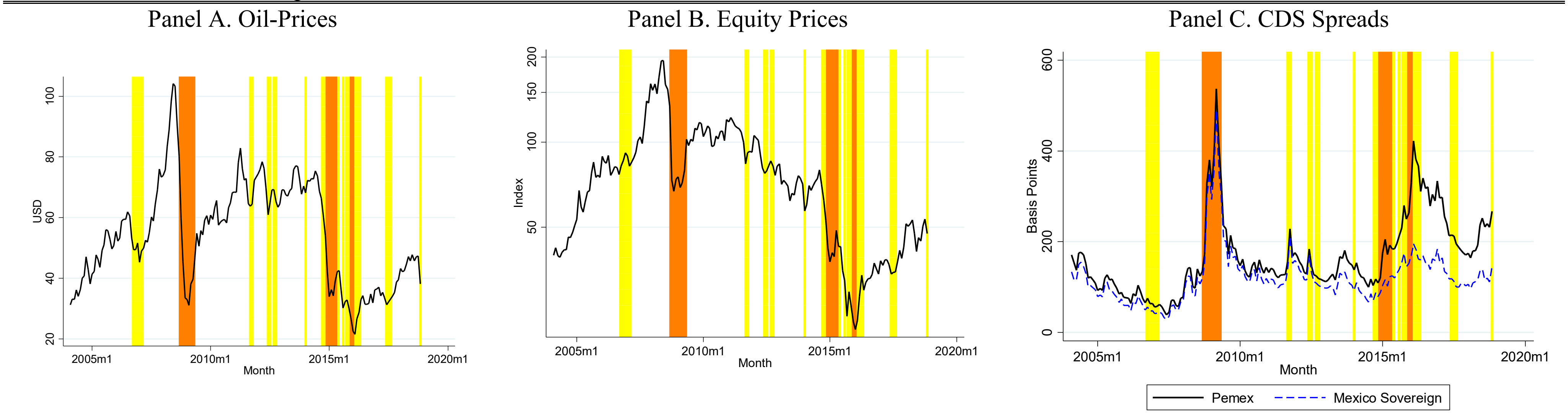


Figure A3 - Distribution of Bank Loans to Energy Borrowers per Sector

This figure displays the distribution of bank loans of energy-related firms.

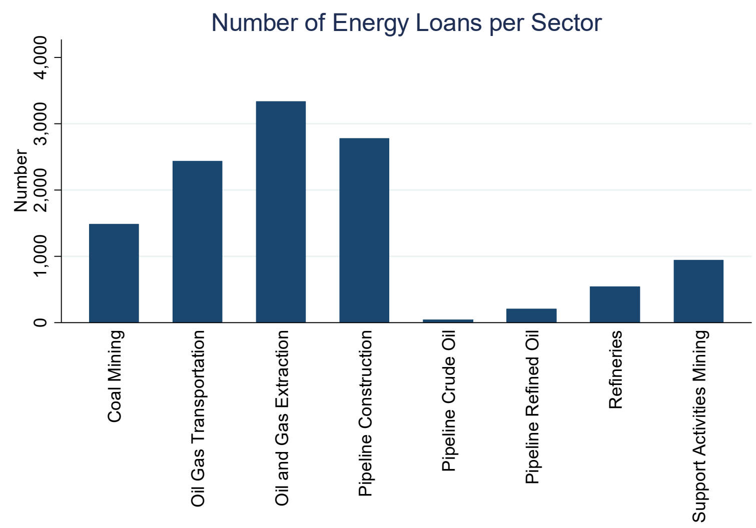


Figure A4 – Ex-ante Loan Value and Ex-Post Loan Growth (Energy Firms)

This figure displays a bin scatter plot for the sample of loans from borrowers in the energy sector. Loans on the x-axis are grouped by loan value. The x-axis plots the value (in logs) of the total loans outstanding in September 2014. The sample is censored above the 90th percentile for confidentiality reasons. The y-axis plots the average growth rate of loan value (in percent) of these firms from September 2014 to June 2016.

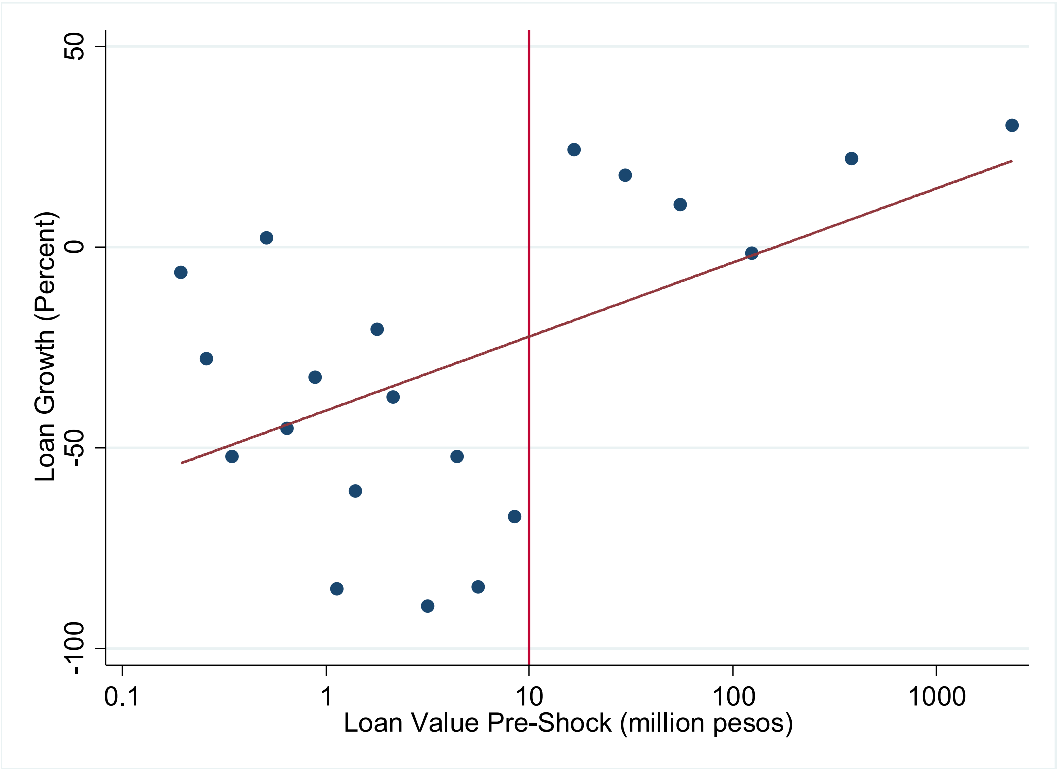


Table A1. Panel A – Variable Definitions

Bank variables	
$Energy_{b,m}$	Share of lending of bank *b* to borrowers operating in the energy sector over Tier-1 capital in month *m* (percent).
$CDS_{b,m}$	Five-year CDS spread of bank *b* in month *m* (percent relative to September 2014).
Stock $Price_{b,m}$	Stock price of bank *b* in month *m* (index relative to September 2014).
$Capital_{b,m}$	Ratio of Tier-1 capital to risk-weighted assets of bank *b* in month *m* (percent).
$Loans_{b,m}$	Value of credit portfolio of commercial loans of bank *b* in month *m* (logs of millions of Mexican pesos).
$Delinquency_{b,m}$	Average share of nonperforming loans of bank *b* to total loans in month *m* (percent).
$RWA_{b,m}$	Risk-weighted assets of bank *b* in month *m* (logs).
$Tier1Cap_{b,m}$	Tier-1 capital of bank *b* in month *m* (logs).
$Liquidity_{b,m}$	Liquidity ratio measured as the share of liquid assets to total assets of bank *b* in month *m* (percent).
$ROA_{b,m}$	Return on assets of bank *b* in month *m* (percent).
Cost $Funds_{b,m}$	Cost of total funds of bank *b* in month *m* (percent).
Cost $Deposits_{b,m}$	Cost of deposits of bank *b* in month *m* (percent).
Cost ST (LT) $Deposits_{b,m}$	Cost of deposits in checking (savings) accounts of bank *b* in month *m* (percent).
Cost Other $Funds_{b,m}$	Cost of other funds of bank *b* in month *m* (percent).
$Assets_{b,m}$	Total assets of bank *b* in month *m* (billions of pesos).
$Herfindahl_{b,Sep14}$	Herfindahl index of loans to the energy sector in September 2014 by bank *b*.
$SpecializationEnergy_{b,Sep14}$	Fraction of total loans of bank *b* in September 2014 that were extended to borrowers in the energy sector.
$EnergyMktShr_{b,Sep14}$	Fraction of loans to borrowers in the energy sector that were extended by bank *b* in September 2014.
$Domestic_{b,Sep14}$($Foreign_{b,Sep14}$)	Indicator that bank *b* is Mexican (foreign) owned in September 2014.
$GovShr_{b,Sep14}$	Fraction of outstanding commercial loans of bank *b* in September of 2014 extended to state-owned entities.
$Equity_{b,m}$	Value of equity (in logs) of bank *b* in month *m*.
Paid-in-$Equity_{b,m}$	Value of equity (in logs) from external funding sources (e.g., initial or issued shares) of bank *b* in month *m*.
$EarnedEquity_{b,m}$	Value of equity (in logs) from internal funding sources (e.g., retained earnings) of bank *b* in month *m*.
$Earnings_{b,m}$	Ratio of net income to assets of bank *b* in month *m* (percent).
Loan variables	
$Loans_{f,b,m}$	Value of outstanding loans of firm *f* from bank *b* in month *m* (thousands of Mexican pesos).
Working $Capital_{f,b,m}$	Value of outstanding loans destined to working capital of firm *f* from bank *b* in month *m* (thousands of Mexican pesos).
$Investment_{f,b,m}$	Value of outstanding loans destined to investment projects of firm *f* from bank *b* in month *m* (thousands of Mexican pesos).
Interest $Rate_{f,b,m}$	Average interest rate of loans of firm *f* from bank *b* in month *m* (percent).
$Maturity_{f,b,m}$	Average maturity of loans of firm *f* from bank *b* in month *m* (logs of years).
$RiskyBorrower_{f,b,Sep14}$	Indicator that loans extended to firm *f* by bank *b* do not have the highest rating (A1) in September 2014.

Table A1. Panel A – Variable Definitions (Continued)

$\text{LargeEnergyBorrower}_{f,b,Sep14}$	Indicator that outstanding loan balances of firm *f* with bank *b* are above 10 million pesos (roughly 600,000 dollars) in September 2014.
$\text{FirmExposureBank}_{f,b,Sep14}$	Fraction of outstanding loans of firm *f* in September 2014 extended by bank *b*.
$\text{BankRelations}_{f,m}$	Number of bank relations of firm *f* in month *m*.
$\text{LongBankRelation}_{f,b}$	Indicator that relation between firm *f* and bank *b* began prior to January 2013.
$\text{Credit Lines}_{f,b,m}$	Total value of outstanding loans obtained from credit lines extended to firm *f* by bank *b* in month *m*.
$\text{Term Loans}_{f,b,m}$	Total value of outstanding term loans extended to firm *f* by bank *b* in month *m*.
$\text{Late}_{f,b,m}$	Indicator that loan extended to firm *f* by bank *b* is more than 90 days in arrears in month *m* (percent).
$\text{Delinquent}_{f,b,m}$	Indicator that loan extended to firm *f* by bank *b* is delinquent (percent).
$\text{MaturingLoan}_{f,b,Sep14}$	Indicator that loan extended to firm *f* by bank *b* in September 2014 has a maturity below 18 months (median maturity).
Firm variables	
$\text{Energy}_{f,Sep14}$	Average exposure to the energy sector in September 2014 of banks serving firm *f*, weighted by loan value (percent).
$\text{Loans}_{f,y}$	Total value of bank loans of firm *f* in year *y* (logs of thousands of Mexican pesos).
$\text{Working Capital}_{f,y}$	Total value of bank loans destined to working capital of firm *f* in year *y* (logs of thousands of Mexican pesos).
$\text{Investment}_{f,y}$	Total value of bank loans destined to investment projects of firm *f* in year *y* (logs of thousands of Mexican pesos).
$\text{Liabilities}_{f,y}$	Total value of liabilities of firm *f* in year *y* (logs of thousands of Mexican pesos) .
$\text{Assets}_{f,y}$	Total value of assets of firm *f* in year *y* (logs of thousands of Mexican pesos).
$\text{Revenue}_{f,y}$	Total operational revenue of firm *f* in year *y* (logs of thousands of Mexican pesos).
$\text{Small (Large) Borrowers}_{f}$	Indicator that firm *f* had fewer than (at least) 50 employees in 2014.
Other variables	
Post_{t}	Indicator that observation at time *t* is after the energy price shock.
$\text{MuniExposureEnergy}_{mun,Sep14}$	Municipality *mun* exposure to the energy sector. It is measured as the average exposure to the energy sector of banks operating in municipality *mun* in September 2014, weighted by loan value (percent).
$\text{StateExposureEnergy}_{s,Sep14}$	State *s* exposure to the energy sector. It is measured as the average exposure to the energy sector of banks operating in state *s* in September 2014, weighted by loan value (percent).
$\text{Spending/GDP}_{s,y}$	Ratio of spending on debt repayments over GDP in state *s* in year *y*.
$\text{Investment/GDP}_{s,y}$	Ratio of public spending minus debt repayments over GDP in state *s* in year *y*.
$\text{Services/GDP}_{s,y}$	Ratio of spending on public projects towards infrastructure over GDP in state *s* in year *y*.
$\text{Transfers/GDP}_{s,y}$	Ratio of federal transfers over GDP in state *s* in year *y*.
$\text{TaxRate}_{s,y}$	Ratio of tax revenue over GDP in state *s* in year *y*.
(Non-)Northern States	Indicator of whether a given state is northern (non-northern) based on the classification of the Mexican national statistics agency (INEGI).
(Non-)Tradable Sector	Indicator that sector is *tradable* (non-tradable) as defined by Mian and Sufi (2014).
Energy-Supplying Sector	Indicator that a sector is *Energy Supplier* (i.e., if its output is an input of the energy sectors based on the Mexican Input-Output matrix).

Table A1. Panel B –Energy-Related Sectors (5-Digit NAICS)

This table displays the 5-digit NAICS energy-related sectors as well as their descriptions. *NAICS* is the North American Industry Classification System.

5-digit NAICS sector	Description
21111	Oil and gas extraction
21211	Coal mining
21311	Support activities for mining and oil and gas extraction
23712	Oil and gas pipeline related structures construction
32411	Petroleum refineries
48311	Marine oil and natural gas transportation
48611	Transportation of crude oil through pipelines
48621	Transportation of natural gas through pipelines
48691	Pipeline transportation of refined petroleum products

Table A2 – Mean Outcomes of Banks with Ex-ante Low vs High Energy Exposure

This table displays the mean outcomes of banks in the month prior to the oil price shock (September 2014), given their exposure to the energy sector that month. Standard deviations of the mean outcomes are in parentheses. A bank is defined as having low (high) exposure to the energy sector if its ratio of loan volume to the energy sector over Tier-1 capital ratio is below (above) the median value in September of 2014. *CDS Spreads* is the CDS spread (in logs) of five-year maturity bonds of banks. *Stock Price* is the bank's stock price (in logs). *Loans* is the bank's total value (in logs) of commercial lending. *Energy* corresponds to the bank's total lending to firms in the energy sector as a share of its Tier-1 capital. *Delinquency* is the bank's share of delinquent corporate loans. *RWA* is the value (in logs) of risk-weighted assets. *Capital* is the bank's Tier-1 capital ratio. *Tier1Cap* is the bank's Tier-1 capital (in logs). *Liquidity* is the bank's average ratio of liquid assets to total assets (percent). *ROA* are the bank's return on assets (percent). *Cost of Funds* is the bank's cost of funds (percent). *Assets* is a measure of total bank assets (in billions of pesos).

	Low Exposure Energy	**High Exposure Energy**	**t-test**
$CDS_{b,Sep14}$	4.0	3.6	0.5
	(0.2)	(0.2)	
Stock $Price_{b,Sep14}$	2.9	3.6	-0.7
	(0.6)	(0.7)	
$Loans_{b,Sep14}$	21.5	25.3	-3.9
	(2.2)	(0.5)	
$Energy_{b,Sep14}$	4.7	20.2	-15.5***
	(1.3)	(3.3)	
$Delinquency_{b,Sep14}$	2.9	2.8	0.1
	(0.9)	(1.1)	
$RWA_{b,Sep14}$	21.5	25.3	-3.9
	(2.2)	(0.5)	
$Capital_{b,Sep14}$	15.4	15.9	-0.5
	(0.7)	(0.8)	
$Tier1Cap_{b,Sep14}$	20	23.7	-3.7
	(2.0)	(0.5)	
$Liquidity_{b,Sep14}$	6.9	7.7	-0.8
	(1.8)	(1.1)	
$ROA_{b,Sep14}$	1.1	1.1	-0.0
	(0.6)	(0.3)	
Cost of $Funds_{b,Sep14}$	2.6	2.5	0.2
	(0.3)	(0.5)	
$Assets_{b,Sep14}$	171.1	515.4	-344.3
	(121.2)	(165.4)	

Table A3 – Loans to Energy Sector given Banks' Ex-Ante Exposure to Energy and Firms' Distance to Maturity Date

This table displays the coefficients of a series of regressions analyzing the impact of ex-ante bank exposure to the energy sector on lending to energy borrowers with loans of varying distance to maturity after the collapse in oil prices. $Loans_{f,b,m}$ is the total lending value (in logs) to firm *f* by bank *b* in month *m*. $Working\ Capital_{f,b,m}$ (in logs) is the total lending value destined to working capital. $Interest\ Rate_{f,b,m}$ is the average interest rate charged to firm *f* on outstanding loans extended by bank *b in* month *m*. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. It is calculated as the value of loans extended to the energy sector by a bank over its Tier-1 capital. $Post_m$ is an indicator that equals one from October 2014 onwards. $MaturingLoan_{f,b,Sep14}$ is an indicator that the loan extended to firm *f* by bank *b* is maturing in less than 18 months in September 2014. All regressions include monthly bank controls (total assets (in logs), capital, and liquidity ratios). Standard errors are doubled clustered at the bank and month levels. Detailed variable definitions are provided in Panel A of Table A1. The sample period is from January 2013 to June 2016. The sample is restricted to firms in energy-related sectors, which are described in Panel B of Table A1 in the Appendix. *** p<0.01, ** p<0.05, * p<0.1.

	$Loans_{f,b,m}$		$Working\ Capital_{f,b,m}$		$Interest\ Rate_{f,b,m}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$Energy_{b,Sep14}*Post_m$	-0.006	-0.001	0.014	0.024	-0.008	0.013
	(0.005)	(0.006)	(0.013)	(0.019)	(0.008)	(0.011)
$MaturingLoan_{f,b,Sep14}*Post_m$	-0.349***	-0.367***	-0.399***	-0.568***	0.400***	0.499***
	(0.054)	(0.063)	(0.087)	(0.130)	(0.055)	(0.077)
$Energy_{b,Sep14}*Post_m*MaturingLoan_{f,b,Sep14}$	0.021***	0.023***	0.026*	0.014	-0.027***	-0.052***
	(0.008)	(0.008)	(0.015)	(0.022)	(0.009)	(0.013)
Observations	21,343	10,396	21,343	10,396	21,343	10,396
R-squared	0.935	0.952	0.921	0.918	0.970	0.973
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State*Sector*Month FE	Yes	-	Yes	-	Yes	-
Firm*Month FE	No	Yes	No	Yes	No	Yes
SD($Energy_{b,Sep14}$)	5.6	5.6	5.6	5.6	5.6	5.6

Table A4 – Loans to Energy Sector given Banks' Ex-Ante Exposure to Energy and Banks' Capitalization

This table displays the coefficients of a series of regressions at the firm-bank-month level analyzing the impact of both banks' ex-ante exposure to the energy sector and capital ratios, on lending outcomes of energy borrowers after the collapse in energy prices. $Loans_{f,b,m}$ is the total lending value (in logs) to firm *f* by bank *b* in month *m*. $Working\ Capital_{f,b,m}$ (in logs) is the total lending value destined to working capital. $Interest\ Rate_{f,b,m}$ is the average interest rate charged to firm *f* on outstanding loans extended by bank *b in* month *m*. $Maturity_{f,b,m}$ are the average months (in logs) of the duration of outstanding loans extended to firm *f* by bank *b* in month *m*. $Energy_{b,Sep14}$ represents the exposure to the energy sector of bank *b* in September 2014. It is calculated as the value of loans extended to the energy sector by a bank over its Tier-1 capital. $Post_m$ is an indicator variable that equals one from October 2014 onwards and zero otherwise. $Capital_{b,Sep14}$ is the Tier-1 capital ratio over risk-weighted assets of bank *b* in September 2014 (in percent). These three regressors are all demeaned. All regressions include monthly bank controls (total assets (in logs), capital, and liquidity ratios). The sample is restricted to firms in energy-related sectors, which are described in Panel B of Table A1. Standard errors are doubled clustered at bank and month levels. Detailed variable definitions are provided in Table A1. The sample period is from January 2013 to June 2016. *** p<0.01, ** p<0.05, * p<0.1.

	$Loans_{f,b,m}$		$Working\ Capital_{f,b,m}$		$Interest\ Rate_{f,b,m}$		$Maturity_{f,b,m}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Energy_{b,Sep14}$*$Post_m$	0.016***	0.031***	0.029***	0.047***	-0.033***	-0.027***	0.006*	0.019***
	(0.004)	(0.006)	(0.007)	(0.011)	(0.005)	(0.006)	(0.004)	(0.005)
$Capital_{b,Sep14}$*$Post_m$	0.033**	0.026*	0.004	0.022	-0.005	0.056***	-0.032***	-0.014
	(0.012)	(0.013)	(0.024)	(0.030)	(0.016)	(0.018)	(0.012)	(0.013)
Observations	23,746	11,361	23,746	11,361	23,746	11,361	19,392	8,709
R-squared	0.925	0.942	0.920	0.918	0.966	0.965	0.814	0.839
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Month FE	No	Yes	No	Yes	No	Yes	No	Yes
SD($Energy_{b,Sep14}$)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
SD($Capital_{b,Sep14}$)	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2