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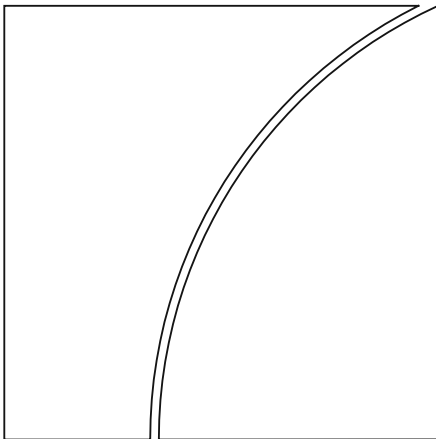
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The impact of financial crises on industrial growth: lessons from the last 40 years

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JEL classification: E44, G01, O10, O16

Keywords: Financial crises, Banking crises, Growth, External finance dependence, Credit frictions

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The impact of financial crises on industrial growth: lessons from the last 40 years

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Abstract

This work shows the impact of financial crises across industries and the total manufacturing sector. I find both a direct impact of financial crises on all manufacturing growth and an additional effect through an external finance dependence channel. Externally dependent industries experience lower growth during banking and currency crises, especially in emerging markets and developing economies. Banking, currency and sovereign debt crises cause an average reduction in total manufacturing growth of 2.7%, 6% and 1%, respectively, with the direct effect being the most significant component. Finally, I show that macroprudential policies adopted after the Great Financial Crisis attenuated the fall in growth caused by banking crises.

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1 Introduction

Financial crises are periods in which economic activity falls substantially (Schularick and Taylor 2012). The frequency of crises has increased substantially since the end of the Bretton-Woods era (Hoggarth et al. 2002, Bordo and Meissner 2016). This has led many policy makers, particularly in emerging markets and developing economies, to question the advantages of financial liberalization and globalization (Bordo and Meissner 2016, Rodrik 2021). Banking crises are especially important, because these often precede other financial crises such as sovereign debt default, currency crises and sudden stops (Kaminsky and Reinhart 1999, Bordo and Meissner 2016). It is also often the case that currency crises and sudden stops do not have such deep effects unless these coincide with a banking crisis (Joyce and Nabar 2009). At the same time, macroeconomic models have difficulties in accounting for financial frictions and the deepness of crises (Linde et al. 2016, Galati and Moessner 2018) such as the Great Financial Crisis (hence on, GFC). Therefore, further research is needed on financial crisis channels and the policies required to shield the economies from their effects (Akinci and Olmstead-Rumsey 2018, Madeira 2024).

This work studies the impact of financial crises on the real growth of a panel of 23 manufacturing industries across 102 countries for the period between 1980 and 2019. One advantage of using detailed industry data are that each industry is small relative to the national economy, addressing the issues of reverse-causality between growth and national shocks such as banking crises (Madeira 2024).¹ A second advantage of the industry level data are that industries' heterogeneous characteristics and their differential capital needs can inform us about the financial channel in which banking

¹Note that assuming small industries are affected by national shocks, rather than the reverse, is a standard assumption in the macroeconomics literature. For instance, Rajan and Zingales 1998, Braun and Larrain 2005, Kroszner et al. 2007, Dell'Ariccia et al. 2008 and Cowan and Raddatz 2013 assume that national financial development, recessions, banking crises and sudden stops are exogenous relative to the individual manufacturing industries. This assumption is also credible relative to other usual identification assumptions used in the macroeconomics literature. For instance, it is standard to assume that small open economies are affected by international shocks such as oil prices, which are taken to be exogenous due to the small size of each country. There are around 196 countries in the world, with 189 nations being members of the World Bank and IMF. Therefore, the average nation represents just 0.51% of the world's GDP. The median manufacturing industry in this dataset represents just 0.32% of the national GDP (as shown in Table 1). Therefore, these are industries that are too small to influence by themselves large national developments such as a financial crisis.

crises affect non-financial firms' activity (Dell'Ariccia et al. 2008, Igan et al. 2022). However, one important limitation of the study is that manufacturing activity represents just 12.7% of the national GDP for the median country. Therefore, this study presents a reliable estimate of financial crisis impact on a set of industries, but it does not analyze its total effect on economic activity.

This study uses mainly an industry-country dataset from the United Nations Industrial Development Organization (UNIDO), which compiles national accounts information for more than 100 countries using the same set of 23 manufacturing industries. I then combine this data with a list of the banking, currency and sovereign debt crises for the period 1980 to 2019, compiled by Laeven and Valencia 2020 and Nguyen et al. 2022. I estimate banking crisis effects on the industries' growth using simple linear methods, with country-industry and time fixed effects, with further controls such as financial crisis dummies and GDP per capita (as a measure of the countries' development levels). Other consistent estimates of the financial crisis effects on growth are obtained using quantile regression methods for panel data (Machado and Santos-Silva 2019). Furthermore, I analyze the impact of banking crises across different country groups, such as advanced economies (AEs) and emerging markets and developing economies (EMDEs). Finally, I show the results are robust to including country-industry, country-year and industry-year fixed effects.

My methodology estimates both a direct effect of financial crises on all industries and an additional effect through the external finance dependence channel which is heterogeneous across industries. This is a relevant improvement upon previous studies, such as Dell'Ariccia et al. 2008, which only studied the external finance dependence channel. My results show that the direct effect of financial crises has a larger impact on manufacturing growth. Banking, currency and sovereign debt crises cause a reduction in total manufacturing growth of 2.7%, 6% and 1% for all countries, 2.5%, 4.1% and 3.4% for AEs and 2.1%, 6.1% and 0.3% for EMDEs. Currency crises impact EMDEs more strongly, while sovereign debt crises have stronger effects on AEs. Furthermore, I show that the estimated effects of banking crises on manufacturing growth are much larger than those found in previous studies, such as Dell'Ariccia et al. 2008 which had their sample ending in 2000 and therefore ignored the GFC period.

One interesting issue is the effect of financial regulations taken after the GFC. To obtain the effect of macroprudential policies, I add as controls the macroprudential policy tightening implemented in each year and the macroprudential policies accumulated since 2010 for each country.

I find that macroprudential policies had a positive impact on industrial growth during the banking crises for the period after 2010 across all country samples (all countries, AEs, EMDEs). However, macroprudential policies also reduced the growth of some industries with high external finance dependence, particularly in EMDEs. Furthermore, macroprudential policy easing during banking crises had a positive impact on growth of externally dependent industries for the samples of all countries and AEs. Considering just the external finance dependence channel, banking crises in the post-GFC period would have caused an additional loss of 2.2% in manufacturing growth. However, the direct effect of macroprudential policies during banking crises on all industries has a counterbalancing impact. Therefore, macroprudential policies during banking crises had an overall positive effect on manufacturing growth relative to a scenario in which no policies had been implemented. This beneficial effect of macroprudential policies during banking crises in the post-GFC period happens across all country groups (all countries, AEs, EMDEs). I find that macroprudential policies increased manufacturing growth during banking crises in 4.3%, 2.2% and 8.3% for the all countries, AEs and EMDEs. These results confirm the importance of accounting for both the direct effects and the external finance dependence channel of crises.

This study is mostly related to the work of Dell’Ariccia et al. 2008, which shows that, during the period between 1980 and 2000, the sectors more dependent on external finance suffer the most during banking crises. In a closely related paper, Kroszner et al. 2007 find that the relative growth in value added of financially dependent industries is faster in financially developed countries in pre-crisis periods but slower in crisis periods. My work extends the analysis in Dell’Ariccia et al. 2008 by adding the last twenty years, a more extensive list of countries (102 countries instead of 41 countries) and a more detailed analysis of the historical list of banking crises (as obtained from the works of Laeven and Valencia 2020 and Nguyen et al. 2022). This extension of the analysis in the previous studies is especially relevant, because the largest financial crisis in the last 40 years happened in 2008 and was outside the scope of past literature. Furthermore, it was only after the Great Financial Crisis of 2008 that macroeconomic research undertook a large effort to include the modeling of financial frictions (Linde et al. 2016). Moreover, there were several reforms to banking regulation, including the wider introduction of macroprudential policies (Akinci and Olmstead-Rumsey 2018, Galati and Moessner 2018). My study shows that emerging markets are more sensitive to banking crises, which is consistent with prior literature showing that these

countries are more procyclical (Frankel 2010).

Relative to the closest previous study of Dell’Ariccia et al. 2008, this work brings three important contributions: i) it analyzes three times as much data as a combination of more countries and twenty additional years (the additional data substantially increases the estimates of the effects of banking crises in AEs); ii) it estimates the full impact of financial crises, through the sum of its direct effect on manufacturing growth and the external finance dependence channel (it is shown that the direct effect, ignored in previous studies, can be two times as large or more than the external finance dependence channel); iii) I show that macroprudential policies implemented after 2010 had a big effect in attenuating the impact of banking crises.

Finally, this paper complements the literature that shows how external finance dependent industries are more strongly affected by financial development (Rajan and Zingales 1998, Raddatz 2006), recessions (Braun and Larrain 2005), banking crises (Dell’Ariccia et al. 2008), sudden-stops (Cowan and Raddatz 2013) and capital flows (Igan et al. 2020, Igan et al. 2022). The article also complements empirical studies showing that a trade-off between the benefits of financial development on growth (Levine 2005, Levchenko et al. 2009) and the cost of increased volatility or crises (Rancière et al. 2008, Dwyer et al. 2013, Laeven and Valencia 2020). Furthermore, Hoggarth et al. 2002 claim that, contrary to popular belief, output losses associated with banking crises are not more severe in developing countries than in developed countries. My work shows that the effect of financial crises on the externally dependent industries is much stronger in EMDEs than in AEs, which helps to explain their diverging growth experiences (Rancière et al. 2008, Dwyer et al. 2013).

This paper is organized as follows. Section 2 describes the data sources and the empirical approach. Section 3 shows the main estimates of the effect of banking crises on industrial growth and the differences across countries’ development levels. Section 4 shows the effects of other types of financial crises on industrial growth. Section 5 summarizes all the estimates in terms of the total impact on the national manufacturing sector. Section 6 estimates the effect of macroprudential policies implemented after the GFC on industrial growth during banking crises. Finally, Section 7 concludes with a summary of the findings and its policy implications.

2 Data and empirical approach

2.1 Data

This study uses the UNIDO's Industrial Statistics Database (Indstat2 - revision 3), which contains annual frequency data for the 2-digit ISIC (International Standard Industrial Classification of All Economic Activities) industries of each country for 23 manufacturing industries. Industrial growth is measured by the log increase in the Index of Real Industrial Production (IIP), $g_{i,c,t} = 100 \ln\left(\frac{IIP_{i,c,t}}{IIP_{i,c,t-1}}\right)$, which accounts for sector-specific prices. Real industrial growth is multiplied by 100 to be similar to the national growth rates in World Bank and IMF data, which are also reported in percentage points. The data are unbalanced, with some countries-industries reporting missing data in several years.

Table 1 summarizes the list of industries and countries available in the dataset. This study comprises 102 countries, including 35 AEs and 67 EMDEs. The median country produces just 12.7% of its GDP from the manufacturing sector. The data shows that even the largest industry of each country is relatively small. The largest industry of the median country produces just 2.8% of GDP. Less than 10% of the countries have an industry that represents more than 5.1% of GDP. No country has an industry that represents more than 18% of the GDP. Finally, Table 1 shows that the median industry produces just 0.3% of the GDP and has a correlation of just 42% with the national real GDP growth. Therefore, the assumptions required for the identification mechanism in this article are valid: i) all industries are small (the median industry represents just 0.3% of the GDP) and not the main cause of the financial crises;² ii) the industries are not similar to a "representative firm" agent and have a correlation with real GDP growth that is less than 42%.

Finally, note that the median and average external finance dependence across the 23 industries is 0.28 and 0.34, respectively. Furthermore, the interdecile range (i.e., the percentiles 10 to 90) of the

²The small value of each individual industry relative to the national economy is crucial to insure that financial crises and other aggregate events can be taken as exogenous. For this dataset, the assumption of the exogeneity of national outcomes is realistic. Assume that the median industry, which represents just 0.3% of national GDP, has a huge crisis and loses one third of its output. Even this large industrial shock represents just 0.1% of GDP, which is unlikely to cause a national financial crisis due to such a small value at the national level. Therefore, it is reasonable to assume that financial crises impact the manufacturing industries, but not the other way around.

external finance dependence of the industries goes from 0.03 to 0.95. Therefore, most industries have some degree of dependence of external funds, although two industries could be said to be externally finance independent (that is, with $EFD \leq 0$).

Table 1: Industries and countries available in the joint industrial and macroprudential policy dataset

Industries (ISIC 2-digit revision 3) with External Finance Dependence (EFD_i) in parentheses: 15 Food and beverages (0.112), 16 Tobacco products (-0.451), 17 Textiles (0.277), 18 Wearing apparel, fur (0.029), 19 Leather, leather products and footwear (-0.113), 20 Wood products (excl. furniture) (0.283), 21 Paper and paper products (0.161), 22 Printing and publishing (0.203), 23 Coke, refined petroleum products, nuclear fuel (0.170), 24 Chemicals and chemical products (0.458), 25 Rubber and plastics products (0.634), 26 Non-metallic mineral products (0.193), 27 Basic metals (0.040), 28 Fabricated metal products (0.213), 29 Machinery and equipment n.e.c. (0.633), 30 Office, accounting and computing machinery (0.948), 31 Electrical machinery and apparatus (0.821), 32 Radio, television and communication equipment (0.975), 33 Scientific instruments, medical, precision and optical instruments (0.961), 34 Motor vehicles, trailers, semi-trailers (0.360), 35 Other transport equipment (0.328), 36 Furniture; manufacturing n.e.c. (0.235), 37 Other manufactured products and recycling (0.339).

Countries covered (102). Advanced Economies (35): Australia, Austria, Belgium, Canada, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, South Korea, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan, UK, USA.

Emerging markets and developing economies (67): Algeria, Albania, Argentina, Armenia, Bangladesh, Barbados, Belarus, Bosnia, Brazil, Bulgaria, Burundi, Cameroon, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Egypt, Fiji, Honduras, Hungary, India, Indonesia, Iraq, Jamaica, Jordan, Kuwait, Kyrgyzstan, Lao, Lebanon, Lesotho, Macao, Malaysia, North Macedonia, Madagascar, Mauritius, Mexico, Moldova, Mongolia, Morocco, Myanmar, Nepal, Oman, Panama, Pakistan, Paraguay, Peru, Poland, Philippines, Romania, Russian Federation, Rwanda, Senegal, Serbia, Sri Lanka, South Africa, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, Ukraine, Uzbekistan, Vietnam, Zambia.

Distribution of the share of manufacturing value-added in GDP across countries in 2019 (in %):

$Share_{i,c,t}$	Total manufacturing over GDP							Largest national industry over GDP						
	min	p10	p25	p50	p75	p90	max	min	p10	p25	p50	p75	p90	max
All countries	0.6	6.3	9.5	12.7	17.6	21.4	47.6	0.2	1.3	2.0	2.8	3.9	5.1	18.0
AEs	1.2	5.8	9.6	12.4	18.7	22.6	31.5	0.4	1.2	1.8	2.1	3.2	5.1	14.6
EMDEs	0.6	6.3	8.9	12.6	17.2	19.9	47.6	0.2	1.4	2.4	3.0	4.2	5.1	18.0

Individual industries value-added as a share of GDP in 2019 and correlation of the individual industries' real growth with real GDP growth during 1980-2019 (in %):

$Share_{i,c,t}$	Individual manufactures over GDP							Correlation with GDP growth						
	p10	p25	p50	p75	p90	p95	p99	min	p10	p25	p50	p75	p90	p95
All countries	0.03	0.1	0.3	0.7	1.5	2.4	4.6	-95.7	-11.4	15.4	41.9	63.8	77.6	82.9
AEs	0.04	0.1	0.4	0.8	1.5	2.1	3.9	-65.2	10.1	32.4	49.8	67.3	78.7	83.3
EMDEs	0.03	0.1	0.3	0.7	1.5	2.5	4.6	-95.7	-22.5	4.9	32.9	60.5	76.1	82.6

2.2 Empirical approach

The empirical approach exploits the differential behavior of each industry in the same sample of countries across time periods with banking crises or not. I estimate a panel data model of the real growth rate, $g_{i,c,t}$, for the industry i in country c at the time t , with an additive-linear form:

$$1) g_{i,c,t} = \gamma EFD_i \times BankCrisis_{c,t} + \alpha Share_{i,c,t-1} + \delta x_{c,t} + f_{i,c} + f_t + \varepsilon_{i,c,t},$$

with $BankCrisis_{c,t}$ being a dummy denoting a banking crisis in country c at time t , EFD_i the external financial dependence of industry i , $Share_{i,c,t-1}$ is the fraction of value-added of industry i in the total manufacturing of the country in the previous year,³ $f_{i,c}$ is industry-country fixed effects, f_t time fixed effects, $x_{c,t}$ is a vector of additional time-varying controls and $\varepsilon_{i,c,t}$ is an idiosyncratic unobservable term. The estimation will be performed using the Correia 2017 estimator for models with a large number of fixed effects,⁴ using industry-country clusters and time dummies. The vector of time-varying controls $x_{c,t}$ includes variables such as $BankCrisis_{c,t}$ and the log of the income per capita ($\ln(GDP_{c,t}^{PPP,pc})$).⁵

Furthermore, I consider models with interactions such as time-changing effects over certain periods or financial policies:

³This variable is used in previous studies to account for larger and more developed industries growing gradually less over time (Braun and Larrain 2005, Kroszner et al. 2007, Cowan and Raddatz 2013).

⁴The standard Stata commands `xtreg` or `reg` with industry-country and time fixed effects give the same coefficient estimates and almost exactly the same standard errors as the `reghdfe` Correia command. The `reg` command sometimes gives small differences in the standard errors, even if the coefficients are the same.

⁵Note that in an online appendix I show that the results remain similar if one adds controls such as the inflation rate ($inflation_{c,t}$) and the monetary policy rate ($MPR_{c,t}$), with values for the current year (t) and the previous one ($t - 1$). The inclusion of inflation and monetary policy do not change much the estimated models, except in the case of currency crises. Since currency crises often coincide with a surge in inflation, then the direct effect of the currency crises in the regression becomes smaller and part of it is captured as an inflation effect. The overall results, however, remain quite similar and the coefficients do not change much after inflation and monetary policy are controlled for.

Results also remain similar after controlling for the real GDP growth ($g_{c,t}^{GDP}$) and its lag ($g_{c,t-1}^{GDP}$). But in this case the interpretation for the isolated coefficient dummy $BankCrisis_{c,t}$ changes. The reason is that $BankCrisis_{c,t}$ also affects $g_{c,t}^{GDP}$ and $g_{c,t-1}^{GDP}$. Therefore, adding the GDP growth rate as controls implies that the coefficient is estimating the effect of banking crises on manufacturing growth, after its effect on economic output is already accounted for. For this reason, the coefficient of $BankCrisis_{c,t}$ on manufacturing growth tends to be small and insignificant. However, the coefficients for $EFD_i \times BankCrisis_{c,t}$ remain similar after accounting for real GDP growth and its lag.

$$2) g_{i,c,t} = \gamma EFD_i \times BankCrisis_{c,t} \times S_{c,t} + \alpha Share_{i,c,t-1} + \delta x_{c,t} + f_{i,c} + f_t + \varepsilon_{i,c,t}.$$

Since the industries are heterogeneous in terms of external finance dependence, then the effect of financial crises is heterogeneous across industries and therefore the coefficient for the interaction $\gamma EFD_i \times BankCrisis_{c,t}$ is identified. Therefore, I consider additional robustness checks that include industry-country and country-year dummies (equation 3) and industry-country, industry-time and country-year fixed effects (equation 4):

$$3) g_{i,c,t} = \gamma EFD_i \times BankCrisis_{c,t} \times S_{c,t} + \alpha Share_{i,c,t-1} + f_{i,c} + f_{c,t} + \varepsilon_{i,c,t},$$

$$4) g_{i,c,t} = \gamma EFD_i \times BankCrisis_{c,t} \times S_{c,t} + \alpha Share_{i,c,t-1} + f_{i,c} + f_{i,t} + f_{c,t} + \varepsilon_{i,c,t}.$$

One interesting issue that this paper studies is the effect of financial regulations taken after the GFC, which is here specified as the time period between 2007 and 2009. Therefore, I use as an additional control the macroprudential policy index from the iMaPP (integrated Macroprudential Policy) database published by the IMF (Alam et al. 2019). This database aggregates information on the countries' prudential policies from the IMF, BIS, FSB and national authorities. The iMaPP dataset has a set of 17 macroprudential categorical indicators (+1,0-1, for tightening, no change and easing, respectively). The 17 prudential policies include: Loan-to-value (LTV), Debt Service to Income (DSTI), Limits on Credit Growth (LCG), Loan Loss Provisions (LLP), Loan restrictions (LoanR), Limits and penalties to the loan-to-deposit (LTD), Limits on foreign currency lending (LFC), Reserve Requirements (RR), Liquidity, Limits on foreign exchange exposure (LFX), Leverage limits or unweighted Leverage Ratio (LVR), Countercyclical buffers (CCB), Conservation buffer, Capital requirements, Tax measures, Systemically Important Financial Institutions (SIFI) risk mitigation measures, Other measures (such as stress testing, restrictions on profit distribution and limits on exposures between financial institutions). The iMaPP data reports a Total Prudential Policy index ($TPI_{c,t}$), which is the sum of the 17 macroprudential policies for a given period.

As shown in previous research (Akinci and Olmstead-Rumsey 2018, Alam et al. 2019), macroprudential policies started being increasingly used by most countries after the GFC. Therefore, I will consider the effect of macroprudential policies implemented after the GFC, by including as additional controls the variables the macroprudential policy implemented in the current year, $TPI_{c,t} \times 1(t \geq 2010)$, and the cumulative macroprudential policy stance with all measures implemented since 2010,

$CTPI_{c,t-1}^{2010} = \sum_{t^*=t_0}^{t-1} TPI_{c,t^*} \times 1(t^* \geq 2010)$, with t_0 denoting the beginning of the iMaPP dataset in 1990.

Table 2 summarizes all the variables used in this article and their sources. All the data used in this article are publicly available. It is worth noting that the dummies for banking, currency, sovereign debt and any financial crisis in this article come from Laeven and Valencia 2020 for the period between 1980 to 2017, but these are updated until 2019 with data from Nguyen et al. 2022. Furthermore, all codes required to replicate the analysis can be made available in a Mendeley Data link.

Table 2: Main industry and country variables used in the article and their sources

Variable	Description	Source
$g_{i,c,t}$	Growth rate of the real production index of the manufacturing industry i in country c in year t	UNIDO
$ShareManVA_{i,c,t}$	Value-added of manufacture i as a fraction of the total manufacturing value-added of country c in year t	UNIDO
$GDP_{c,t}^{PPP,pc}$	GDP per capita of country c in year t (2017 USD in PPP)	World Bank
$BankCrisis_{c,t}$	Dummy with value 1 if country c in year t is facing a banking crisis, 0 otherwise (Laeven and Valencia 2020, Nguyen et al 2022)	Laeven & Valencia
$CurrencyCrisis_{c,t}$	Dummy with value 1 if country c in year t is facing a currency crisis, 0 otherwise (Laeven and Valencia 2020, Nguyen et al 2022)	Laeven & Valencia
$DebtCrisis_{c,t}$	Dummy with value 1 if country c in year t is facing a sovereign debt crisis, 0 otherwise (Laeven and Valencia 2020, Nguyen et al 2022)	Laeven & Valencia
$AnyCrisis_{c,t}$	Dummy with value 1 if country c in year t is facing a financial crisis, 0 otherwise (Laeven and Valencia 2020, Nguyen et al 2022)	Laeven & Valencia
$Crisis$ $OutputLoss_{c,t}$	Output loss given by the cumulative sum of the difference between actual and trend real GDP over the period $[T, T+3]$, in % of GDP	Laeven & Valencia
$TPI_{c,t}$	Total prudential policy index: net sum of all macroprudential tightening measures (+1,0,-1) taken by country c in year t (including 17 different types of regulation affecting borrowers or lenders)	iMaPP (IMF)
$CTPI_{c,t}^{2010}$	Cumulative total prudential policy index: net sum of all prudential tightening measures in country c since 2010 until year t	iMaPP (IMF)
EFD_i	External Finance Dependence index of manufacture i : the fraction of capital expenditures of the median firm that is not financed with cash-flow: (capital expenditures-cash-flow)/capital expenditures. Calculation for the US firms in Compustat between 1980 and 1989.	Rajan & Zingales (1998)

3 Main results for banking crises

The main model estimates are shown in Table 3. The results show that all industries (even those with no external finance dependence, i.e., with $EFD \leq 0$) are affected by banking crises, at least in the samples for all countries, AEs and EMDEs. Even an industry with no external dependence experiences a decline in growth of 2.4%, 2.5% and 0.8% in the samples of all countries, AEs and EMDEs. This effect is statistically significant, besides being economically sizeable. The regressions across all the country groups show that externally dependent industries are much more affected during banking crises, especially in EMDEs.

Externally dependent industries (that is, with $EFD > 0$) experience a further negative growth effect during a banking crisis, confirming the results of Dell’Ariccia et al. 2008. The coefficient of $EFD_i \times BankCrisis_{c,t}$ in the sample of all countries is estimated to be -3.39 and -3.56 in the regressions with macroeconomy controls and country-year fixed effects, respectively. This effect is somewhat higher in absolute value than the -2.74 coefficient estimated by Dell’Ariccia et al. 2008 for a sample of 41 countries during the period between 1980 to 2000. However, these coefficients are not statistically different from the Dell’Ariccia et al. 2008 estimates if a two standard deviation interval is considered.

Externally dependent industries in EMDEs experience reductions in growth that are more than twice as large as in the all countries’ sample. Fully externally dependent industries (that is, industries with $EFD = 1$) during banking crises experience a reduction in growth of 3.4%, 0.9% and 7.5% in the samples for all countries, AEs and EMDEs, respectively, using the regressions with macroeconomic controls. In the regressions with country-year fixed effects, fully externally dependent industries during banking crises experience a reduction in growth of 3.6%, 1.2% and 7.2% in the samples for all countries, AEs and EMDEs, respectively. Note that only the coefficients for the advanced economies are statistically insignificant. The all countries and emerging markets coefficients are significant both in the specifications with macroeconomic controls and with country-year fixed effects.

Finally, the results in Table 3 show that industrial growth is declining relative to the development of the economy as given by its GDP per capita and relative to the size of the individual industry in terms of the total manufacturing. Both results make sense. As countries develop and reach the

technological frontier, its manufacturing growth falls. It is also likely that individual industries present lower growth as their size becomes big relative to their national economy and their resource demands for labor and materials become more expensive. These two results are statistically significant and quite similar in size in whatever the model specification is used across this article (see also Madeira 2024).

Table 3: Effects of banking crises on industrial growth across country groups

Controls	With macroeconomic controls			With country-year fixed effects		
	All countries	Advanced economies	EMDEs	All countries	Advanced economies	EMDEs
$EFD_i \times$	-3.389***	-0.824	-7.502***	-3.562***	-1.153	-7.188***
$BankCrisis_{c,t}$	(1.075)	(1.324)	(1.738)	(0.963)	(1.224)	(1.466)
$ShareManVA_{i,c,t-1}$	-0.164***	-0.149***	-0.170***	-0.154***	-0.136***	-0.162***
	(0.0359)	(0.0427)	(0.0484)	(0.0331)	(0.0409)	(0.0454)
$\ln(GDP_{c,t-1}^{PPP,pc})$	-6.882***	-7.635***	-6.346***			
	(0.597)	(0.820)	(1.081)			
$BankCrisis_{c,t}$	-2.398***	-2.457***	-0.791			
	(0.394)	(0.504)	(0.637)			
N	41,648	20,228	21,420	41,980	20,472	21,508
R^2 (overall)	0.142	0.242	0.107	0.315	0.369	0.292

Robust standard errors in (). Clusters by industry-country.

***, **, * denote 1%, 5%, 10% statistical significance.

All regressions include fixed effects by industry-country and year (omitted).

Now I show how the effects of banking crises differed during the Great Financial Crisis (hence on GFC), defined as a time dummy between 2007-2009. Table 4 shows that the effects of banking crises on all types of industries were particularly strong during the GFC, especially in EMDEs. Banking crises during the GFC had a further reduction in growth of 2.7% and 9.6% in the samples of all countries and EMDEs, in addition to the usual negative effect of banking crises. For the AEs the effect is more complicated to determine, since the coefficient for the interaction of banking crises with the GFC period was positive for the effect of all industries, but with a similarly sized coefficient for the externally dependent industries. The regressions with country-industry and country-year fixed effects do not show an additional effect of the GFC on externally dependent industries for any of the country samples (all countries, AEs, EMDEs). These regressions show estimates similar to Table 3, indicating a reduction in growth of fully dependent industries during banking crises of 3.9%, 0.7% and 7.3% for the all countries, AEs and EMDEs.

Table 4: Effects of banking crises on industrial growth, with interactions for the Great Financial Crisis (2007-2009)

Controls	With macroeconomic controls			With country-year fixed effects		
	All countries	Advanced economies	EMDEs	All countries	Advanced economies	EMDEs
$EFD_i \times Bank$	-3.474***	0.193	-7.546***	-3.962***	-0.730	-7.288***
$Crisis_{c,t}$	(1.277)	(1.817)	(1.683)	(1.156)	(1.694)	(1.494)
$EFD_i \times Bank$	0.714	-2.613	1.388	1.505	-1.068	1.443
$Crisis_{c,t} \times GFC_t$	(1.992)	(2.137)	(8.284)	(1.813)	(1.980)	(8.164)
$ShareManVA_{i,c,t-1}$	-0.164***	-0.149***	-0.170***	-0.154***	-0.136***	-0.162***
	(0.0359)	(0.0429)	(0.0484)	(0.0331)	(0.0409)	(0.0454)
$\ln(GDP_{c,t-1}^{PPP,pc})$	-6.824***	-7.638***	-6.214***			
	(0.597)	(0.821)	(1.072)			
$BankCrisis_{c,t}$	-1.847***	-3.304***	-0.0809			
	(0.448)	(0.637)	(0.611)			
$BankCrisis_{c,t} \times GFC_t$	-2.687**	2.755**	-9.593**			
	(1.086)	(1.177)	(3.999)			
N	41,648	20,228	21,420	41,980	20,472	21,508
R^2 (overall)	0.142	0.243	0.108	0.315	0.369	0.292

Robust standard errors in (). Clusters by industry-country.

***, **, * denote 1%, 5%, 10% statistical significance.

All regressions include fixed effects by industry-country and year (omitted).

4 Effects of other types of financial crises on industrial growth

Now I analyze the effects of other financial crises, including currency and sovereign debt crises. Note that banking and currency crises are much more common than sovereign debt crises (Laeven and Valencia 2020), therefore the latter have fewer observations and more imprecise results. Currency crises often precede or coincide with banking crises. One potential channel for this is the negative balance sheet effect for companies borrowing from abroad, which see their debts appreciate during currency crises. Firms can then become delinquent and transmit their losses to the financial system.

Table 5 shows the effects on industrial growth of currency, sovereign debt and any type of financial crises in separate regressions and in a joint regressions with all types of crises. The models are estimated with both macroeconomic control variables and country-year fixed effects. In the regressions with macro controls there are two effects of financial crises, one a direct effect on all industries and then an additional effect on externally dependent industries.

Currency crises have an even larger negative effect on externally dependent industries than banking crises, whether in terms of the direct effect on all industries or in terms of the additional effect on externally dependent industries. Sovereign debt crises also have strong negative effect on all industries and on externally dependent industries' growth, but with less impact than banking and currency crises. The regressions with all types of crises in the same model confirm these results. However, the effect of sovereign debt crises on externally dependent industries is not statistically significant in the regressions with all types of crises. All the results are robust to considering either macroeconomic controls or country-year fixed effects.

Summarizing the regressions with all financial crises included, the results with macroeconomic controls show that the effect on all industries is a reduction in growth of 1.8%, 4.8% and 0.4% for banking, currency and sovereign debt crises, respectively. Fully externally dependent industries experience a further reduction in growth of 2.9%, 3.9% and 1.7% during banking, currency and sovereign debt crises, respectively. Therefore, currency crises have a much stronger effect on industrial growth whether directly on all industries or as an additional effect through their external finance dependence. Note that the coefficients for sovereign debt crises are statistically insignificant in the regressions with all types of crises, although being significant in the separate regressions.

Table 5: Effects of different types of financial crises (banking, currency, sovereign debt, any financial crisis), across the entire country sample

Controls	With macroeconomics controls				With country-year fixed effects			
$EFD_i \times Banking$				-2.910***				-2.993***
$Crisis_{c,t}$				(1.092)				(0.990)
$EFD_i \times Currency$	-5.086***			-3.932**	-5.048***			-4.034**
$Crisis_{c,t}$	(1.764)			(1.828)	(1.794)			(1.871)
$EFD_i \times Sovereign$		-2.858**		-1.736		-2.135*		-1.076
$DebtCrisis_{c,t}$		(1.366)		(1.333)		(1.126)		(1.155)
$EFD_i \times Any$			-2.906***				-2.832***	
$Crisis_{c,t}$			(0.901)				(0.821)	
$ShareManVA_{i,c,t-1}$	-0.163***	-0.164***	-0.168***	-0.165***	-0.152***	-0.153***	-0.154***	-0.154***
	(0.0357)	(0.0357)	(0.0360)	(0.0359)	(0.0330)	(0.0329)	(0.0331)	(0.0332)
$\ln(GDP_{c,t-1}^{PPP,pc})$	-6.123***	-6.797***	-7.062***	-6.483***				
	(0.583)	(0.597)	(0.603)	(0.599)				
$BankCrisis_{c,t}$				-1.774***				
				(0.405)				
$CurrencyCrisis_{c,t}$	-5.247***			-4.794***				
	(0.788)			(0.818)				
$DebtCrisis_{c,t}$		-1.207**		-0.439				
		(0.478)		(0.488)				
$AnyCrisis_{c,t}$			-2.375***					
			(0.360)					
N	41,648	41,648	41,648	41,648	41,980	41,980	41,980	41,980
R^2 (overall)	0.145	0.139	0.143	0.147	0.315	0.315	0.315	0.316

Robust standard errors in (). Clusters by industry-country.

***, **, * denote 1%, 5%, 10% statistical significance.

All regressions include fixed effects by industry-country and year (omitted).

I then estimate effects of all types of financial crises across country groups (AEs, EMDEs). In terms of the direct effect of crises on all industries, Table 6 shows that banking, currency and debt crises reduce growth in AEs by 2.1%, 5.6% and 2%, respectively. For EMDEs the direct effect of banking and sovereign debt crises is small and statistically insignificant, but currency crises reduce the growth of all industries by 4.7%.

The effects of financial crises on externally dependent industries in AEs are not statistically significant. However, for EMDEs banking and currency crises imply an additional growth reduction of 6.3% and 4.4% for fully dependent industries. These results are confirmed by either the regressions with macroeconomic controls or country-year fixed effects, with similar coefficients for both models. In the case of the regressions with macroeconomic controls for EMDEs, there is a

stronger effect of currency crises on all industries, although banking crises have a stronger impact through the external finance dependence channel.

Table 6: Effects of different types of financial crises across country groups

Controls	With macro controls		With country-year fixed effects	
	Advanced economies	EMDEs	Advanced economies	EMDEs
$EFD_i \times Banking$	-1.047	-6.266***	-1.137	-6.182***
$Crisis_{c,t}$	(1.300)	(1.830)	(1.217)	(1.560)
$EFD_i \times Currency$	4.721	-4.418**	1.075	-4.215**
$Crisis_{c,t}$	(3.682)	(2.026)	(4.709)	(2.074)
$EFD_i \times Sovereign$	-4.281	-0.672	-4.035	-0.287
$DebtCrisis_{c,t}$	(5.165)	(1.359)	(4.276)	(1.202)
$ShareManVA_{i,c,t-1}$	-0.150***	-0.170***	-0.137***	-0.161***
	(0.0428)	(0.0486)	(0.0410)	(0.0455)
$\ln(GDP_{c,t-1}^{PPP,pc})$	-7.760***	-5.747***		
	(0.825)	(1.080)		
$BankCrisis_{c,t}$	-2.143***	-0.145		
	(0.496)	(0.662)		
$CurrencyCrisis_{c,t}$	-5.661***	-4.738***		
	(1.768)	(0.902)		
$DebtCrisis_{c,t}$	-1.957	-0.129		
	(1.415)	(0.547)		
N	20,228	21,420	20,472	21,508
R^2 (overall)	0.244	0.113	0.369	0.292

Robust standard errors in (). Clusters by industry-country.

***, **, * denote 1%, 5%, 10% statistical significance.

All regressions include fixed effects by industry-country and year (omitted).

As a robustness check, I estimate a quantile regression model with country-industry fixed effects, using the methodology proposed by Machado and Santos-Silva 2019. This methodology allows us to test the effect of financial crises effects under different stages of each industry's growth, whether a low (say, quantile 25), median (quantile 50) or high growth stage. Quantile regression is also robust to the effects of outliers, such as results driven by only a few extreme observations (Machado and Santos-Silva 2019).

The regressions in Table 7 show a strong direct effect of banking and currency crises on all industries in the cases of low and median growth periods (quantiles 25 and 50). Currency crises also have a strong direct effect on all industries in periods of high growth (quantile 75). Banking crises reduce the growth of all industries by 4.1%, 2.5% and 1.1% at the quantiles 25, 50 and 75.

Currency crises reduce the growth of all industries by 6.5%, 4.7% and 3.1% at the quantiles 25, 50 and 75. It is also noticeable that the coefficients for currency crises are statistically significant for all the quantiles. For banking crises there is statistical significance for the quantiles 25 and 50. The effects estimated for sovereign debt crises in the all countries sample are small and statistically insignificant for all quantiles.

For the country groups (AEs, EMDEs) only the median quantile regression is reported. The median quantile shows a strong negative effect of banking and sovereign debt crises on all industries in AEs. The financial crises coefficients are not statistically significant for the EMDEs, although the coefficient size is large in the case of currency crises,

The results in Table 7 do not show statistically significant coefficient for the effect of financial crises on externally dependent industries. However, the size and sign of the coefficients confirm the previous results in this article. Banking, currency and sovereign debt crises have a negative effect on the externally dependent industries, particularly in periods of low and median growth. Banking and currency crises seem to have a much stronger effect on EMDEs. Sovereign debt crises only have a sizeable effect on externally dependent industries in AEs. However, none of these coefficients are statistically significant in the quantile regressions. This makes sense due to the higher standard errors involved in the moment conditions of panel quantile regressions (Machado and Santos Silva 2019).

Table 7: Quantile regressions with country-industry fixed effects for the impact of different types of financial crises (banking, currency, sovereign debt)

	All countries			Advanced economies	EMDEs
Controls	Q25	Q50	Q75	Q50	Q50
$EFD_i \times Banking$	-3.932	-3.008	-2.151	-1.245	-5.901
$Crisis_{c,t}$	(3.381)	(2.154)	(2.083)	(1.604)	(71.09)
$EFD_i \times Currency$	-3.769	-3.765	-3.762	4.609	-4.560
$Crisis_{c,t}$	(5.431)	(3.460)	(3.345)	(5.142)	(68.67)
$EFD_i \times Sovereign$	-3.550	-1.782	-0.141	-4.207	-0.754
$DebtCrisis_{c,t}$	(4.131)	(2.632)	(2.545)	(6.150)	(50.90)
$ShareManVA_{i,c,t-1}$	-0.0673	-0.173***	-0.271***	-0.171***	-0.173
	(0.104)	(0.0661)	(0.0639)	(0.0418)	(1.673)
$\ln(GDP_{c,t-1}^{PPP,pc})$	-4.117***	-6.859***	-9.403***	-7.631***	-5.485
	(1.470)	(0.937)	(0.906)	(0.618)	(31.86)
$BankCrisis_{c,t}$	-4.070***	-2.548***	-1.137	-3.350***	-1.039
	(1.304)	(0.831)	(0.804)	(0.621)	(26.16)
$CurrencyCrisis_{c,t}$	-6.474***	-4.724***	-3.101**	-3.472	-5.044
	(2.014)	(1.284)	(1.241)	(2.290)	(25.09)
$DebtCrisis_{c,t}$	-0.279	-0.672	-1.037	-3.706**	-0.389
	(1.532)	(0.976)	(0.944)	(1.802)	(19.47)
$GreatModeration_t$	-1.253*	-1.079**	-0.918**	-1.476***	-0.687
(1988-2006)	(0.664)	(0.423)	(0.409)	(0.259)	(16.17)
GFC_t	-7.033***	-4.433***	-2.021***	-5.944***	-3.100
(2007-2009)	(0.942)	(0.600)	(0.581)	(0.470)	(17.29)
N	41,648	41,648	41,648	20,228	21,420

Standard errors in ().

***, **, * denote 1%, 5%, 10% statistical significance.

All regressions include fixed effects by industry-country (omitted).

Finally, Table 8 reports the effects of the financial crises across all country groups (all countries, AEs and EMDEs), with a full set of country-industry, country-year and industry-year fixed effects. These results show that the estimated effects of financial crises on externally dependent industries are robust. For the regressions with all types of financial crises, the sample of all countries shows that fully externally dependent industries experience a reduction in growth of 2.6% and 4.1% during banking and currency crises. However, across country groups, the only statistically significant effects are found for the EMDEs. Fully financially dependent industries in EMDEs experience a growth reduction of 6.3% and 4.9% during banking and currency crises. Sovereign debt crises are not statistically significant for any sample in the all crises model. However, it is relevant to note that all types of financial crises have relevant and statistically significant effects in the models with

separate regressions. This is the case for both the samples of all countries and EMDEs. Interestingly, both in the models with all financial crises in the same regression and in separate regressions, the estimated effect on externally dependent industries is always stronger for the EMDEs.

Table 8: Effects of different types of financial crises with industry-country, country-year and industry-year fixed effects

Controls	All countries	Advanced economies	EMDEs
All crises in the same regression model			
$EFD_i \times Banking$	-2.612***	-1.479	-6.290***
$Crisis_{c,t}$	(1.011)	(1.618)	(1.554)
$EFD_i \times Currency$	-4.133**	1.381	-4.847**
$Crisis_{c,t}$	(1.964)	(4.340)	(2.317)
$EFD_i \times Sovereign$	-0.972	-0.693	-1.300
$DebtCrisis_{c,t}$	(1.107)	(3.720)	(1.264)
$ShareManVA_{i,c,t-1}$	-0.158***	-0.158***	-0.159***
	(0.0341)	(0.0503)	(0.0449)
N	41,910	20,400	21,480
R^2 (overall)	0.343	0.426	0.330
Coefficients obtained with different types of crises in separate regressions			
$EFD_i \times Banking$	-3.183***	-1.425	-7.221***
$Crisis_{c,t}$	(0.986)	(1.579)	(1.535)
$EFD_i \times Currency$	-4.944***	0.597	-6.054***
$Crisis_{c,t}$	(1.894)	(4.244)	(2.258)
$EFD_i \times Sovereign$	-1.907*	-1.012	-2.328*
$DebtCrisis_{c,t}$	(1.094)	(3.679)	(1.273)
$EFD_i \times Any$	-2.533***	-1.592	-5.503***
$Crisis_{c,t}$	(0.867)	(1.439)	(1.537)
N	41,910	20,400	21,480

All regressions include $ShareManVA_{i,c,t-1}$ as a control, but its coefficient is omitted in the regressions with each type of crisis separately.

Clusters by industry-country and industry-year.

Robust standard errors in ().

***, **, * denote 1%, 5%, 10% statistical significance.

Fixed effects in the regressions are omitted.

For the separate regressions with each type of crisis, the results show a statistical significant effect of all types of crises on the samples of all countries and EMs. Fully dependent industries experience a growth reduction of 3.2%, 4.9% and 1.9% for banking, currency and sovereign debt crises in the all countries sample. In EMs the effect on externally dependent industries is much

stronger for banking crises. Fully dependent industries experience a growth reduction of 8.8%, 4.1% and 3% for banking, currency and sovereign debt crises in EMs. These estimates confirm the previous results, showing stronger effects on externally dependent industries in EMs during financial crises. Currency crises have a large effect on LICs, but the effect is not statistically significant (similarly to previous tables). The estimated result of banking crisis effects just for EMDEs fits well with Dell’Ariccia et al. 2008, who also find only a negative impact of banking crises on the industrial growth of externally dependent industries for developing countries. However, the coefficient of -7.22 shown in Table 8 for EMDEs is almost twice the size of the -3.73 value reported in Dell’Ariccia et al. 2008.

5 Total impact of financial crises on manufacturing growth

The previous sections show the effects on growth of a particular industry. Coefficients must be interpreted as giving an effect on industries with no external finance dependence ($EFD = 0$) or an additional growth effect on industries with a specific external finance dependence value. However, industries have fairly different levels of EFD, as shown in Table 1. Furthermore, countries have different industrial specializations and their industries change over time. Therefore, the EFD of the total manufacturing sector differs both across countries and time.

For this reason, Table 9 summarizes the effect on total manufacturing implicit in the previous exercises. In the case of the additional growth effect experienced by industries with external finance dependence, the total effect on the manufacturing sector of a country c at time t can be obtained as: $\theta_{c,t} = \gamma \sum_i \varpi_{i,c,t} EFD_i$, with the weight $\varpi_{i,c,t} = \frac{VA_{i,c,t}}{\sum_i VA_{i,c,t}}$ being the share of each individual industry in terms of the value added of the entire national manufacturing sector. In the case of the regressions that include country-year fixed effects, this is the only term being estimated. For the regressions with macroeconomic controls, there is also the effect of financial crises on all industries (even those with $EFD = 0$). Therefore, in this case the total effect on the manufacturing sector is given by: $\mu_{c,t} = \delta_{Crisis} + \gamma \sum_i \varpi_{i,c,t} EFD_i$. Table 9 reports both kinds of effects. Furthermore, since the effects differ across countries, Table 9 shows the average effects on the different country samples, that is: $\frac{1}{n_S} \sum_{c \in S} \theta_{c,t}$ and $\frac{1}{n_S} \sum_{c \in S} \mu_{c,t}$, with S denoting either the sample of all countries, AEs or EMDEs, and n_S the number of countries in each sample.

Table 9: Effect on total manufacturing growth (in %) of different types of financial crises (average across countries in 2019): estimates from all the models

All crises in the same regression model									
Coefficient average across countries	Tripe FE (i,c+i,t+c,t) $\gamma \sum_i \varpi_{i,c,t} EFD_i$			Double FE (i,c+c,t) $\gamma \sum_i \varpi_{i,c,t} EFD_i$			FE (i,c+t) plus controls $\delta_{Crisis} + \gamma \sum_i \varpi_{i,c,t} EFD_i$		
Crisis type	Bank	Currency	Debt	Bank	Currency	Debt	Bank	Currency	Debt
All countries	-0.8	-1.3	-0.3	-1.0	-1.3	-0.3	-2.7	-6.0	-1.0
AEs	-0.5	0.5	-0.2	-0.4	0.4	-1.3	-2.5	-4.1	-3.4
EMDEs	-2.0	-1.5	-0.4	-2.0	-1.3	-0.1	-2.1	-6.1	-0.3
Separate models for each crisis type									
Coefficient average across countries	Tripe FE (i,c i,t c,t) $\gamma \sum_i \varpi_{i,c,t} EFD_i$			Double FE (i,c+c,t) $\gamma \sum_i \varpi_{i,c,t} EFD_i$			FE (i,c+t) plus controls $\delta_{Crisis} + \gamma \sum_i \varpi_{i,c,t} EFD_i$		
Crisis type	Bank	Currency	Debt	Bank	Currency	Debt	Bank	Currency	Debt
All countries	-1.0	-1.6	-0.6	-1.1	-1.6	-0.7	-3.5	-6.9	-2.1
AEs	-0.5	0.2	-0.3	-0.4			-2.7		
EMDEs	-2.3	-1.9	-0.7	-2.3			-3.2		

Table 9 summarizes the total industry impact obtained from the triple fixed effect regressions (Table 8), the double fixed effect regressions (Tables 3, 5 and 6) and the fixed effects model with macroeconomic controls (Tables 3, 5 and 6). For simplicity, I show only the effects for the last year of the sample, which corresponds to the last pre-pandemic year, 2019. The results for the triple and the double fixed effect models are almost the same, both qualitatively and in size. The results are also similar, whether qualitative or in size, for the simultaneous regression with all crises and the separate regressions. Therefore, I will comment only on the results from the simultaneous regressions.

The coefficients on total manufacturing due to the external finance dependence of industries ($\gamma \sum_i \varpi_{i,c,t} EFD_i$) show that EMDEs are much more affected by banking crises. The triple FE estimates show that the average country experiences a manufacturing growth loss of 0.8%, 1.3% and 0.3% during banking, currency and sovereign debt crises, respectively. For AEs, there is a reduction in manufacturing growth of 0.5% and 0.2% during banking and sovereign debt crises, while currency crises have no effect. For EMDEs there is a reduction in growth of 2%, 1.5% and 0.4% during banking, currency and sovereign debt crises.

Considering the total effect from the model with fixed effects and macroeconomic controls, it is shown that currency crises have the strongest impact across all country groups (all countries, AEs, EMDEs). There is a loss in industrial growth of 2.7%, 6% and 1% during banking, currency

and sovereign debt crises in the all countries sample. EMDEs experience the strongest effects from currency crises, while AEs experience the strongest effect of banking and sovereign debt crises. In AEs there is a reduction in industrial growth of 2.5%, 4.1% and 3.4% during banking, currency and debt crises. In EMDEs there is a loss of industrial growth of 2.1%, 6.1% and 0.3% during banking, currency and sovereign debt crises. EMDEs are the countries least affected by banking crises, which could be due to the low development of their banking sector (Rajan and Zingales 1998, Raddatz 2006). Perhaps the stronger effect of sovereign debt crises in AEs is due to their larger sovereign debt markets and the unexpected of sovereign crises in advanced economies. In EMDEs the level of sovereign debt relative to the economy is much smaller, which could explain the small effect of sovereign debt crises on these countries.

Table 10: Effects on total manufacturing growth (in %, yearly) of banking crises compared with Dell’Ariccia et al. 2008 sample: triple FE (i,c+i,t+c,t)

Source	All crises in same regression		Crises types in separate regressions	
	This work	Dell’Ariccia et al.	This work	Dell’Ariccia et al.
Period	1980-2019	1980-2000	1980-2019	1980-2000
Country sample	102 countries	41 countries	102 countries	41 countries
Banking crises				
All countries	-0.8	-0.3	-1.0	-0.7
AEs	-0.5	0.6	-0.5	0.7
EMDEs	-2.0	-1.0	-2.3	-1.3
Currency crises				
All countries	-1.3	-1.4	-1.6	-1.5
AEs	0.5	0.1	0.2	0.7
EMDEs	-1.5	-1.5	-1.9	-1.8
Sovereign debt crises				
All countries	-0.3	-0.2	-0.6	-0.4
AEs	-0.2	0.0	-0.3	0.0
EMDEs	-0.4	-0.2	-0.7	-0.5

Finally, Table 10 summarizes the results of the triple fixed effect model (with country-industry, country-year and industry-year dummies) in this article relative to the sample of Dell’Ariccia et al. 2008. The results show that the estimates in this article for currency and sovereign debt crises are similar to those implicitly estimated by Dell’Ariccia et al. 2008,⁶ whether for all countries,

⁶Note that Dell’Ariccia et al. 2008 only report the coefficients from their regressions. Their article does not report the total effect on the externally dependent industries, which requires weighting the impact according to the value-added of each industry. Therefore these calculations are obtained by replicating their analysis on their 41

AEs and EMDEs. However, the calculations in this article show that my estimates of the effect of banking crises are much larger than those in previous work. Using the regressions for all types of financial crises in the same regression, I estimate a reduction in the growth of externally dependent industries of 0.8%, 0.5% and 2% for the all countries, AEs and EMDEs samples, which is more than twice the effect from the Dell’Ariccia et al. 2008 sample. Furthermore, one cannot find negative effects of banking crises on AEs in the Dell’Ariccia et al. 2008 sample. Note that the time period of Dell’Ariccia et al. 2008 ends in 2000, therefore excluding the Great Financial Crisis. This could explain their lower estimate for the effect of banking crises, particularly in the case of AEs.

Furthermore, the Dell’Ariccia et al. 2008 study only estimated the effect of banking crises on the externally dependent industries, but did not include the direct effect on all industries that is estimated in this article.⁷ The total effect on manufacturing in this article is obtained from the regression with macroeconomic controls, country-industry and time fixed effects. Table 9 shows that including this direct effect for all countries makes the estimates of banking, currency and sovereign debt crises more than three times larger. For the all countries sample in Table 9, the total reduction in manufacturing growth is 2.7%, 6% and 1% for banking, currency and sovereign debt crises, which are estimates more than four times larger than the externally dependence of industries’ effect obtained in the Dell’Ariccia et al. 2008 sample. The estimates in this article (in the last 3 columns of Table 9) for the costs of financial crises in terms of the total effect on manufacturing growth are nine, four and five times larger for banking, currency and sovereign debt crises relative to the Dell’Ariccia et al. 2008 sample.

6 Effects of financial policy during banking crises

Now I estimate a model with interaction components for the intensity of the banking crises, as expressed by its total output loss as a fraction of GDP (Laeven and Valencia 2020) and a dummy

country sample for the period between 1980 to 2000.

⁷Note that the sample of Dell’Ariccia et al. 2008 was only about one third of the sample used in this article. Dell’Ariccia et al. 2008 were using only about half of the sample in terms of time periods (1980-2000) and less than half in terms of countries (41 countries). Therefore, their smaller sample made it harder to estimate more coefficients and obtain statistically significant results. However, the estimates for the external finance channel of financial crises on manufacturing growth are quite similar between this article and the study of Dell’Ariccia et al. 2008.

for the GFC.⁸ The dummy for the GFC in this regression takes into account both the time period between 2007 and 2009 and also crises that started in that period even if such crises finished afterwards, that is: $GFC_{c,t} = 1(\max(t, BegBankCrisis_{c,t}) \geq 2007)1(\min(t, BegBankCrisis_{c,t}) \leq 2009)$, with $BegBankCrisis_{c,t}$ denoting the year in which the crisis began (Laeven and Valencia 2020).⁹ Furthermore, the model also considers the interaction effect of macroprudential policies introduced after the GFC, which were widely adopted across both developed and developing economies after 2010 (Akinci and Olmstead-Rumsey 2018, Alam et al. 2019). Therefore, the model considers the effect of macroprudential policies implemented after the GFC, measured as the net macroprudential policy tightening implemented in the current year, $TPI_{c,t} \times 1(t \geq 2010)$, and the cumulative macroprudential policy stance with all measures implemented since 2010, $CTPI_{c,t-1}^{2010}$. Note that the analysis in this section is limited to 2017 due to the availability of data on the output loss of banking crises (Laeven and Valencia 2020).

Table 11 shows the results of this model that accounts for both the intensity of the banking crises and the financial policies that have been implemented since 2010. The regressions with macroeconomic controls show that the output loss of banking crises has a negative effect on all industries for the samples of all countries and AEs. Macroprudential policies had a positive impact on industrial growth during the banking crises for the period after 2010 across all country samples (all countries, AEs, EMDEs), as seen by the coefficient for $BankCrisis_{c,t} \times CTPI_{c,t-1}^{2010}$.

For the coefficients that interact with the industries' external finance dependence, there is a negative effect of banking crises on externally dependent industries in the samples of all countries and EMDEs. The output loss of banking crises causes a negative effect on externally dependent industries in AEs.¹⁰ I also find that externally dependent industries are negatively affected by the previous accumulated macroprudential tightening in the sample of all countries. This result makes sense, because these industries have more needs of external financial funds (Madeira 2024).

⁸Note that now the coefficients for $BankCrisis_{c,t}$ and $EFD_i \times BankCrisis_{c,t}$ no longer represent the full effect of a banking crisis on industries, because the model takes into account several interactions with other variables.

⁹It is worth noting, however, that the results do not change much if one uses instead the simple time period criterion for the GFC: $GFC_{c,t} = 1(2009 \geq t \geq 2007)$.

¹⁰Note that the coefficient for the interaction between external finance dependence and the GFC period is now positive for the externally dependent industries in all countries and AEs. However, this does not mean that the GFC was positive for growth, since the GFC implied a large loss in output and this output loss causes lower growth. The coefficient for the GFC effect on all industries is still negative, both in the sample of all countries and for EMDEs.

Furthermore, macroprudential policy easing during banking crises (that is, the opposite sign of $EFD_i \times TPI_{c,t} \times 1(t \geq 2010)$) has a positive impact on growth of externally dependent industries for the samples of all countries and AEs.

Table 11: Effects of banking crises on industrial growth, with controls for the intensity of the crisis and for post-GFC net macroprudential policy tightening

Controls	With macroeconomic controls, country-industry and year FE			With country-industry, country-year and industry-year FE		
	All countries	Advanced economies	EMDEs	All countries	Advanced economies	EMDEs
$EFD_i \times$	-5.291***	0.115	-8.413***	-6.248***	-0.232	-9.257***
$BankCrisis_{c,t}$	(1.894)	(3.359)	(2.336)	(1.544)	(3.077)	(2.286)
$EFD_i \times Output$	-0.0337	-0.0778	-0.0138	-0.0299	-0.0845*	-0.0105
$Loss_{c,t}$	(0.0387)	(0.0485)	(0.0558)	(0.0355)	(0.0442)	(0.0603)
$EFD_i \times GFC_{c,t}$	6.284***	2.954	-1.320	9.162***	5.209*	4.230
	(2.149)	(3.192)	(8.257)	(2.002)	(3.110)	(7.244)
$EFD_i \times TPI_{c,t}$	-1.774	-3.508*	-0.0610	-2.358*	-3.997***	-0.994
$\times 1(t \geq 2010)$	(1.328)	(2.017)	(2.194)	(1.371)	(1.244)	(2.426)
$EFD_i \times CTPI_{c,t-1}^{2010}$	-2.597**	-1.442	-1.896	-2.229**	-0.222	-1.810
	(1.188)	(1.471)	(1.364)	(1.038)	(1.091)	(1.375)
$ShareManVA_{i,c,t-1}$	-0.210***	-0.187***	-0.214***	-0.190***	-0.190***	-0.189***
	(0.0442)	(0.0491)	(0.0621)	(0.0433)	(0.0648)	(0.0586)
$\ln(GDP_{c,t-1}^{PPP,pc})$	-8.714***	-7.355***	-10.28***			
	(0.833)	(1.350)	(1.362)			
$BankCrisis_{c,t}$	-0.547	-0.767	0.579			
	(0.706)	(1.326)	(0.868)			
$BankCrisis_{c,t} \times$	-0.0375**	-0.0538***	-0.0343			
$OutputLoss_{c,t}$	(0.0153)	(0.0208)	(0.0224)			
$BankCrisis_{c,t} \times$	-2.263**	0.651	-7.259*			
$GFC_{c,t}$	(0.892)	(1.210)	(3.778)			
$BankCrisis_{c,t} \times$	0.916	1.228	1.391			
$TPI_{c,t}^{2010}$	(0.632)	(0.845)	(1.132)			
$BankCrisis_{c,t} \times$	1.878***	2.794***	1.927***			
$CTPI_{c,t-1}^{2010}$	(0.325)	(0.694)	(0.552)			
N	33,200	16,661	16,539	33,244	16,677	16,561
R^2 (overall)	0.168	0.276	0.124	0.358	0.456	0.333

Robust standard errors in (). Clusters by industry-country.

***, **, * denote 1%, 5%, 10% statistical significance.

All regressions include fixed effects by industry-country and year (omitted).

I now summarize in Table 12 the total effect on manufacturing growth from the regressions with macroprudential policies and output losses of banking crises. The results show the average impact

on manufacturing growth of a banking crises across three different periods: before the GFC (until 2006), during the GFC (between 2007 and 2009) and post GFC (between 2010 and 2017). In the case of the last period I also show a counterfactual scenario in which no macroprudential policies had been implemented (that is, considering $TPI_{c,t} = 0$ and $CTPI_{c,t-1}^{2010} = 0$). The triple fixed effects estimates consider only the impact on manufacturing growth through the external finance dependence channel, while the results based on macroeconomic controls consider the total effect on manufacturing growth.

Table 12: Effect on total manufacturing growth (in %, yearly) of banking crises across different periods and policies

Coefficient average across countries	Triple FE (i,c+i,t+c,t)				FE (i,c+t) plus macro controls			
	pre-GFC	GFC	post-GFC	post-GFC*	pre-GFC	GFC	post-GFC	post-GFC*
	With average weights $\varpi_{i,c,t}$ and output loss for periods t							
All countries	-2.5	0.2	-4.4	-2.2	-4.6	-4.2	-1.5	-5.8
AEs	-1.4	0.4	-2.5	-1.6	-4.4	-2.3	-4.1	-6.3
EMDEs	-3.0	-3.7	-5.0	-2.6	-3.9	-6.8	3.2	-5.1

Note: post-GFC* is the counterfactual scenario in which no macroprudential policies had been implemented since 2010.

The results show that an absence of macroprudential policies would have improved the growth of externally dependent industries during banking crises. Considering just the external finance dependence channel, banking crises in the post-GFC period would have caused a loss of just 2.2% in manufacturing growth (instead of the 4.4% loss with the macroprudential policies). This loss in growth through the external finance dependence channel happens across all country groups (all countries, AEs and EMDEs). However, when considering the effect on manufacturing through both channels (the direct effect on manufacturing and the external finance dependence channel), the results show that macroprudential policies were highly beneficial for growth during banking crises. In the scenario with no macroprudential policies there is a 5.8% loss in manufacturing growth during banking crises in the post GFC period, which is much higher than the 1.5% growth loss observed with the macroprudential policies implemented. This beneficial effect of macroprudential policies during banking crises in the post-GFC period happens across all country groups. The results show that macroprudential policies increased manufacturing growth during banking crises by 4.3%, 2.2% and 8.3% across the all countries, AEs and EMDEs samples.

7 Conclusions and policy implications

This work studies the effect of banking crises on the real industrial growth, with a particular focus on external finance dependent industries. Using data for 23 industries across 102 countries between 1980 and 2019, I find that banking crises have a negative growth effect on industries through two channels, a direct effect on all manufacturing activity and an effect through industries' external finance dependence. The direct effect of banking crises on manufacturing activity is strong, especially in advanced economies (AEs). The direct effect of a banking crisis on all industries implies a reduction in growth of 2.4% for all countries and 2.5% for AEs. This direct effect of banking crises was even stronger during the Great Financial Crisis (GFC), especially in emerging markets and developing economies (EMDEs). Banking crises during the GFC period implied a further direct loss in manufacturing growth of 2.7%, 2.8% and 9.6% for all countries, AEs and EMDEs, respectively.

The external finance dependence channel is especially large for EMDEs. For the advanced economies the effect is small and not statistically significant. In the model with country-industry, country-year and industry-year fixed effects, fully externally dependent industries during a banking crisis suffer a growth reduction of 3.2%, 1.4% and 7.2% in the samples for all countries, AEs and EMDEs, respectively. The estimates of this effect on manufacturing growth are significantly bigger than in previous studies which ignored the GFC period.

Estimating the effects of other types of financial crises, I find that banking and currency crises have a much stronger effect on externally dependent industries than sovereign debt crises. In the model with country-industry, country-year and industry-year fixed effects, fully externally dependent industries suffer a growth reduction of 3.2%, 4.9% and 1.9% during banking, currency and sovereign debt crises, respectively, in the sample of all countries. Financial crises in EMDEs have an even stronger effect on externally dependent industries. Fully dependent industries in EMDEs reduce their growth by 7.2%, 6.1% and 2.3% during banking, currency and sovereign debt crises. Externally dependent industries in AEs do not experience a statistically significant effect from any type of financial crisis.

I then estimate the effect on total manufacturing growth from each type of financial crises, obtained as the sum of both the effect on all industries and the financial dependence channel. This effect is weighted by the value added of each industry in the national economy. The results show

that currency crises have the strongest effect on manufacturing growth across any country group. For the sample of all countries, manufacturing growth falls by 2.7%, 6% and 1% during banking, currency and sovereign debt crises. EMDEs are the most affected countries by currency crises, while banking and sovereign debt crises impact AEs more strongly. During banking, currency and sovereign debt crises, there is a fall in manufacturing growth of 2.5%, 4.1% and 3.4% for AEs and 2.1%, 6.1% and 0.3% for EMDEs.

Finally, I study the effects of macroprudential policies during banking crises, focusing on the post GFC period when most countries quickly adopted these mechanisms. The results show that macroprudential policies increased manufacturing growth during banking crises in 4.3%, 2.2% and 8.3% for the all countries, AEs and EMDEs.

Future research could investigate which other characteristics of the industries, besides external finance dependence, explain vulnerabilities during financial crises in EMDEs. Furthermore, there is a need to measure output effects on other sectors of the economy besides manufacturing.

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