

Owe a Bank Millions, the Bank Has a Problem: Credit Concentration in Bad Times*

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**The views expressed in these slides and associated remarks are solely those of the authors and do not necessarily represent those of the Bank of Mexico, the Board of Governors of the Federal Reserve System, or of the World Bank*

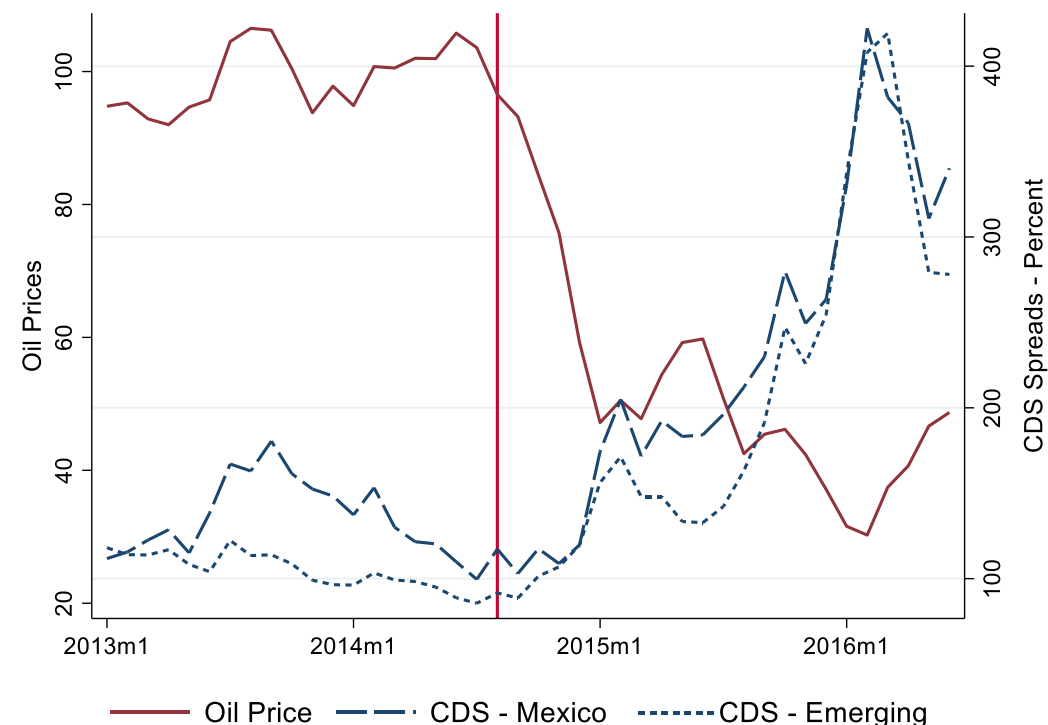
Motivation

- Large exposures and portfolio concentration can materially increase banks' risks (Basel Committee on Banking Supervision, 2014).
- There is limited knowledge on bank behavior when large share of borrowers suffers a common negative shock (e.g. sectoral shock).
 - Identification is usually a concern. Large sectoral shocks tend to impact activity across sectors.
- Why do we care?
 - Large bank exposures (e.g. to energy sector) may trigger a credit channel whereby banks reallocate resources away from healthy firms/sectors to troubled borrowers. Furthermore, this reallocation raises [financial risks](#).

Motivation

Energy Prices and Energy Firms' CDS spreads

- Global energy prices halved in mid-2014 due to increase in U.S. production (fracking) and weaker global demand.
- CDS spreads of energy producers in EMs shot up.
- Decline in energy prices did not pass through to fuel prices in Mexico (not shown).
 - Therefore, the sharp decline in energy prices did not change activity (directly) in non-energy sectors.



Main Question

Broadly:

- How do banks react when a large fraction of their borrowers faces a common negative shock?
 - Impact of the mid-2014 collapse in energy prices on bank lending in Mexico.

More concretely:

- Do banks more exposed to energy sector:
 - Scale back their lending to the energy sector to reduce losses and diversify loan portfolio?
 - Expand their lending to struggling borrowers to contain losses and preserve their regulatory capital ratios?

Contribution

- Role of bank capital in amplifying bargaining power (Santos and Winton, 2008, 2019; Rajan 1992; Froot, Stein, 1998 and Diamond and Rajan 2000).
 - We show evidence consistent with banks with lower bargaining power rolling-over and increasing low-quality loans to large borrowers.
- Effects of liquidity shocks on bank lending. Monetary policy shocks (Kashyap and Stein 2000); local liquidity shocks (Gilje, Loutskina, and Strahan 2016); global liquidity shocks (Schnabl 2012; Khwaja and Mian 2008).
 - We examine a liquidity shock that works through troubled borrowers' demand for short-term funding and its effect on the asset side of banks' balance sheets instead of their liabilities.
- Bank diversification and performance. Diamond (1984) proposes that bank diversification reduces risk. Conversely, Laeven and Levine, 2007; Tabak, Fazio, and Cajueiro 2011 argue diversification is related with risk.
 - We uncover another channel through which portfolio concentration can lead to misallocation and increased financial risk.
- Impact of commodity price shocks on financial markets and economic growth (Agarwal, Duttagupta, and Presbitero 2019; Blanchard and Gali 2010; Alesina, Campante, and Tabellini 2008).
 - We document that banks amplify commodity price shocks via the credit channel.

Data

Sources

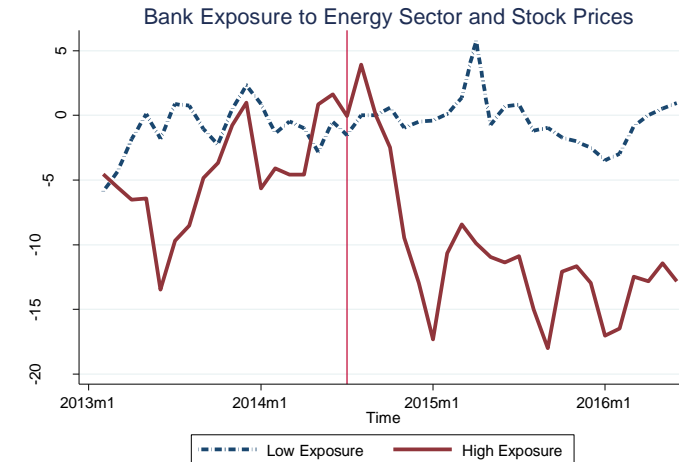
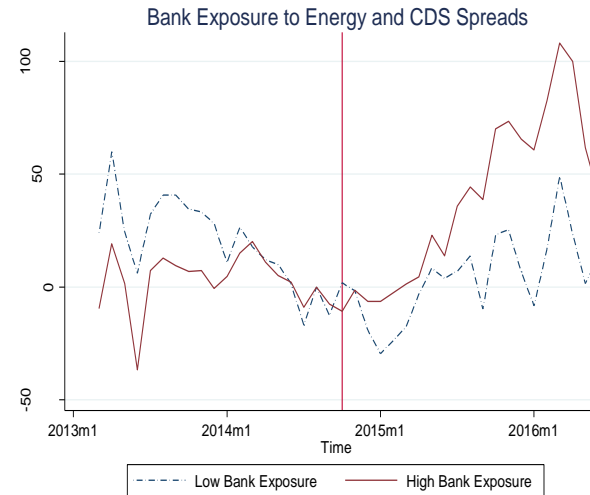
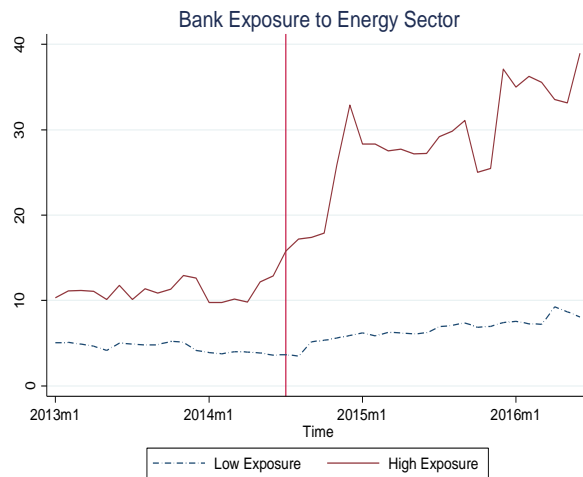
Data from four main sources, from January 2013 to June 2016.

1. Universe of commercial loans in Mexico, at monthly level. Overall, we have 1.7 million loans extended by 18 banks to 50,000 firms.
2. Balance sheet information of the 18 commercial banks in our sample. We merge this dataset with information from Bloomberg on the stock prices and CDS spreads of the banks.
3. Orbis, a firm-year level dataset, containing information on the balance sheets and income statements of a large set of Mexican firms.
4. GDP information for each of Mexico's 32 states, normalized to 2004, obtained from the National Statistics Institute. Includes GDP decomposition through primary, secondary and tertiary sectors.

Stylized Facts

Credit Allocation and Financials

- We split banks depending on whether their exposure at time of shock was below/above median.



Empirical Strategy

Bank-level benchmark specification

$$y_{b,m} = \alpha + \beta \text{ExposureEnergy}_{b, \text{Aug14}} * \text{Post}_m + \gamma_m + \gamma_b + \varepsilon_{b,m}$$

where:

- | | |
|---|---|
| $y_{b,m}$ | - Bank b variable (e.g. loans) in month m |
| Post_m | - Observation post August 2014 |
| $\text{ExposureEnergy}_{b, \text{Aug14}}$ | - Bank b exposure to Energy in August 2014. Ratio of loans to energy sector over tier-1 capital |
| γ_m, γ_b | - Month and Bank fixed effects |

Evolution of Lending after Energy Price Shock

Bank Balance-Sheet Variables

	ExposureEnergy _{b,m}	Total Lending _{b,m}	CDS Spreads _{b,m}	Stock Price _{b,m}	Delinquency _{b,m}
	(1)	(2)	(3)	(4)	(5)
ExposureEnergy _{b,Aug14} *Post _m	0.192*** (0.022)	-0.003 (0.002)	0.016* (0.009)	-0.005*** (0.002)	0.024*** (0.007)
Observations	612	612	272	350	612
R-squared	0.884	0.992	0.706	0.996	0.896
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
SD(ExposureEnergy _{b,Aug14})	6.5	6.5	6.3	6.2	6.5

Loans to Firms in the Energy Sector

What we Test/Find

- Analysis at loan-level.
 - Control for demand and supply shocks.
 - Analyze heterogeneities across type of lending and borrowers.
- We show that:
 - Banks with higher exposure to energy, provide more credit and loosen credit standards on the energy sector.
 - Especially to borrowers with weaker credit quality.
 - Banks with higher capital ratios provide more credit and loosen credit terms relatively more.
 - Energy firms increase borrowing from more exposed bank. Not from bank with which they have the longest relation.
 - Energy firms prioritize delinquency on loans from banks with higher exposure to energy.

Loans to Firms in the Energy Sector

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Loans to Firms in the Energy Sector

Firms borrow from banks with higher exposure to energy sector

- Empirical specification, we test

$$y_{f,b,m} = \alpha + \beta \text{ExposureEnergy}_{b,\text{Aug14}} * \text{Post}_m + \gamma_{f,b} + \gamma_m + \varepsilon_{f,b,m}$$

where:

- | | | |
|--|---|---|
| $y_{f,b,m}$ | - | Outcome of Firm f with Bank b in month m |
| Post_m | - | Observation post September 2014 |
| $\text{ExposureEnergy}_{b,\text{Aug14}}$ | - | Bank b Exposure to Energy Sector in August 2014 |
| $\gamma_{f,b} \gamma_m$ | - | Borrower*bank fixed effects and month fixed effects |
| $\gamma_{f m}$ | - | Some specifications use firm*month fixed effects |

Loans to Firms in the Energy Sector

Firms borrow more from their more exposed bank

	Loans _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
BankExposureEnergy _{b,Sep14} *Post _m	0.03** (0.01)	0.04* (0.02)	0.10* (0.06)	0.17* (0.11)	0.01 (0.05)	0.09 (0.05)
Observations	4,400	3,062	4,400	3,062	4,400	3,062
R-squared	0.90	0.92	0.92	0.91	0.92	0.94
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Month FE	Yes	-	Yes	-	Yes	-
Sector-Month FE	Yes	-	Yes	-	Yes	-
Firm-Month FE	No	Yes	No	Yes	No	Yes
SD(BankExposureEnergy _{b,Sep14})	6.1	6.1	6.1	6.1	6.1	6.1

Loans to Firms in the Energy Sector

Banks with largest exposure loosen credit terms

	Interest Rate _{f,b,m}		Collateral _{f,b,m}		Maturity _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
BankExposureEnergy _{b,Sep14} *Post _m	-0.026*	-0.033*	0.080	0.325	0.022*	0.026**
	(0.014)	(0.019)	(0.253)	(0.256)	(0.011)	(0.011)
Observations	4,495	3,142	4,495	3,142	4,285	2,983
R-squared	0.938	0.932	0.849	0.874	0.801	0.838
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Month FE	Yes	-	Yes	-	Yes	-
Sector-Month FE	Yes	-	Yes	-	Yes	-
Firm-Month FE	No	Yes	No	Yes	No	Yes
SD(BankExposureEnergy _{b,Sep14})	6.1	6.1	6.1	6.1	6.1	6.1

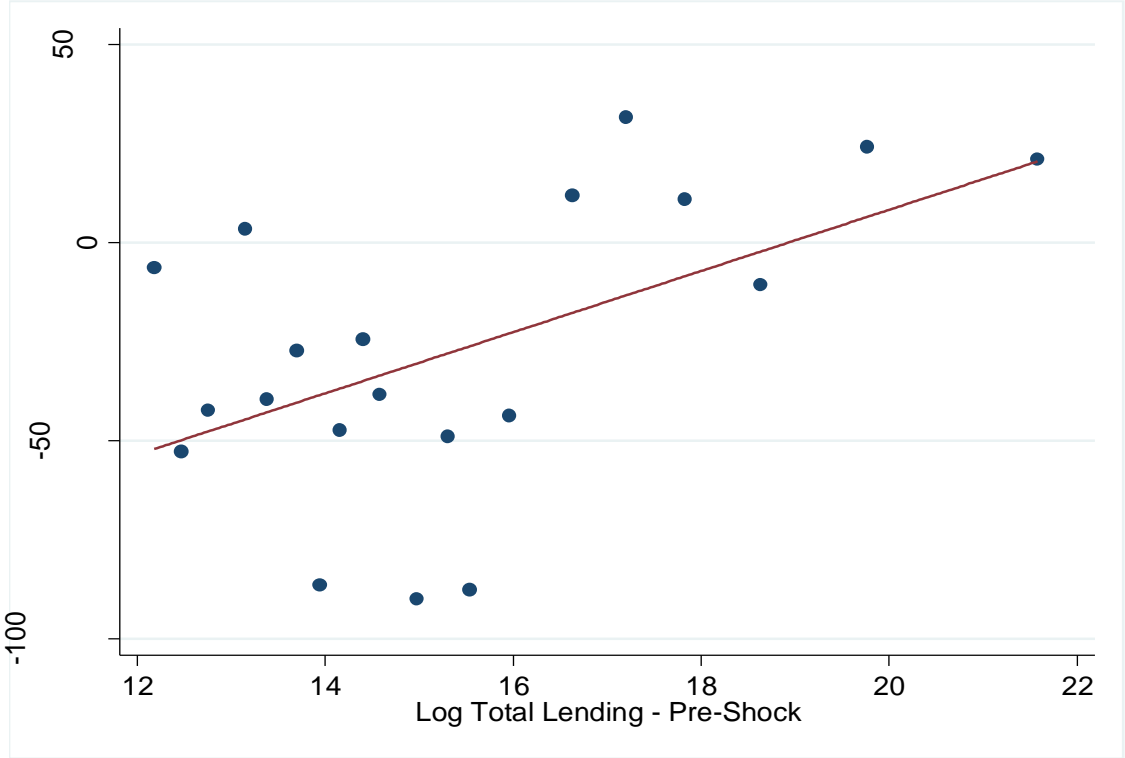
Loans to Firms in the Energy Sector

Borrower Heterogeneity

- Does the impact on lending to the energy sector depend on the size of bank exposure to individual borrowers?
 - Do banks loosen lending mainly to firms with which they have a larger exposure to?
 - In other words, do larger borrowers have higher bargaining power with the bank?

Loans to Firms in the Energy Sector

Positive relation between loan size ex-ante and subsequent growth one year after price shock



Loans to Firms in the Energy Sector

What we Test/Find

- Analysis at loan-level.
 - Control for demand and supply shocks.
 - Analyze heterogeneities across type of lending and borrowers.
- We show that:
 - Banks with higher exposure to energy provide more credit and loosen credit standards on the energy sector.
 - Especially to borrowers with weaker credit quality.
 - Banks with higher capital ratios provide more credit and loosen credit terms relatively more.
 - Energy firms increase borrowing from more exposed bank. Not from bank with which they have the longest relation.
 - Energy firms prioritize delinquency on loans from banks with higher exposure to energy.

Spillovers to Firms in Non-Energy Sectors

- Credit channel. From bank-level results we found total bank lending does not change.
 - Are non-energy firms less likely to obtain bank credit?
 - If so, what type of borrowers and type of credit is most affected?
- Real outcomes.
 - Do declines in bank lending affect firms' assets, investment and revenues?

Loan-level Results – Non-Energy Sectors

Lending Volumes

	Total Lending _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
ExposureEnergy _{b,Aug14} *Post _m	-0.022*** (0.007)	-0.017*** (0.005)	-0.014* (0.008)	0.001 (0.007)	-0.050*** (0.007)	-0.067*** (0.011)
Observations	1,262,712	573,544	1,262,712	573,544	1,262,712	573,544
R-squared	0.794	0.897	0.824	0.899	0.873	0.921
Bank*firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	-	Yes	-	Yes	-
Firm-month FE	No	Yes	No	Yes	No	Yes
SD(ExposureEnergy _{b,Aug14})	6.1	6.1	6.1	6.1	6.1	6.1

Loan-level Results – Non-Energy Sectors

Borrower Heterogeneity – Large vs Small Firms

- Split sample depending on whether number of employees below/above 50.

	Total Lending _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
ExposureEnergy _{b,Aug14} *Post _m	-0.027*** (0.007)	-0.005 (0.005)	-0.020** (0.008)	0.006 (0.010)	-0.047*** (0.006)	-0.062*** (0.014)
Observations	1,026,135	236,519	1,026,135	236,519	1,026,135	236,519
R-squared	0.766	0.847	0.816	0.840	0.872	0.871
Borrower size	Small	Large	Small	Large	Small	Large
Bank*firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
SD(ExposureEnergy _{b,Aug14})	6.1	6.1	6.1	6.1	6.1	6.1

Impact of Banks' Exposure on Real Outcomes

- In this section, we analyze the impact that banks' exposure to energy sector have on real outcomes of firms.
- We cannot merge firms with their banks. However, as bank lending is local, we calculate the average exposure to energy of the banks lending in a municipality m — $AvgExposureEnergy_{m, Aug14}$.
- Therefore, we test:

$$y_{f,y} = \alpha + \beta AvgExposureEnergy_{m, Aug14} * Post_y + \gamma_f + \gamma_y + \varepsilon_{f,y}$$

where:

$y_{f,y}$	-	Firm f real outcome (e.g. assets) in year y
$AvgExposureEnergy_{m, Aug14}$	-	Exposure to Energy Sector of Municipality m in August 2014
$Post_y$	-	Indicator observation post 2014
γ_f, γ_y	-	Firm and Year fixed effects

Impact of Banks' Exposure on Real Outcomes

	Bank Lending _{f,y} (1)	Working Capital _{f,y} (2)	Investment _{f,y} (3)	Liabilities _{f,y} (4)	Assets _{f,y} (5)	Revenue _{f,y} (6)
AvgExposureEnergy _{m,Aug14} *Post _y	-1.00** (0.48)	-0.88* (0.50)	-5.90*** (1.56)	-1.37** (0.60)	-1.24*** (0.47)	-0.55 (0.96)
Observations	122,157	118,581	12,022	1,115	1,239	1,236
R-squared	0.85	0.84	0.86	0.99	1.00	0.98
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year FE	No	No	No	No	No	No
SD(AvgExposureEnergy _{m,Aug14})	2.1	2.1	2.1	2.1	2.1	2.1

State-level Activity

- In this section, we analyze the impact that banks' exposure to energy sector have on aggregate output of states.
- Since bank lending is local, we calculate the average exposure to energy of the banks lending in a state s — $AvgExposureEnergy_{s,Aug14}$.
- Therefore, we test:

$$y_{s,q} = \alpha + \beta AvgExposureEnergy_{s,Aug14} * Post_q + \gamma_s + \gamma_q + \varepsilon_{f,y}$$

where:

$y_{s,q}$	-	State s sectoral GDP (e.g. primary) in year y
$AvgExposureEnergy_{s,Aug14}$	-	Exposure to energy sector of state s in August 2014
$Post_y$	-	Indicator observation post 2014
γ_s, γ_q	-	State and Quarter fixed effects

State-level Activity

Impact of Banks' Exposure on States' GDP

	(1)	GDP _{s,q} (2)	GDP Primary _{s,q} (3)	(4)	GDP Secondary _{s,q} (5)	(6)	GDP Tertiary _{s,q} (7)	(8)
AvgExposureEnergy _{s, Aug14} * Post _q	-0.67* (0.42)	-1.14*** (0.36)	-3.67* (2.19)	-2.94 (2.32)	-1.92** (0.85)	-2.44*** (0.85)	-0.17 (0.28)	-0.30 (0.27)
Observations	512	480	512	480	512	480	512	480
R-squared	0.69	0.77	0.31	0.32	0.51	0.53	0.82	0.86
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
States	All	Non-Energy	All	Non-Energy	All	Non-Energy	All	Non-Energy
SD(AvgExposureEnergy _{s, Aug14})	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6

Conclusions

- We analyzed the evolution of bank credit in the event of large negative shock to a sector.
 - We studied the impact of energy price declines on the banking sector in Mexico, a large energy producer.
 - As energy prices declined, the CDS spreads of energy producers ramped up, as financial needs outpaced their revenues.
- Banks more exposed to the energy sector prior to the shock:
 - Increased their exposure to the sector ex post—by offering loans of higher volume and reducing interest rates on those loans.
 - Banks with larger capital ratios provide more credit and loosen standards, potentially a result of weaker bargaining power.
 - These banks contract their credit to firms in non-energy sectors, with important negative real effects.

Appendix

Motivation

“Investors are confronted with the alarming possibility that a collapse in oil prices could trigger a wave of defaults by borrowers. [...] U.S. bank shares had their worst single-session performance since 2009 and the industry was a big contributor to a global stock market rout.”

Financial Times - March of 2020

Preview of the Results (1/2)

Impact of drop in Energy Prices on Banking in Mexico

- In this paper, we analyze the impact of the drop in global energy prices on banking in Mexico.
 - Fuel prices in Mexico were regulated in the period of analysis. This limits impact on demand for credit in other sectors.
- We find that banks with greater ex-ante exposure to the energy sector, become even more exposed ex-post.
 - Mainly through loans to larger borrowers with weaker (repayment) performance. Loans at *lower* interest rates.
 - A one standard deviation increase in ex-ante exposure is associated with:
 - An increase of 1.2 percentage points (roughly 10 percent) in ex post exposure to the sector. An 18 percent increase in the size of loans to firms in the energy sector. A 0.8 percentage point (roughly 6 percent) decrease in the interest rate.
- After the collapse in energy prices, energy borrowers:
 - Increased borrowing from more exposed bank, not from bank with which they had the largest relation.
 - Prioritize delinquency on loans from banks with higher exposure to energy.
- This strategy was associated with a substantial increase in financial stress of more exposed banks.
 - An increase of one standard deviation in bank exposure to the energy sector results in:
 - 10.1 percent higher credit default swap (CDS) spreads; 3.1 percent lower stock prices; 0.16 percentage points (roughly 8 percent) higher delinquency rates.
- Results consistent with weaker banks loosening credit standards on weaker borrowers to maintain regulatory ratios.

Preview of the Results (2/2)

Impact of drop in Energy Prices on Banking in Mexico – Non-Energy Sector and Aggregate Outcomes

- Injection of credit to the energy sector did not result in an increase in total lending. Credit was reallocated across sectors.
 - Credit contraction among non-energy borrowers was stronger among smaller firms and especially for loans destined to investment projects.
 - An increase of one standard deviation in ex-ante bank exposure leads to a 16.5 percent reduction in credit to smaller firms.
- We find negative real effects on non-energy firms due to the contraction of bank credit. Especially in locations (i.e. municipalities) where banks had higher exposure to energy sector.
 - An increase of one standard deviation in a municipality's exposure to the energy sector (via its bank branches) leads to a reduction in total liabilities of 2.9 percent and a reduction in assets of 2.6 percent.
- On aggregate. Non-energy-producing states with banks more exposed to the energy sector had a larger decline in GDP, especially in the capital-intensive secondary sector.
 - An increase of one standard deviation in the ex-ante exposure reduces the total GDP by 1.8 percent.
- Overall, these findings suggest a credit channel, whereby banks amplified a sector-specific shock by contracting their lending to non-energy borrowers, who struggled to switch lenders and smooth the shock.

Outline for the rest of the talk

- Contribution
- Data
- Stylized Facts
- Empirical Strategy
- Results
 - Bank-level
 - Loan-level
 - Real outcomes
- Conclusion

Summary Statistics

	# Obs	Average	p10	Median	p90	Std dev
<i>Panel A. Bank-month-level variables</i>						
ExposureEnergy _{b,m} (%)	897	9.9	0	5.9	25.4	12.1
Tier 1 Capital Ratio _{b,m} (%)	897	15.4	12.5	15.3	18.5	2.2
Total Lending _{b,m} (logs)	897	21.8	19.6	21.3	24.2	1.8
Delinquency _{b,m} (%)	897	2.4	0.4	2	4.7	2
CDS _{b,m} (basis points)	367	410	321	425	492	71
Stock Price _{b,m} (index)	470	3.4	0.7	3.9	5.2	1.6
ExposureEnergy _{b,Aug14} (%)	897	8.0	0	5.0	19.6	6.5
<i>Panel B. Loan-level variables of firms in energy-related sectors</i>						
Total Lending _{f,b,m} ('000)	34,741	89,790	96	1,560	126,930	307,605
Loans to working capital _{f,b,m} ('000)	34,741	78,848	25	1,218	96,521	285,116
Loans to investment _{b,m} ('000)	34,741	2,980	0	0	131	13,470
Interest Rate _{f,b,m} (%)	31,257	11.4	4.4	11.8	18.0	10.7
Maturity _{f,b,m} (months)	31,257	25	2.4	20.4	52.0	25.7
Collateral _{f,b,m} (%)	31,257	14.6	0.0	0.0	54.7	29.1

Data

Definitions

- We classify firms as belonging to an energy-related sector according to their [5-digit](#) North American Industry Classification System (NAICS) codes.
- We define bank exposure to the energy sector as:
 - The ratio of loans to energy sector over tier-1 capital in August 2014 (Basel Committee on Banking Supervision, 2014).
 - As robustness check we use [alternative](#) measures of exposure.

Energy Sectors

Energy Sectors

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
32419	All other petroleum and coal products manufacturing
32511	Petrochemical manufacturing
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

Loans to Firms in the Energy Sector

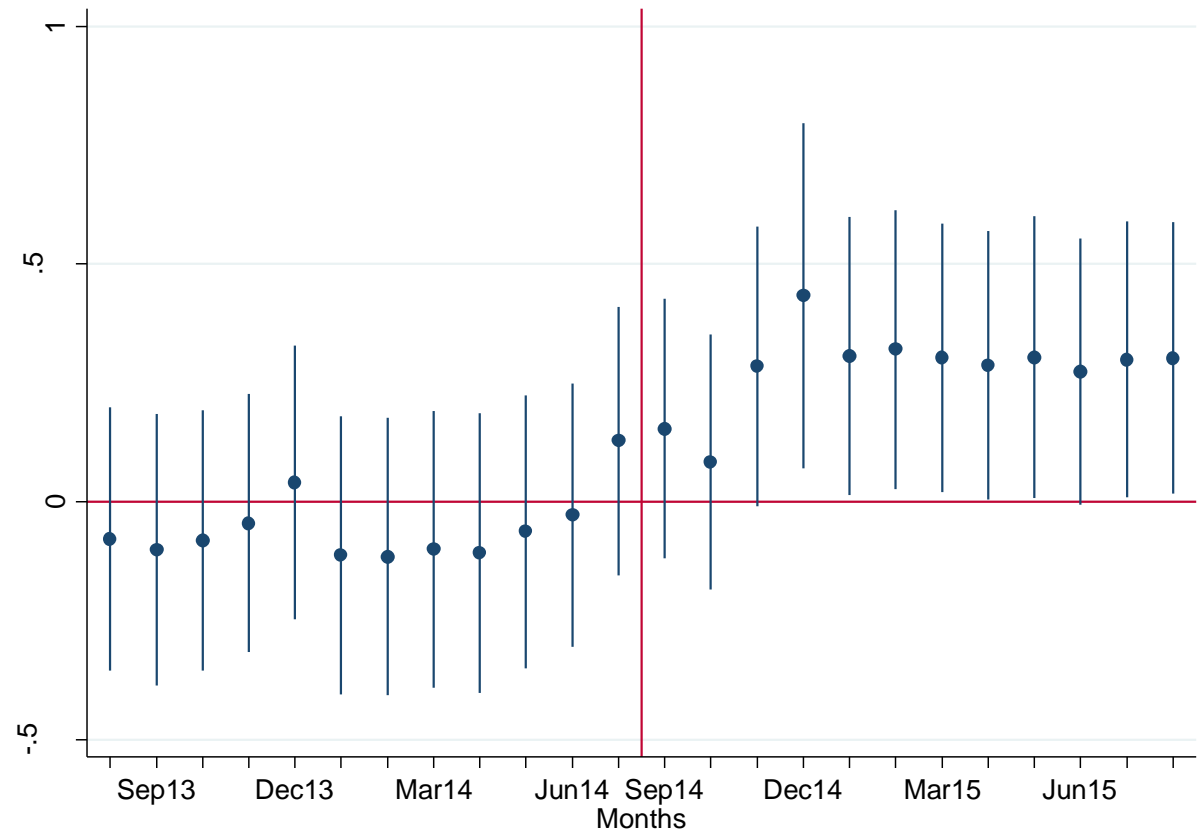
Dynamic behavior – Testing for Pre-trends

$$y_{f,b,m} = \alpha + \sum \beta_m \text{Month}_m * \text{ExposureEnergy}_{b, \text{Aug14}} + \gamma_{b,f} + \gamma_m + \varepsilon_{f,b,m}$$

where:

- $y_{f,b,m}$ - Outcome of Firm f with Bank b variable in month m
- Month_m - Indicator of month m
- $\text{ExposureEnergy}_{b, \text{Aug14}}$ - Bank b Exposure to Energy Sector in August 2014
- $\gamma_{b,f}, \gamma_m$ - Borrower f *Bank b fixed effects and month fixed effects

Evolution of Bank Exposure to the Energy Sector



Loan-level Results – Energy Sector

Bank Lending given Exposure to Energy Sector and Quality of Borrowers

- Do more exposed banks extend bank credit to borrowers with weaker performance?
 - They may do so to prevent loans from being declared delinquent and maintain regulatory ratios.
- For each loan we use a measure— $Rating_{f,b,Aug14}$ —of the performance of the loans given to firm f by bank b in August 2014.
- The measure $Rating_{f,b,Aug14}$ is a categorical variable from 1 (Best loan performance) to 10 (Worse performance).

Loan-level Results – Energy

Bank Lending given Exposure to Energy Sector and Quality of Borrowers (Larger Borrowers)

	Loans _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
ExposureEnergy _{b,Aug14} *Post _m	0.011 (0.010)		0.016 (0.014)		-0.012 (0.018)	
Rating _{f,b,Aug14} *Post _m	-0.024 (0.036)	-0.041 (0.032)	-0.016 (0.039)	-0.058*** (0.017)	0.072 (0.054)	-0.045 (0.044)
ExposureEnergy _{b,Aug14} *Rating _{f,b,Aug14} *Post _m	0.014* (0.007)	0.015* (0.008)	0.013* (0.007)	0.007** (0.003)	0.011** (0.005)	0.020*** (0.004)
Observations	11,638	11,528	10,750	10,626	1,733	1,583
R-squared	0.901	0.906	0.905	0.916	0.873	0.884
Firm-Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Month	No	No	No	No	No	No
Average(ExposureEnergy _{b,Aug14})	11.5	11.5	11.5	11.5	11.5	11.5
Average(Rating _{f,b,Aug14})	1.7	1.7	1.7	1.7	1.7	1.7
SD(ExposureEnergy _{b,Aug14})	6.2	6.2	6.2	6.2	6.2	6.2
SD(Rating _{f,b,Aug14})	2.1	2.1	2.1	2.1	2.1	2.1

Loan-level Results – Energy

Lending to Energy Given Exposure to Energy and Bank Capitalization – Alternative Measure of Capital Ratio

	Total Lending _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
$(\text{LoansEnergy}/\text{Loans})_{b,\text{Aug14}} * \text{Post}_m$	0.04*** (0.011)	0.06*** (0.01)	0.06* (0.03)	0.16** (0.06)	-0.02 (0.04)	-0.07** (0.03)
$(\text{RWA}/\text{Tier1Capital})_{b,\text{Aug14}} * \text{Post}_m$	-0.03 (0.030)	0.02 (0.04)	-0.07 (0.05)	0.01 (0.07)	0.20 (0.19)	0.36* (0.17)
Observations	30,393	3,353	28,537	2,932	3,029	890
R-squared	0.880	0.844	0.900	0.893	0.886	0.683
Firm-Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan value pre-shock	All	Large	All	Large	All	Large
$\text{SD}(\text{ExposureEnergy}_{b,\text{Aug14}})$	6.2	6.2	6.2	6.2	6.2	6.2

Loan-level Results – Energy

Lending Volumes Given Concentration of Energy Portfolio – Alternative Measure of Bank Exposure to Energy

	Total Lending _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
$(\text{LoansEnergy}/\text{Loans})_{b,\text{Aug14}} * \text{Post}_m$	0.058 (0.038)	-0.021 (0.025)	0.124*** (0.038)	-0.010 (0.052)	-0.265 (0.151)	-0.577*** (0.166)
$\text{HerfindahlEnergy}_{b,\text{Aug14}} * \text{Post}_m$	0.186 (0.283)	-1.042** (0.390)	0.409 (0.409)	-1.377 (0.972)	0.294 (1.951)	-2.918 (1.933)
$(\text{LoansEnergy}/\text{Loans})_{,\text{Aug14}} * \text{HerfindahlEnergy}_{b,\text{Aug14}} * \text{Post}_m$	-0.038 (0.066)	0.153** (0.052)	-0.117 (0.100)	0.315* (0.149)	0.318 (0.280)	0.785** (0.286)
Observations	30,393	3,353	28,537	2,932	3,029	890
R-squared	0.880	0.845	0.900	0.895	0.887	0.684
Firm-Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan Size	All	Large	All	Large	All	Large

Loans to Firms in the Energy Sector

What we Test/Find

- Analysis at loan-level.
 - Control for demand and supply shocks.
 - Analyze heterogeneities across type of lending and borrowers.
- We show that:
 - Banks with higher exposure to energy, provide more credit and loosen credit standards on the energy sector.
 - Especially to borrowers with weaker credit quality.
 - Banks with higher capital ratios provide more credit and loosen credit terms relatively more.
 - Energy firms increase borrowing from more exposed banks. Not from banks with which they have the longest relation.
 - Energy firms prioritize delinquency on loans from banks with higher exposure to energy.

Loans to Firms in the Energy Sector

Firms borrow more from their more exposed bank

- We have shown, that energy firms increase borrowing from more exposed banks.
- Does the result hold when controlling for the relative exposure of each borrower to a bank?
 - Do energy firms borrow more from the more exposed bank, or from the bank with which they have the longest relation?
- We include a variable $BorrowerExposureToBank_{f,b,Aug14}$ which is the share of credit firm f received from bank b prior to the shock.

Loans to Firms in the Energy Sector

Lending Given Borrowers' Exposure to the Bank

	Total Lending _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
ExposureEnergy _{b,Aug14} *Post _m	0.006*	0.025*	0.016**	0.031*	0.002	0.015
	(0.003)	(0.013)	(0.005)	(0.016)	(0.019)	(0.034)
BorrowerExposureToBank _{f,b,Aug14} *Post _m	-0.091	-0.420	-0.025	-0.257	-0.601	-0.528
	(0.108)	(0.412)	(0.113)	(0.221)	(0.462)	(1.002)
Observations	26,554	3,733	25,033	3,293	2,615	861
R-squared	0.882	0.887	0.897	0.908	0.907	0.697
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Month	No	No	No	No	No	No
Firm Size	All	Large	All	Large	All	Large
SD(ExposureEnergy _{b,Aug14})	6.2	6.2	6.2	6.2	6.2	6.2

Loans to Firms in the Energy Sector

What we Test/Find

- Analysis at loan-level.
 - Control for demand and supply shocks.
 - Analyze heterogeneities across type of lending and borrowers.
- We show that:
 - Banks with higher exposure to energy, provide more credit and loosen credit standards on the energy sector.
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 - Banks with higher capital ratios provide more credit and loosen credit terms relatively more.
 - Energy firms increase borrowing from more exposed bank. Not from bank with which they have the longest relation.
 - Energy firms prioritize delinquency on loans from banks with higher exposure to energy.

Loan-level Results – Energy Sector

Loan Performance

- Do borrowers prioritize the type of loans they are late on?
 - Loan size
 - Type of borrower
- We regress loan performance of firm f with bank b in month m , using as main regressors of interest
 - $\text{ExposureEnergy}_{b,\text{Aug14}}$
 - $\text{BorrowerExposureToBank}_{f,b,\text{Aug14}}$

Exposure to Energy Sector and Cost of Funds

	Total _{b,m}	Deposits _{b,m}	ST Deposits _{b,m}	LT Deposits _{b,m}	Foreign _{b,m}
	(1)	(2)	(3)	(4)	(5)
ExposureEnergy _{b,Aug14} *Post _m	-0.001 (0.006)	-0.004 (0.005)	-0.008 (0.006)	-0.002 (0.005)	0.018 (0.014)
Observations	594	594	594	594	594
R-squared	0.976	0.977	0.951	0.935	0.509
Firm-Bank FE	Yes	Yes	Yes	Yes	Yes
Firm-Month	Yes	Yes	Yes	Yes	Yes
SD(ExposureEnergy _{b,Aug14})	6.5	6.5	6.5	6.5	6.5

Loan-level Results – Energy Sector

Lending to Energy Sector Given Exposure to Energy Sector and Bank Capitalization

- Bank exposure can be decomposed in two parts. We decompose previous regression into these two components

$$\frac{\text{LoansEnergy}_{b,\text{Aug14}}}{\text{Tier1 Capital}_{b,\text{Aug14}}} = \frac{\text{LoansEnergy}_{b,\text{Aug14}}}{\text{TotalLoans}_{b,\text{Aug14}}} * \frac{\text{TotalLoans}_{b,\text{Aug14}}}{\text{Tier1 Capital}_{b,\text{Aug14}}}$$

Loan-level Results – Energy

Lending to Energy Sector Given Exposure to Energy Sector and Bank Capitalization

	Total Lending _{f,b,m}		Working Capital _{f,b,m}		Investment _{f,b,m}	
	(1)	(2)	(3)	(4)	(5)	(6)
$(\text{LoansEnergy}/\text{TotalLoans})_{b,\text{Aug14}} * \text{Post}_m$	0.04*** (0.011)	0.06*** (0.01)	0.06* (0.03)	0.16** (0.06)	-0.02 (0.04)	0.07** (0.03)
$(\text{Loans}/\text{Tier1Capital})_{b,\text{Aug14}} * \text{Post}_m$	-0.03 (0.030)	0.02 (0.04)	-0.07 (0.05)	0.01 (0.07)	0.20 (0.19)	0.36* (0.17)
Observations	30,393	3,353	28,537	2,932	3,029	890
R-squared	0.880	0.844	0.900	0.893	0.886	0.683
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan value pre-shock	Small	Large	Small	Large	Small	Large
$\text{SD}(\text{ExposureEnergy}_{b,\text{Aug14}})$	6.2	6.2	6.2	6.2	6.2	6.2

Four Alternative Measures of Bank Exposure to the Energy [Sector](#)

- August 2014 ratio of energy sector loans to total loans
- August 2014 ratio of energy sector loans to total assets
- August 2014 ratio of energy sector loans to total bank equity
- December 2012 ratio of energy sector loans to tier 1 capital

Alternative Measures of Bank Exposure to the Energy Sector

<i>Energy sector</i>	Total Lending _{f,b,m}			
	(1)	(2)	(3)	(4)
ExposureEnergy _{b,Aug14} *Post _m	0.028* (0.015)	0.136 (0.104)	0.098*** (0.029)	0.045* (0.026)
Observations	6,994	6,994	6,994	6,994
R-squared	0.947	0.947	0.948	0.947
Bank-firm FE	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes
SD(ExposureEnergy _{b,Aug14})	6.2	6.2	6.2	6.2
<i>Non-Energy sector</i>	Total Lending _{f,b,m}			
	(1)	(2)	(3)	(4)
ExposureEnergy _{b,Aug14} *Post _m	-0.012*** (0.002)	-0.131*** (0.023)	-0.033*** (0.006)	-0.006* (0.003)
Observations	1,262,640	1,262,640	1,262,640	1,262,640
R-squared	0.795	0.795	0.795	0.794
Bank-firm FE	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes
SD(ExposureEnergy _{b,Aug14})	6.1	6.1	6.1	6.1

Oil Prices and Leverage of Energy Firms

