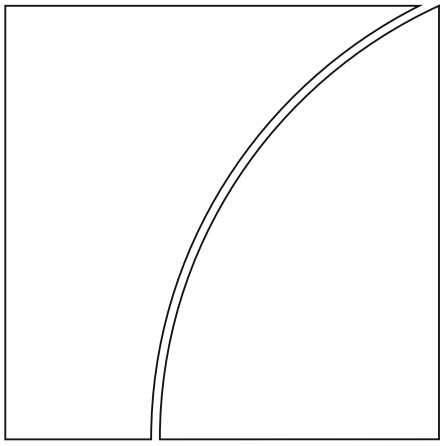

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The impact of macroprudential policies on industrial growth

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Abstract

This paper analyses the causal impact of macroprudential policies on growth, using industry-level data for 89 countries for the period 1990 to 2021. The small industry size creates an exogenous identification and avoids reverse-causality. I find that macroprudential tightening measures have a negative impact on manufacturing growth, but only for industries with high external finance dependence. This effect is stronger during banking crises, periods of higher output growth and for advanced economies. The effect is weaker during period of high private credit growth. Growth effects on externally dependent industries are economically sizeable and can persist over three years.

JEL Classification: E44; G28; O10; O16.

Keywords: Macroprudential policy; Financial development; Growth; External finance dependence; Credit frictions.

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1 Introduction

Many countries have implemented macroprudential policies, especially in the aftermath of the Great Financial Crisis (GFC) of 2007-2008 (Galati and Moessner 2018, Alam et al. 2019). There are substantial studies of the impact of these policies in curbing excessive credit and housing prices growth (Cerutti et al. 2017, Akinci and Olmstead-Rumsey 2018, Alam et al. 2019). However, estimates of the impact of macroprudential measures on economic growth are still lacking, with some studies finding a weak and uncertain effect (Alam et al. 2019). One of the reasons for the difficulty in finding a reliable estimate of the effect on economic growth and macroeconomic variables is the reverse causality problem, due to authorities taking into account economic activity in their decisions of financial policy (Boar et al. 2017, Cerutti et al. 2017). This study aims to fill this gap. For this goal, I use industry-country level data as an identification strategy, by assuming that the activity of small industries is not a core part of the authorities' policy function. Therefore, the national macroprudential policies can be taken to be fairly exogenous in terms of their impact on the growth of small individual industries.[1]

This work studies the impact of macroprudential policies on the real growth of a panel of 23 manufacturing industries across 89 countries. The median industry in the sample study represents just 0.32% of GDP. Even the largest industries in the data are still small, with around 95% of the industries showing a value-added production below 2.29% of GDP. The fact that each industry is small relative to the national economy makes it more credible that the empirical analysis is indeed estimating the impact of financial policy on growth, addressing the issues of reverse-causality. Therefore, the main advantage of the industry-country level data is that it allows for a more plausible identification mechanism. A second advantage of the industry level data

[1] This identification strategy is similar to the studies that assume, for instance, an exogenous monetary policy for the countries in the euro area (Peersman 2004, Jiménez et al. 2012). The reason is that the individual eurozone countries are only a fraction of the euro area activity. Even a large country such as Spain represent only 10% of the eurozone output (Jiménez et al. 2012). Therefore, there is a common component in the monetary policy decisions that is exogenous to each individual country and allows for the identification of its effect on the national outcomes. The same identification mechanism is used for identifying the effect of international shocks such as energy and commodity shocks on small open economies, because small countries have little impact on large international markets. For instance, the UK is a small player in the world markets, so oil shocks are considered to be exogenous. Yet the UK represents 3.2% of the world GDP, 10 times larger than the median industry relative to national GDP.

is that the industries' heterogeneous characteristics and their differential capital needs can also inform about the channels in which macroprudential policies affect non-financial firms' activity (Rajan and Zingales 1998, 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 macroprudential policies' impact on a set of industries, but it does not analyse its total effect on economic activity.

This study combines data on real yearly growth at the industry-country level with national macroprudential policies for the period between 1990 and 2021. The industry-country data comes 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. This industry-country level dataset has been widely used in the economics and finance literature to document that some industries are more sensitive to financial development, recessions and sudden stops (Rajan and Zingales 1998, Braun and Larrain 2005, Cowan and Raddatz 2013). The macroprudential policies data comes from the integrated Macroprudential Policy (iMaPP) database, published by the International Monetary Fund (Alam et al. 2019). The iMaPP data gives a set of macroprudential tightening or easing measures for each country. I also use information on industries' external finance dependence (Rajan and Zingales 1998) to characterize the heterogeneous response across industries to the countries' financial policies. The reason is that companies that cannot fund their capital expenses using past earnings must resort to outside funds through banks or capital markets, being therefore more sensitive to financial shocks (Braun and Larrain 2005, Cowan and Raddatz 2013). Finally, I control for other macroeconomic factors that may influence both the macroprudential policy decisions and the industries' growth, such as real GDP growth, inflation, monetary policy and the level of GDP per capita.

I then obtain estimates of the macroprudential policies' effect on the industries' growth using simple linear methods. Due to the exogeneity assumption of countries' macroprudential policies in relation to the growth of the individual industries, there are several simple methods that can consistently estimate the policies' effect. In particular, I use a panel data framework with fixed effects for country-industry and time periods (Correia 2017) and controls for other macroeconomic factors. Other consistent estimates of the macroprudential policies' effect can be obtained using quantile regression methods for panel data (Machado and Santos-Silva 2019). Furthermore, I

also estimate the differential role of macroprudential policies in different environments using its interaction terms with the industries' external finance dependence, the countries' domestic credit to the private sector, and the stage of the business cycle. The interaction of the macroprudential policies with business cycle measures allows me to estimate whether its effect differs in slow versus strong growth periods or in tightening versus easing cycles. Furthermore, I analyse the strength of macroprudential policies across different country groups, such as advanced economies (AEs), emerging markets (EMs) and low-income countries (LICs).

The results show that macroprudential policies have a heterogeneous effect on the different industries. Industries with no need for external funds are not affected by the countries' macroprudential policy stance. This makes sense, as such industries can use their own funds to finance their capital and economic activity. However, I find that industries with high external finance dependence experience lower growth with macroprudential policy tightening measures. Industries differ substantially in their external finance dependence (Rajan and Zingales 1998). Therefore, for simplicity of exposition I explain the growth effects on the industries with full external finance dependence, that is, those industries that fund all capital expenses using external funds (either from banks or markets). For industries with full external finance dependence (i.e., industries that fund all its capital expenses with external funds) there is a loss in growth of 0.3% for each macroprudential policy introduced this year. This loss in growth has some persistence, since the coefficients for the lags of the macroprudential policies show that a similar 0.3% reduction in the growth rate persists after one and two years, with an accumulated loss in growth of 0.87% over three years.

Estimating the same model for different country types, I show that the effect is stronger for advanced economies (AEs). For advanced economies there is a reduction of 0.56% in the growth of fully externally dependent industries for each additional macroprudential policy in the current year. Even after two years the reduction in growth is still 0.4% for each macroprudential tightening measure. For fully externally dependent industries in emerging markets (EMs) there is a reduction in growth of 0.30% and 0.36% for each macroprudential tightening measure taken in the current year and in the previous year. However, after two years there are no longer effects on industrial growth in emerging markets (EMs), even for externally dependent industries. Over a three year period, fully dependent industries experience a loss in growth of 1.07% and 0.68% in an Advanced Economy and Emerging Market, respectively. The fact that prudential policies have a larger effect

in advanced economies whether in the first year or over three years may indicate that developed countries are faster and more efficient in implementing financial regulation.

The effect of the macroprudential policies differs through the business cycle. For each country I classify its years in terms of GDP growth, as being low (growth in the percentile 30 or below), high (growth equal or above the percentile 70), or middle growth (if between the percentiles 30 and 70). During periods of low national growth, for fully externally dependent industries there is a reduction in the growth of 0.35% for each macroprudential tightening measure taken in the current year. During periods of middle growth, for fully externally dependent industries there is a reduction in the growth of 0.80% and 0.50% for each macroprudential tightening measure taken in the previous year and two years before, respectively. For periods of high growth, for fully externally dependent industries there is a reduction in the growth of 0.38% for each tightening measure taken two years before. There is, therefore, a difference across the business cycle in terms of the intensity of the effect and of the duration of the macroprudential policies. In periods of low growth there is a significant effect, but which lasts only for the current period. In periods of middle growth, a significant effect does not start in the current year, but it is quite strong for one or two years later. In periods of high growth, there is a significant effect which appears only with a lag of two years.

I also measure the effect of macroprudential policies during banking crises, tightening versus easing periods, and across different quantiles of growth for each industry. Using the dates of Laeven and Valencia 2020, I show that during banking crises, macroprudential policies have a much stronger negative effect on the growth of externally dependent industries. The effect of macroprudential policies during banking crises is about 7 times larger than during non-crisis years. This result makes sense, since in those periods it is much harder for firms to get bank loans. The effects of macroprudential policy on industries' growth are shown to be stronger and more statistically significant during periods of macroprudential tightening. The effects are not statistically significant during easing periods, but this estimate could be due to the trend over the last 20 years showing lots of tightening periods and only one easing period which was during the Covid-19 pandemic. In terms of the growth of the individual industries (rather than the national GDP growth), the quantile regressions show that industries are more strongly affected during the median and higher growth periods, as measured by the percentiles 50, 75 and 90. This makes sense, since the median and higher growth periods of each industry require more investments and therefore the higher

demands for capital could be obstructed by tighter financial regulations.

During stress episodes such as the Covid-19 pandemic, I find that macroprudential policy tightening measures in the previous two years increases the growth of externally dependent industries. This is a sign that these policies can be positive in mitigating the negative impact of these episodes.

In terms of the channel for the macroprudential policy effects, I show that there is a strong role in terms of the loan restrictions. This is also confirmed in terms of more specific categories, which find a strong effect for both borrower and restrictions. I also find a specific role for loan-to-value limits, because these borrower restrictions may make it harder for some industries to offer collateral. Finally, I show that there is a strong role for capital requirements on financial institutions, which reduce the growth of fully externally dependent industries by 0.67% in the current year of being taken. Restrictions of general capital supply do not have an immediate effect, but these reduce the growth of fully externally dependent industries by 0.68% and 0.52% one and two years later. This can be due to the complexity of these regulations taking a longer time to come into full effect.

Finally, I complete the analysis of the channel of the macroprudential policies by showing that their effect is reduced with a stronger growth in the private credit of the country. This confirms that a big part of the effect is from a credit channel. Furthermore, I show that the macroprudential polices have a negative effect on the number of firm establishments, which can come either from a lower creation of new firms or by encouraging firm exit due to the difficulties in finding capital. The lack of capital may also reduce labor productivity, since there is a reduction in the average wage per worker of the industries with higher external finance dependence.

This paper is organized as follows. Section 2 reviews the literature and explains how this paper fits into previous findings. Section 3 describes the data sources and the empirical approach for determining the impact of macroprudential policies on industrial growth. Section 4 shows the main regressions. Section 5 summarizes how the results differ across the business cycle, different industrial growth quantiles, banking crises and tightening versus easing periods. Section 6 analyses the channel in which macroprudential policies act by studying different kinds of financial regulations, the effect of domestic credit growth, and the effect on establishments and workers. Finally, Section 7 concludes with a summary of the findings and its policy implications. The article also includes an online appendix with further robustness exercises.

2 Literature review

This section focuses on reviewing the empirical studies of macroprudential policies and therefore it is not an exhaustive review of this large field. Readers can refer to Galati and Moessner 2018, Elenev et al. 2021, Kim and Mehrotra 2022 and Biljanovska et al. 2023 for longer analyses of this literature, including the macroeconomic theory that supports regulation.

Macroprudential policies are increasingly used by both advanced and emerging economies, especially after the Great Financial Crisis (Galati and Moessner 2018, Alam et al. 2019). However, there is a significant endogeneity between regulators' policy decisions and the macroeconomic variables (Galati and Moessner 2018). This complicates finding a credible effect of macroprudential policies on economic activity, which is the main innovation in this article. The closest work to this study is the one by Alam et al. 2019, who estimate a small and statistically insignificant coefficient on real GDP growth. Previous works find a negative impact of macroprudential policies (MaPPs) on the growth of consumption (Alam et al. 2019, Teixeira and Venter 2023), housing prices, mortgages, total credit, household credit, corporate credit (Cerutti et al. 2017, Akinci and Olmstead-Rumsey 2018, Coulier and De Schryder 2024). However, only a few studies, such as Boar et al. 2017 and Alam et al. 2019, attempt to estimate prudential policies' impact on output. Most studies use GDP growth as an additional control variable that can influence credit growth but which is not an endogenous variable (Cerutti et al. 2017, Bruno et al. 2017, Akinci and Olmstead-Rumsey 2018).

One methodology for estimating the macroeconomic effects of macroprudential policies is to use panel vector autoregressions (VARs), as in Kim and Mehrotra 2022. Using panel VARs for 32 economies, Kim and Mehrotra 2022 find that macroprudential policies have broad macroeconomic effects in a similar way as monetary policy, with an impact on real GDP, inflation, residential investment and credit growth. However, the identification of the panel VARs depends on specific assumptions about which variables have contemporaneous versus lagged effects and the structure of the transmission of the shocks to each outcome.

The identification assumption in this article instead is focused on the exogeneity assumption of the macroprudential policies relative to individual industries,[2] which allows for a more reduced-form

[2] This identification strategy is similar to the macroeconomic studies that assume that international shocks are exogenous to small open economies (Peersman 2004).

estimation with simpler assumptions. Some studies use this assumption to identify the effect of macroprudential policies in micro-data of firms, but these studies often concentrate on relatively short periods of time such as a decade and are mostly limited to a specific country such as Spain (Jiménez et al. 2017), Brazil (Becker et al. 2021) or Chile (Madeira 2021). Using a survey of firms from the European Union countries, Ćehajić and Košak 2022 find that macroprudential policies strengthen the capitalization of the banking sector, but at the cost of reducing bank credit for firms, especially small enterprises. Some studies also consider the prudential policy effects on firms in a specific database such as Orbis (Ayyagari et al. 2018). However, the Orbis database is not representative of each country and industry, since it has very few firms from emerging markets, although it has a wide coverage for some European countries (Ayyagari et al. 2018). This article innovates by using a database such as UNIDO which covers equally many countries and a broad number of industries for a long period of time.

Other studies show that macroprudential policies can reduce bank risk (Claessens et al. 2013, Altunbas et al. 2018), the probability of banking crises (Nakatani 2020, Belkhir et al. 2022) and the chances that credit booms end badly (Dell'Ariccia et al. 2012). Some studies analysed the macroprudential policies' effect on capital flows (Andrikopoulos et al. 2023), spillovers to other countries (Buch and Goldberg 2017) and international bank lending (Bussière et al. 2021).

This article is related to the literature documenting unintended costs from prudential policies (Mendicino et al. 2020). Some studies find prudential policies are positively correlated with inequality (Frost and van Stralen 2018, Teixeira 2023), reduced access to bank finance (Ćehajić and Košak 2022) and an increase of non-bank credit (Cizel et al. 2019, Hodula and Ngo 2024).

Finally, this paper complements the literature that shows how external finance dependent industries are more strongly affected by financial development (Rajan and Zingales 1998, Claessens and Laeven 2003, Raddatz 2006), recessions (Braun and Larrain 2005), banking crises (Kroszner et al. 2007), sudden-stops (Cowan and Raddatz 2013) and capital flows (Alfaro et al. 2017, 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, Laeven and Valencia 2020).

3 Data and empirical approach

3.1 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 from 1963 onwards. It comprises data on 23 manufacturing industries. Industrial growth is measured by the log increase in the Index of Real Industrial Production (IIP), $g_{i,c,t} = \ln(\frac{IIP_{i,c,t}}{IIP_{i,c,t-1}})$, which accounts for sector-specific prices. The data is unbalanced, with some countries-industries reporting missing data in several years.

The UNIDO data is then matched with country level data for the macroprudential policies of 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) for each country since 1990.

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 ($TPI_{c,t} = \sum_{k=1}^{K} PP_{c,t}^{k}$), which is the sum of the 17 macroprudential policies for a given period.

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 (89). 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 (29): Algeria, Argentina, Belarus, Bosnia, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Hungary, Kuwait, Lebanon, Malaysia, North Macedonia, Mauritius, Mexico, Oman, Peru, Poland, Romania, Russian Federation, Serbia, South Africa, Thailand, Trinidad and Tobago, Turkey, Uruguay.
Low-income countries (25): Albania, Armenia, Burundi, Ecuador, Fiji, Honduras, India, Indonesia, Jamaica, Jordan, Kyrgyzstan, Lao, Moldova, Mongolia, Morocco, Nepal, Pakistan, Paraguay, Philippines, Senegal, Sri Lanka, Tunisia, Vietnam, Ukraine, Zambia.

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

$Share_{i,c,t}$	min	p10	p25	p50	p75	p90	max	min	p10	p25	p50	p75	p90	max
	Total manufacturing over GDP							Largest national industry over GDP						
All countries	1.2	6.3	9.7	12.7	17.6	21.4	31.5	0.4	1.4	2.0	2.8	3.5	4.9	14.6
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
EMs	3.7	7.2	10.9	12.8	17.9	21.6	26.8	1.2	1.9	2.2	2.8	3.5	4.5	7.0
LICs	5.9	7.1	8.6	12.6	14.9	18.8	26.1	1.0	1.9	2.7	3.1	4.1	4.9	9.9

Individual industries value-added as a share of GDP in 2019 and correlation of the individual industries' real growth with real GDP growth during 1990-2021 (in %):

$Share_{i,c,t}$	p10	p25	p50	p75	p90	p95	p99	min	p10	p25	p50	p75	p90	p95
	Individual manufactures over GDP							Correlation with GDP growth						
All countries	0.04	0.11	0.32	0.74	1.51	2.29	4.16	-73.3	6.4	27.7	48.4	66.1	77.8	83.5
AEs	0.04	0.14	0.37	0.80	1.55	2.06	3.90	-65.2	12.6	33.6	52.1	67.2	78.3	82.6
EMs	0.05	0.13	0.33	0.76	1.58	2.32	4.32	-69.4	12.8	32.2	54.7	69.4	80.2	84.5
LICs	0.03	0.08	0.23	0.57	1.25	2.44	4.27	-73.3	-12.3	11.9	31.6	52.3	69.1	82.0

Furthermore, I also separate the Total Prudential Policy Index into 6 subsets of policies: i) Borrower restrictions (the net sum of LTV and DSTI); ii) Lender restrictions (the net sum of LCG, LLP, LoanR, LTD, LFC); iii) All loan restrictions (the net sum of both borrower and lender restrictions); iv) General supply requirements (the net sum of RR, Liquidity, LFX); v) Capital

requirements (LVR, CCB, Conservation, Capital); vi) Supply, capital and other requirements (the net sum of General supply requirements, Capital requirements, plus SIFI, Tax, Other). The idea of the first three policy subsets is to test the different effects from policies that affect only loans versus policies that affect borrowers differently from lenders. The policy subset of General supply requirements includes policies that restrict banks' activities, such as liquidity restrictions, reserve requirements and limits to foreign exchange exposures. The policy subset of Capital requirements includes only policies that increase the minimum requirements for bank capital or which limit leverage. Finally, the policy subset Supply, capital and other requirements includes both the restrictions on banks' activities, the requirements on bank capital, plus other prudential policies (such as SIFI mitigation measures or additional capital, taxes on financial activity, and requirements such as stress testing, restrictions on dividends and limits to inter-bank exposures).

Furthermore, the article uses the External Finance Dependence measure (EFD_i) for the industries obtained from the classic paper of Rajan and Zingales 1998. This variable represents the fraction of capital expenditures of the median firm in industry i that is not financed with cash-flow: (capital expenditures-cash-flow)/capital expenditures. Rajan and Zingales 1998 computed these values for the US firms in Compustat between 1980 and 1989, because the US companies are active in a country with lower financial constraints and at the top of the technological frontier. This measure of external finance dependence for the industries at the international level has been used in several papers in the recent decades, such as Claessens and Laeven 2003, Braun and Larrain 2005 or Cowan and Raddatz 2013, among others. Furthermore, using the External Finance Dependence index estimated in the 1980s gives us a predetermined measure of the exogenous financial demands of each industry, since this variable is not affected by the macroprudential policies adopted from 1990 onwards.[3] Note that including industry-country fixed effects can correct for the unobserved heterogeneity that may exist in industries across different countries (Claessens and Laeven 2003).

The total matched dataset of the UNIDO Industrial data plus the iMaPP database, the External Finance Dependence index and the additional controls gives us an industry-country-time panel dataset with annual frequency for the period 1990 until 2021.

Table 1 summarizes the list of industries and countries available in the dataset. This study

[3] For instance, a financial crisis such as the 2007-2009 period could affect both capital expenditures and cash-flow. Using the variable for the 1980-1989 period makes the External Finance Dependence regressor exogenous.

comprises 89 countries, including 35 advanced economies, 29 emerging markets and 25 low-income countries.[4] The median country produces just 12.7% of its GDP from the manufacturing sector. Even the most industrialized economy has a manufacturing sector below 31.5% of the GDP. Advanced economies differ in industrial composition from other countries, because they have more industries with a higher external finance dependence, while the low-income countries have the least of such industries (Madeira 2020, Rajan and Zingales 1998). This result makes sense, since less financially developed economies are less likely to specialize in industries that require more funding. The data shows that even the largest industry of each country is quite small. The largest industry of the median country produces just 2.8% of the GDP. Less than 10% of the countries have an industry that represents more than 4.9% of the GDP. No country has an industry that represents more than 14.6% of the GDP. Finally, Table 1 shows that the median industry produces just 0.32% of the GDP and has a correlation of just 48% with the national real GDP growth. Even the largest industries, as expressed by the percentile 95, represent just 2.29% of the GDP and have a correlation coefficient of 83.5% with real GDP growth, which is still far less than perfect correlation. Therefore, the assumptions required for the identification mechanism in this article are valid: i) all industries are small (the median industry represents just 0.32% of the GDP) and not the main concern of the national authorities; ii) the industries are not similar to a "representative firm" agent and have a correlation with real GDP growth that is less than 48.4%.

3.2 Empirical approach

The empirical approach consists of exploiting the differential behavior of each industry in countries and time periods with different macroprudential policies. 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, using an additive-linear form:

1) $g_{i,c,t} = \sum_{l=0}^{L}(\beta_l MacroPru_{c,t-l} + \gamma_l EFD_i \times MacroPru_{c,t-l}) + \alpha Share_{i,c,t-1} + \delta x_{c,t} + f_{i,c} + f_t + \varepsilon_{i,c,t}$,

[4] Low income countries are defined as countries that have an average GDP per capita for the period 2011-2021 that is lower than 11,000 USD (in constant 2017 prices). Some exceptions are made for large economies that are traditionally classified as emerging markets instead (Cerutti et al. 2017).

with $MacroPru_{c,t}$ denoting a measure of the macroprudential policies of 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,[5] $f_{i,c}$ 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 model also considers that there could be lags between 0 to L years ($l = 0, 1, .., L$) in the effects of macroprudential policies on industry growth. The coefficients β_0 and γ_0 give the effect of the macroprudential policies for the current year. The sums $\sum_{l=0}^{L} \beta_l$ and $\sum_{l=0}^{L} \gamma_l$ give the prudential policy effect over a period of L years.

For the vector of time-varying controls $x_{c,t}$, I consider macroeconomic variables such as the log of the income per capita ($\ln(GDP_{c,t}^{PPP,pc})$), inflation rate ($inflation_{c,t}$), the real GDP growth ($g_{c,t}^{GDP}$), the monetary policy rate ($MPR_{c,t}$) and a dummy for whether the country is in a zero lower bound year ($ZLB_{c,t}$). In the case of the inflation and GDP growth rates, I will consider model estimates with just the values observed in the previous year ($t-1$) and also with values for the current year (t) to account for other confounding that may influence authorities' decisions. I also account for the monetary policy decisions ($MPR_{c,t}$, $ZLB_{c,t}$), because monetary policy is often undertaken by the same authority as the financial regulator (i.e., the central bank). Therefore, this helps to control for confounding effects as monetary policy cycles may coincide with the prudential policy actions and are influenced by the same authorities. Furthermore, in the online appendix I will also consider other controls as robustness checks, such as the quality of the countries' institutions (which is highly correlated with the GDP per capita).

This panel data model is quite similar to past studies that show the effects on industries of recessions (Braun and Larrain 2005), banking crises (Kroszner et al. 2007) or sudden-stops (Cowan and Raddatz 2013). The main difference is that I am using the countries' macroprudential policies index instead of a recession or crises dummy. A second difference is that I am considering lags for the prudential policies in the previous years and not just for the current period. In the next sections I will show model estimates with just contemporary effects and no lags (i.e., with just $l = 0$), current effects and one lag ($l = 0, 1$) and lags up to two years ($l = 0, 1, 2$). The estimation will be performed using the Correia 2017 estimator for models with a large number of fixed effects,[6]

[5] This variable is used in previous studies to account for larger and more developed industries growing gradually less over time (Claessens and Laeven 2003, Braun and Larrain 2005, Kroszner et al. 2007, Cowan and Raddatz 2013).

[6] The standard Stata commands xtreg or reg with industry-country and time fixed effects give exactly the same

using industry-country clusters and time dummies.

Furthermore, I also consider models with further interactions as robustness exercises or for determining how the effect of macroprudential policies differs over time:

2) $g_{i,c,t} = \sum_{l=0}^{L}(\beta_l MacroPru_{c,t-l} \times S_{c,t} + \gamma_l EFD_i \times MacroPru_{c,t-l} \times S_{c,t}) + \alpha Share_{i,c,t-1} + \delta x_{c,t} + f_{i,c} + f_t + \varepsilon_{i,c,t}$,

with $S_{c,t}$ being the variable that interacts with the effect of the macroprudential policies. $S_{c,t}$ can include variables for the business cycle (for instance, dummies of high, middle and low growth), domestic credit growth, banking crises or special periods such as the Covid pandemic. Finally, the regression models are estimated for the entire country sample and for country groups, such as advanced economies, emerging markets and low-income countries.

I also consider several options for the measure of macroprudential policies of each country c, $MacroPru_{c,t}$, which can denote just a single variable or a vector of variables. The name $MacroPru_{c,t}$ is a general term for several potential variables that can be possible measures of the macroprudential framework of the countries. In general, the article will use as its main macroprudential measure a variable called Total Prudential Policies Index, $TPI_{c,t}$, which corresponds to the net sum of the tightening measures taken by country c in year t across 17 different types of regulation affecting borrowers or financial firms. This measure is described in more detail in the iMaPP database (Alam et al. 2019), but it will also be summarized in the next subsection. $TPI_{c,t}$ is a sum of dummy indicators of policy actions, with +1,0,-1, denoting tightening (i.e., a measure implying more restrictive credit or financial conditions), no change and easing actions, respectively:

3) $TPI_{c,t} = \sum_{k=1}^{K} PP_{c,t}^{k}$,

with $PP_{c,t}^{k}$ being the prudential policy indicator with action values +1,0,-1, for the policy type k on a range of $K = 17$ types of prudential policy. I also consider a Cumulative Total Prudential Policies Index, which corresponds to the net stock of all policies since the starting year of the data:

4) $CumulativeTPI_{c,t} = \sum_{h=1990}^{t} TPI_{c,h} = \sum_{h=1990}^{t} \sum_{k=1}^{K} PP_{c,h}^{k}$.

coefficient estimates and almost exactly the same standard errors as the Correia command. The reg command sometimes gives small differences in the standard errors, even if the coefficients are the same as the other commands.

This cumulative measure is similar to the one used by Akinci and Olmstead-Rumsey 2018 to summarize the macroprudential policy stance. Furthermore, the model specifications in equations 1) and 2) can denote the case in which the macroprudential policy variable is a vector. In particular, the empirical estimates in the next section will consider the case in which $MacroPru_{c,t}$ is set as the Total Prudential Policies Index, $TPI_{c,t}$, and with lags of the policies taken up to two years before, $l = 0, 1, 2$. I also consider the case with the policy vector $MacroPru_{c,t} = (TPI_{c,t}, CumulativeTPI_{c,t-1})$. This vector does not consider lags, because the cumulative policy index for the previous year is a proxy for the macroprudential policies taken in the previous years.

Furthermore, I also consider indexes which sum only a subset of the policy measures K:

5) $MacroPru_{c,t} = \sum_{k \in P} PP^{k}_{c,t}$,

with P being a subset of the policies $k = 1, .., K$. The article focuses on 6 different subsets of policies: Borrower restrictions, Lender restrictions, All loan restrictions, General supply requirements, Capital requirements, and the sum of Supply, capital and other requirements.

I also consider the average Loan to Value ratio of country c in year t, $LTV_{c,t}$, as an alternative measure of the macroprudential stance. This variable has the advantage that it is a continuous measure of the intensity of the macroprudential regulations (Alam et al. 2019), while the previous indexes are simply a counting of the net sum of tightening measures. This means that the previous indexes cannot account for some countries taking more gradual decisions with several small steps, while other countries decide to make bigger adjustments. The previous indexes also cannot account whether some countries may decide to take two small tightening measures and then one larger easing action. Although the Loan to Value ratio affects mostly the households, there are several companies that resort to mortgages and real estate collateral to approve their loan applications.

Table 2 summarizes all the variables used in this article and their sources, except for the variables which are left for robustness exercises in the online appendix. All the datasets used in this article are publicly available and free of cost. Interested researchers can find the Stata codes that replicate all the analysis of this article and its online appendix in Mendeley Data: https://data.mendeley.com/datasets/r5g3zty39p/1 .

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
$TPI_{c,t}$	Total prudential policies index: the net sum of the macroprudential tightening measures taken by country c in year t (the sum includes 17 different types of regulation affecting borrowers or financial firms)	iMaPP (IMF)
$CumulativeTPI_{c,t}$	Cumulative total prudential policies index: net sum of all tightening macroprudential measures taken by country c since 1990 until year t	iMaPP (IMF)
$LTV_{c,t}$	Mean regulatory mortgage Loan to Value of country c in year t	iMaPP (IMF)
Borrower restrictions$_{c,t}$	Net sum of borrower prudential policies (LTV and Debt Service to Income (DSTI)) taken by country c in year t	iMaPP (IMF)
Lender restrictions$_{c,t}$	Net sum of lender prudential policies (LCG, LLP, LoanR, LTD, LFC) taken by country c in year t	iMaPP (IMF)
All loan restrictions$_{c,t}$	Net sum of all loan (borrower plus lender) prudential policies taken by country c in year t	iMaPP (IMF)
General supply requirements$_{c,t}$	Net sum of financial services supply prudential policies (RR, Liquidity, LFX) taken by country c in year t	iMaPP (IMF)
Capital requirements$_{c,t}$	Net sum of capital requirement measures (LVR, CCB, Conservation, Capital) taken by country c in year t	iMaPP (IMF)
Supply, capital & other req.$_{c,t}$	Net sum of general supply, capital requirements & other prudential policies (SIFI, Tax, Other) taken by country c in year t	iMaPP (IMF)
$MPR_{c,t}$	Monetary policy rate of country c in year t (mean yearly value)	IMF & BIS
$ZLB_{c,t}$	Dummy with value 1 for whether $MPR_{c,t} \leq 0.5\%$	IMF & BIS
$GDP_{c,t}^{PPP,pc}$	GDP per capita of country c in year t (2017 USD in PPP)	World Bank
$g_{c,t}^{GDP}$	Real GDP growth rate of country c in year t	World Bank
$inflation_{c,t}$	Consumer Price Index inflation of country c in year t	World Bank
$DomesticPrivate CreditOverGDP_{c,t}$	Domestic credit to private sector (% of GDP)	World Bank
$BankingCrises_{c,t}$	Dummy indicator with value 1 if country c in year t is facing a banking crisis, 0 otherwise (Laeven and Valencia 2020)	Laeven & Valencia
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)

3.3 Robustness checks to the main methodology

The article also includes several robustness exercises, besides the main models. One test is for checking one of the main assumptions of the model, regarding the exogeneity of financial policies relative to the individual industries. This assumption is validated by Table 1 in this article, which confirms that: i) the industries are small (the median industry represents 0.32% of the GDP); ii) the industries are not representative agents and the median industries' correlation with GDP growth is just 48%; iii) the industries do not include any of the sectors that are direct concerns of regulators, such as construction sector or financial services. The figure in the online appendix A shows the distribution of industries by size as a fraction of GDP and correlation with GDP growth, confirming the arguments that the industries are small and not representative agents of the economy. Table A.1 then shows the results of a regression that tests whether the industrial growth in the past can predict the macroprudential policies in the current year, estimating:

6) $MacroPru_{c,t} = \beta(\ln(GDP_{c,t}^{PPP,pc}), inflation_{c,t}, g_{c,t}^{GDP}, inflation_{c,t-1}, g_{c,t-1}^{GDP}) + \gamma MacroPru_{c,t-1} + \sum_i \beta_i g_{i,c,t-1} + \alpha_c + \alpha_t$.

The results show that there are few industries correlated with the current macroprudential policy decisions, either $TPI_{c,t}$ or $LTV_{c,t}$. The only positive industry coefficients are for the "Tobacco products", "Chemicals and chemical products" and "Non-metallic mineral products". Furthermore, these coefficients (although statistically significant) are very small, with values below 0.05 in absolute value. In the case of the regressions for Loan to Value, the coefficient for the lagged growth of the "Office, accounting and computing machinery" industry. This regression is another confirmation that the analysis in this article is estimating an effect of prudential policies on industrial growth and not the other way around, because lagged industry growth either has no effect on prudential policies or it has a very small effect in the case of three industries ("Tobacco products", "Chemicals and chemical products", "Non-metallic mineral products").

As a robustness check, I estimate quantile regressions, which show the effect of the macroprudential policies on different quantiles of the industrial growth. This estimates the effect of macroprudential policies on periods of median growth for industry i in country c (which would be the quantile 50), periods of lower growth (quantiles below 50) or higher growth (such as the quantiles 75 or

90). In general, the quantile regression estimators do not have derivatives and may be inconsistent with the inclusion of large numbers of ancillary parameters such as fixed effects. For this reason, I use the quantile regression with fixed effects (QR-FE) estimator of Machado and Santos-Silva 2019, which is valid under some regularity assumptions imposed on the conditional moments. The fixed effects will again be the industry-country pairs. This estimator is not valid when there is a second set of ancillary variables, such as time dummies, that grows to infinity. Therefore, for the QR-FE estimator, I consider only dummy variables for certain periods, such as dummies for the Great Moderation (1991-2006), Great Financial Crisis (2007-2009), European Sovereign Debt Crisis (2010-2014) and Covid-19 Pandemic (2020-2021). These regressions are shown in Table 7 of this article for the quantiles 50, 75 and 90 (the quantiles with median and high industrial growth) and in Table A.3 of the online appendix for the quantiles 10 and 25 (for low industrial growth).

Another robustness check is to estimate the regressions with different combinations of macroeconomic controls. Table A.2 of the online appendix considers just controls for the previous year's macroeconomic factors (inflation and GDP growth) and adds the current year's as well. Those regressions also show that the results remain similar even if we exclude the controls for the current monetary policy.

The main article's estimation does not consider lags of the endogenous variable of industrial growth, $g_{i,c,t}$, for two reasons. The first reason is that it makes it easier to interpret the effect of the macroprudential policies and its lags on the industrial growth, since the lag of the growth variable implies an endogenous dynamic that can accumulate for several periods. The second reason is that the combination of the lagged dependent variable with the fixed effects implies an inconsistency of the traditional least squares estimator. This problem would therefore require instrumental variables for the lagged dependent variables, under the form of older lags in levels (Blundell and Bond 1998) or first-differences (Arellano and Bond 1991). In the online appendix, I show a robustness check of the main model using the Arellano and Bond 1991 estimator. The results (in Table A.4 of the online appendix) show a small and insignificant autoregressive coefficient with a value of just -0.0131, which would support the main analysis discussed in this article. The Blundell and Bond 1998 estimator can be used for cases in which the autoregressive component of the dependent variables is too large. Since the estimated coefficient is so close to zero, then it would seem to be preferable to use the Arellano and Bond 1991 estimator. However, the interested readers can also see model estimates obtained with the Blundell and Bond 1998 estimator in an older working paper

version of this article (Madeira 2020). This working paper version estimates a similar model for the period 1990 to 2016, using the Blundell and Bond 1998 estimator to instrument for the endogenous lagged variable. The results in that exercise are broadly similar to the ones in the traditional least squares estimates and show a high statistical significance of macroprudential policies to affect the industrial growth of industries with a high external finance dependence.

In the online appendix I also show several exercises with alternative measures of external finance dependence, such as: i) the measure obtained by Kroszner et al. 2007 for the period 1980 to 1999; ii) the measure from Lo Turco et al. 2019 for the period 1990-2007; iii) the measure by Villani 2021 for the period 2010-2015; iv) the average Kaplan-Zingales index of financial constraints (which considers leverage, the Tobin-Q ratio of market value over book assets cost, cash-flow, cash balances and dividends) for the period 2010-2017 (Hadlock and Pierce 2010), which was generously shared by professor Joshua Pierce. Furthermore, I also consider exercises that apply a simpler indicator of external finance dependence with values -1, 0 and +1 according to whether the industries are in the lower or higher values of the variable. This type of indicator considers that there could be measurement error for the exact value of external finance dependence, but that at least the general ranking or classification of the industries should be correct (Igan et al. 2022). The results of these robustness exercises are shown in Tables B.1, B.2, B.3 and B.4 of the online appendix. These tables show that all the measures of external finance dependence are highly correlated with the classic Rajan and Zingales 1998 variable and that the results are qualitatively similar to the main article.[7]

Finally, there is another argument that supports the broad findings of this article. As Hausman 2001 demonstrates, in the presence of measurement error the estimated coefficients always tend

[7] Table B.1 details the different measures of External Finance Dependence and their sources. Note that the Worldscope data used by Villani 2021 has fewer US companies than the Compustat dataset used by Rajan and Zingales 1998, Kroszner et al. 2007, Lo Turco et al. 2019. Therefore, the measure of Villani 2021 has a higher standard error and could be more noisy, often with numbers above one in absolute value.

Table B.2 shows that all these measures have a high correlation with the standard Rajan and Zingales 1998 variable.

Table B.3 shows that the article's results are robust to using: i) indicator variables (-1,0,+1) of the external finance dependence; ii) the External Finance Dependence measure of Villani 2021 for the period 2010-2015; iii) the Kaplan-Zingales financial constraints measure for the period 2010-2017 (Hadlock and Pierce 2010).

Table B.4 shows that the results are robust to using the External Finance Dependence measures for the period 1980-1999 (Kroszner et al. 2007) and for the period 1990-2007 (Lo Turco et al. 2019).

to be smaller than the true values. Consider the linear model estimator of $\hat{\beta} = \frac{Cov(Y,X+\varepsilon)}{Variance(X+\varepsilon)} = \frac{Cov(Y,X)}{Variance(X+\varepsilon)}$ where the observed control variable is measured with error relative to the true variable X. If the measurement error is uncorrelated with the dependent variable, then the numerator of the coefficient would be the same and the denominator with the variance of the control variable would be larger. This gives smaller estimates than the true coefficients. Therefore, finding significant coefficients even in the presence of mismeasured control variables still indicates that there must be a true effect of the variable, since the measurement error pushes against that result.

In this article, possibly the measure of external finance dependence is only a proxy for the true finance needs of the industries. In the same way, it is possible that the different macroprudential policy indexes are only an imperfect proxy for the true strictness in the financial regulation of the country, since some indexes are a simple net sum of tightening versus easing measures. Furthermore, several factors can influence the application of financial regulations, since some authorities may have imperfect enforcement of the laws due to a lack of administrative resources. However, in both of these cases of measurement error for the external finance dependence and the macroprudential policies, the econometric theory argues that the existence of measurement error goes against the results either in size or statistical significance (Hausman 2001). Therefore, the results in this article can be adequately taken as representing a true qualitative effect, even if imperfectly measured.

Finally, I consider an additional robustness check that includes country-year dummies. In general, the effect of macroprudential policies ($MacroPru_{c,t}$) by itself is not identified with an inclusion of a full set of country-year dummies, since the macroprudential policy is the same for the entire country and does not differ across industries. However, since the industries are heterogeneous in terms of external finance dependence, then the effect of the macroprudential policies is heterogeneous across industries and therefore the coefficient for the interaction $EFD_i \times MacroPru_{c,t-l}$ is identified. This allows for the estimation of a model with a full set of both industry-country and country-time fixed effects:

$$7)\ g_{i,c,t} = \sum_{l=0}^{L}(\gamma_l EFD_i \times MacroPru_{c,t-l}) + \alpha Share_{i,c,t-1} + f_{i,c} + f_{c,t} + \varepsilon_{i,c,t}.$$

Note also that this model cannot identify the effect of any country-time vector such as $x_{c,t}$, because any variables that are common to the country in a single year are captured by the country-year fixed effect. This means that this model cannot identify the effect of any country

time-varying variable, such as income per capita, inflation, GDP growth and monetary policy. Therefore, this estimation can only identify the effects of the interaction of macroprudential policies with the industrial external finance dependence ($EFD_i \times MacroPru_{c,t-l}$) and of the share of each industry in the value-added of manufacturing ($Share_{i,c,t-1}$). Note also that this model is estimating the effect of the macroprudential policies on industries' growth in relation to a hypothetical industry that has zero external finance dependence.[8]

4 Main results

4.1 Evolution of the macroprudential policies since 1990 across country types

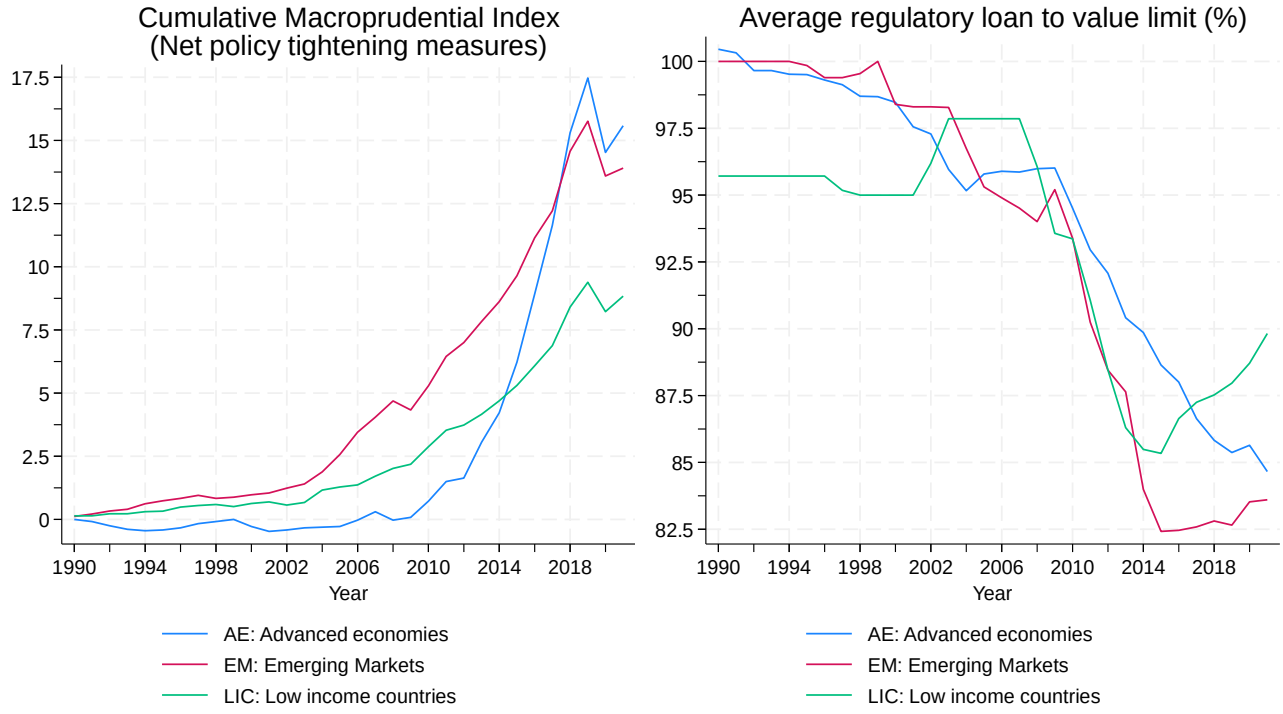
This section starts with a brief overview of the evolution of the macroprudential policies across the different countries since 1990. This helps to give a sense of the regulatory cycle that will help identify the industrial growth effects in the panel data of industries-countries-years.

Figure 1 shows the evolution of the Cumulative Total Prudential Policy Index ($CumulativeTPI_{c,t}$) and Loan to Value (LTV) across the country types until 2021. Both variables show that all the country groups (AEs, EMs, LICs) tightened their policies substantially since 1990. Note that for the loan-to-value (LTV) a lower index corresponds to a tighter policy. In terms of the Cumulative Total Prudential Policy Index ($CumulativeTPI_{c,t}$), the advanced economies eased their policies slightly in the early 1990s and again between 1999 and 2005. In 2006 all the country types started a tightening cycle, which was slow at first and was briefly paused between 2007 and 2009. After 2009 all the country types show a sharp tightening trend that lasted until the Covid pandemic in 2020, which saw the country groups ease their prudential policies significantly in 2020. The country groups tightened again their policies slightly in 2021 as the world recovered from the pandemic.

In terms of country group differences, emerging markets tightened their prudential frameworks substantially more than other countries until 2007. Emerging markets had substantially tighter frameworks (relative to 1990) than the advanced economies until 2016. The advanced economies

[8] An alternative interpretation of the coefficients is that the model implicitly assumes that the growth effect of the prudential policies on the industries with zero external finance dependence is null or unidentified.

Figure 1: Cumulative macroprudential policy stance across country groups (1990-2021)



started tightening their regulations after 2009, surpassing the tightening stance of low-income countries in 2014 and again surpassing emerging markets' regulatory stance in 2017.

All the country groups tightened their Loan to Value regulations until 2000. However, the low-income countries (LICs) eased their mortgage regulations between 2000 and 2007. Perhaps this choice was due to these countries having substantially more restrictive policies than the advanced economies and emerging markets during the 1990s. The advanced economies and emerging markets tightened their Loan to Value between 2000 and 2005. After 2010 all country groups lowered their LTV levels substantially, with regulatory Loan to Values dropping from around 90% in 2010 to levels below 90% in 2015. Emerging markets was the country group with the strongest tightening and reached an average Loan to Value of 82.5% after 2015. Advanced economies kept tightening their Loan to Value during the entire 2010's decade, reaching a value around 85% in 2019, just before the pandemic. On the contrary, low-income countries eased their mortgage regulations after 2015, increasing their Loan to Value from 85% to almost 90% in 2021.

This section shows that all the country groups presented three different periods, according

to their Cumulative Prudential Policy Index: a very stable regulatory framework during the 1990s until the Great Financial Crisis in 2007, an increasingly tight regulatory stance after 2009, although with a substantial easing during the Covid pandemic in 2020. The Loan to Value regulations were tightened substantially between 2010 and 2015 across all the country groups, although the advanced economies persisted in tightening further their mortgage restrictions until 2021.

4.2 Effects of the prudential policies according to the external finance dependence

This subsection has the main results of the article. Table 3 shows the results with three alternative of the macroprudential vector: i) both the current and the cumulative prudential indexes ($TPI_{c,t}$, $CumulativeTPI_{c,t-1}$); ii) just the current prudential index, $TPI_{c,t}$; iii) the current index ($TPI_{c,t}$) and up to two years of lag ($TPI_{c,t-1}$, $TPI_{c,t-2}$). All regressions control for the current monetary policy decisions ($MPR_{c,t}$, $ZLB_{c,t}$), for the macroeconomic factors of the previous year ($inflation_{c,t-1}$, $g^{GDP}_{c,t-1}$) and the current year ($inflation_{c,t}$, $g^{GDP}_{c,t}$). The current and previous year's macroeconomic factors help to control for confounding variables (which influence both the prudential decisions and the industrial growth). The monetary policy variables control for other measures that may also represent confounding factors for the prudential policies, especially since in many countries the central bank and the financial regulator are the same institution.[9]

For industries that can fund their activities without external funds (that is, industries with an external finance dependence of zero or negative), then the effect of the current macroprudential policies ($TPI_{c,t}$) on industrial growth is found to be positive. This result can be interpreted in terms of an improvement of the prudential management for financial stability, in which the economic outlook improves due to the prudential restrictions on excessive credit.

[9] Note that including the current monetary policy variables implies a loss in terms of the number of observations. The reason is that not all the countries started the 1990s with a fully developed monetary policy framework and therefore some less developed economies do not have statistics for the monetary policy rate for the earliest years in the dataset. However, Table A.2 of the online appendix shows that the results remain similar even if monetary policy ($MPR_{c,t}, ZLB_{c,t}$) or the current year's macroeconomic factors ($inflation_{c,t}, g^{GDP}_{c,t}$) are excluded from the controls.

Table 3: Effects on industries' growth of macroprudential policies, with controls for monetary policy: Panel OLS-FE

Controls	(1)	(2)	(3)	(4)	(5) Period 1991-2019	(6) with $LTV_{c,t}$
$TPI_{c,t}$	0.148**	0.148**	0.142**	0.146**	0.0781	
	(0.0579)	(0.0579)	(0.0595)	(0.0593)	(0.0689)	
$TPI_{c,t-1}$			-0.000259	-0.0139		
			(0.0595)	(0.0618)		
$TPI_{c,t-2}$				0.0894		
				(0.0776)		
$CumulativeTPI_{c,t-1}$	0.0140				0.0238	
	(0.0233)				(0.0260)	
$LTV_{c,t}$						-0.0352**
						(0.0170)
$TPI_{c,t} \times EFD_i$	-0.343***	-0.340***	-0.287**	-0.290**	-0.308**	
	(0.123)	(0.123)	(0.124)	(0.124)	(0.152)	
$TPI_{c,t-1} \times EFD_i$			-0.295**	-0.228*		
			(0.124)	(0.127)		
$TPI_{c,t-2} \times EFD_i$				-0.347**		
				(0.170)		
$CumulativeTPI_{c,t-1}$	-0.0438				-0.102**	
$\times EFD_i$	(0.0373)				(0.0442)	
$LTV_{c,t} \times EFD_i$						0.109**
						(0.0477)
$ShareManVA_{i,c,t-1}$	-0.240***	-0.246***	-0.242***	-0.245***	-0.246***	-0.226***
	(0.0503)	(0.0502)	(0.0507)	(0.0516)	(0.0515)	(0.0533)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-4.018***	-3.954***	-4.079***	-3.936***	-3.851***	-4.710***
	(0.898)	(0.838)	(0.843)	(0.854)	(0.980)	(0.844)
Other controls:						
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
N	31,313	31,526	31,313	30,979	28,856	27,623
R^2 (overall)	0.247	0.247	0.247	0.247	0.232	0.288

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and year (omitted).

A second interpretation for the positive effect of the variable $TPI_{c,t}$ is that financial authorities could decide to implement the macroprudential tightening in a period in which growth is accelerating or decide to ease when growth is falling. One result supporting this interpretation is that in the models that control for the prudential index in the previous year ($TPI_{c,t-1}$) or in the previous two

tears ($TPI_{c,t-1}$, $TPI_{c,t-2}$), the estimates show that the past prudential policies have a value that is very close to zero, both in terms of size and statistical significance. Note also that a regression that excludes the Covid pandemic period (column 5 of Table 3) shows that the current effect of macroprudential policies on industrial growth of the industries without external finance dependence is close to zero and statistically insignificant. This regression supports the idea that the statistical significance of $TPI_{c,t}$ could be an artifact of a missing confounding variable, such as a simultaneous drop in growth and an easing of prudential policies during the pandemic. Furthermore, the regressions for the period 1990-2016 show that this coefficient is small and statistically insignificant after accounting for current and past macroeconomic factors (Madeira 2020).

Other robustness checks confirm that the positive coefficient for $TPI_{c,t}$ is explained by a confounding factor with the Covid pandemic period. I re-estimated the regressions with the interaction variables $S_{c,t} = (Constant, CovidPandemic_t)$, as formally described in equation 2). Here the $CovidPandemic_t$ is a dummy with value one for the period 2020-2021. The results in Table C.1 of the appendix confirm that the variable $TPI_{c,t}$ had a small and statistically insignificant coefficient before the pandemic period. Furthermore, I estimate a model with interactions for several periods, $S_{c,t} = (Constant$, Great Moderation$_t$, Great Financial Crisis$_t$, Sovereign Debt Crisis$_t$, Covid Pandemic$_t$), with the Great Moderation, Great Financial Crisis, Sovereign Debt Crisis and Covid-19 Pandemic variables representing dummies for the periods 1990-2006, 2007-2009, 2010-2014 and 2020-2021, respectively. The results are shown in Table C.2 and again confirm that the coefficient for $TPI_{c,t}$ is not significant after accounting for the Covid pandemic.

Table 3 also shows that externally dependent industries (that is, those with EFD_i above zero) have a significantly lower growth than the other industries in years of macroprudential policy tightening ($TPI_{c,t} > 0$). This result makes sense and it fits well with previous literature showing that these industries are more sensitive to financial development (Rajan and Zingales 1998, Claessens and Laeven 2003) and to negative events such as recessions or sudden stops (Braun and Larrain 2005, Cowan and Raddatz 2013). Very importantly, the regressions show that this negative effect on the growth of externally dependent industries has some persistence, with coefficients being statistically significative for the current year, the previous year and the previous two years. The results imply that, for an industry with full external finance dependence (that is, an $EFD_i = 1$), then each prudential policy tightening reduces growth in the current year by 0.29%.

A prudential policy tightening also reduces industrial growth by 0.23% and 0.35% after one and two years, respectively. Overall, over a three year period, fully externally dependent industries (i.e., with $EFD_i = 1$) lose 0.87% of growth for each tightening policy. These are very significant values in economic terms, besides being statistically significant. Note also that the coefficients for the interaction between external finance dependence and the effect of macroprudential policies ($TPI_{c,t} \times EFD_i$, $CumulativeTPI_{c,t-1} \times EFD_i$) are statistically significant and economically large even if the Covid pandemic period is excluded, as shown in the regression number 5 of Table 3. These coefficients are also significant in the regressions for the period 1990 until 2016 (which was the first edition of the iMaPP database), as shown in Madeira 2020.

Using the Loan to Value ($LTV_{c,t}$) gives similar results. Note that in the case of the Loan to Value, a higher value implies an easing and a lower value implies a tightening of the prudential policy. The regression 6 in Table 3 shows that a lower Loan to Value (which implies a tighter policy) reduces the growth of the industries with a high external finance dependence.

All the regressions in Table 3 (and also in all the Tables of this article) also 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.

I now estimate the main model across different country groups. Table 4 shows two models that were estimated for each country group, with the macroprudential stance being given by: i) $TPI_{c,t}$ and $CumulativeTPI_{c,t-1}$; ii) the current $TPI_{c,t}$ and its two lags. The regressions show that both for advanced economies and emerging markets, there is a negative effect of the macroprudential policies on the industries with a high external finance dependence (that is, industries with $EFD_i > 0$). This negative effect is also persistent for some years. For advanced economies, there is a negative effect on externally dependent industries for the prudential policies implemented this year and two years before, while the previous year's coefficient is also negative but not statistically significant. For emerging markets, there is a negative effect on externally dependent industries for the prudential policies implemented this year and last year. The fact that the coefficient is stronger for advanced economies in the current year could indicate that developed countries are faster to implement the

new regulations.

Table 4: Effects on industries' growth of the national macroprudential policies across different country groups (AEs, EMs, LICs): Panel OLS-FE

	Advanced economies		Emerging markets		Low-income countries	
Controls	(1)	(2)	(3)	(4)	(5)	(6)
$TPI_{c,t}$	0.110	0.127	0.0490	0.0550	0.456**	0.560**
	(0.0776)	(0.0796)	(0.0822)	(0.0831)	(0.213)	(0.223)
$TPI_{c,t-1}$		-0.0263		-0.00648		-0.175
		(0.118)		(0.0778)		(0.211)
$TPI_{c,t-2}$		-0.164		0.0686		0.387
		(0.115)		(0.106)		(0.302)
$CumulativeTPI_{c,t-1}$	0.0157		-0.0172		-0.0450	
	(0.0360)		(0.0314)		(0.121)	
$TPI_{c,t} \times EFD_i$	-0.621***	-0.564***	-0.344*	-0.296*	0.857**	0.837**
	(0.162)	(0.167)	(0.176)	(0.176)	(0.397)	(0.395)
$TPI_{c,t-1} \times EFD_i$		-0.118		-0.355**		-0.0873
		(0.198)		(0.163)		(0.504)
$TPI_{c,t-2} \times EFD_i$		-0.391*		-0.0278		-1.507**
		(0.233)		(0.250)		(0.594)
$CumulativeTPI_{c,t-1}$	-0.0599		0.0300		-0.470***	
$\times EFD_i$	(0.0620)		(0.0451)		(0.138)	
$ShareManVA_{i,c,t-1}$	-0.159***	-0.168***	-0.265**	-0.261**	-0.363**	-0.363**
	(0.0541)	(0.0569)	(0.104)	(0.104)	(0.147)	(0.148)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-4.904***	-4.830***	-5.340***	-5.336***	2.198	-0.113
	(1.502)	(1.480)	(1.314)	(1.099)	(3.880)	(3.566)
Other controls:						
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
N	17,345	17,066	9,701	9,663	4,267	4,250
R^2 (overall)	0.291	0.293	0.296	0.293	0.162	0.162

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and year (omitted).

These effects are economically significant. For fully dependent industries (i.e., with $EFD_i = 1$) in advanced economies, there would be a reduction in the growth rate of 0.56% in the current year and 1.07% (the sum $\sum_{l=0}^{L} \gamma_l$) over three years for each prudential policy tightening. In the case of emerging markets, fully dependent industries have a reduction in growth of 0.30% in the current year and 0.68% over three years for each policy tightening. In the case of the low-income countries (LICs), it is worth noting that the sample is much smaller, being around 4,000 observations. This is

Table 5: Effects on industries' growth of the national macroprudential policies across different country groups (AEs, EMs, LICs): Panel OLS-FE

	All countries	All countries	Advanced economies	Emerging markets	Low-income countries
Controls	(1)	(2)	(3)	(4)	(5)
$TPI_{c,t} \times EFD_i$	-0.203*	-0.163	-0.507***	-0.237	0.755**
	(0.120)	(0.121)	(0.167)	(0.188)	(0.317)
$TPI_{c,t-1} \times EFD_i$		-0.197*	-0.137	-0.293*	0.0173
		(0.119)	(0.166)	(0.161)	(0.412)
$TPI_{c,t-2} \times EFD_i$		-0.264*	-0.232	-0.0303	-1.054**
		(0.151)	(0.203)	(0.238)	(0.431)
$CumulativeTPI_{c,t-1}$	-0.00885				
$\times EFD_i$	(0.0350)				
$ShareManVA_{i,c,t-1}$	-0.197***	-0.204***	-0.183***	-0.226***	-0.192**
	(0.0375)	(0.0386)	(0.0501)	(0.0642)	(0.0906)
N	39,288	38,527	18,868	12,642	7,017
R^2 (overall)	0.325	0.322	0.365	0.332	0.257

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and country-year (omitted).

less than 25% and 50% of the samples for advanced economies and emerging markets, respectively. Therefore, the standard errors for the low-income countries coefficients are much bigger and the results are less precise. The results show a positive effect of prudential policies on non externally dependent industries. This result can either be interpreted as a positive effect on growth given by the higher macroprudential stability or maybe just a confounding factor associated with tightening in years of high growth. This coefficient is not significant for the prudential policies implemented last year or two years before. For externally dependent industries, there is a positive effect on growth for the prudential policies implemented this year, although there is an effect twice as big for the prudential policies implemented two years before. For low-income countries, it is not clear whether there is a negative effect on externally dependent industries, since the sum of $\sum_{l=0}^{L} \beta_l + \gamma_l$ is only 0.0147 and very close to zero.

The model estimates with country-year fixed effects are shown in Table 5. The estimates for the sample of all countries are very similar to Table 3, while the results for the different country groups (advanced economies, emerging markets, low-income countries) are very similar to Table 4. The coefficients are also statistically significant, just like in the standard model estimated in Tables 3 and 4. The coefficients are statistically significant for the previous year and two years before for

the sample of all countries, for the current year for advanced economies, for the previous year in emerging markets, and two years before for low-income countries.

Table 5 confirms that the economic effect of prudential tightening on externally dependent industries is sizeable. For the sample of all countries, fully externally dependent industries (i.e., with $EFD_i = 1$) would experience a reduction in growth of 0.16% and 0.64%, respectively, in the current year and over three years for each net tightening prudential measure. Again, Table 5 confirms that advanced economies are the most affected by macroprudential policies, while the low-income countries are the least affected. For advanced economies, fully externally dependent industries (i.e., with $EFD_i = 1$) experience a reduction in growth of 0.51% and 0.88%, respectively, in the current year and over three years for each net tightening prudential measure. For emerging markets, fully externally dependent industries (i.e., with $EFD_i = 1$) experience a reduction in growth of 0.24% and 0.56%, respectively, in the current year and over three years for each net tightening prudential measure. The low-income countries have a small sample and again show a puzzling result. Fully externally dependent industries would grow by 0.76% in the current year of the net tightening measure, but then experience a reduction in growth of 1.05% two years later. The overall effect on fully externally dependent industries over a three year period would be a growth reduction of 0.28% for the low-income countries. This puzzling result could be rationalized by a late implementation of prudential policies in the Low income economies.

A final robustness check is to test whether these growth effects persist over the long term. In the web appendix, Table A.7 shows the results of models estimated for half-decade periods. Table A.7 shows that the mean growth effect of the average prudential policies in the current half-decade is statistically significant for the sample of all countries, advanced economies and emerging markets. The coefficients for the previous half-decade for the sample of all countries and advanced economies are quite large, but not statistically significant. For the low-income countries there is a large and statistically significant effect for the average prudential policies implemented in the previous half-decade. This exercise confirms that the negative growth effect of prudential policies on externally dependent industries can last for around five years or maybe even ten years, but the coefficient for the previous half-decade is only significant for the low-income countries.

In conclusion, this section shows that the effect of prudential policies on the industries that are financially independent (that is, with $EFD_i \leq 0$) is small and statistically insignificant, especially

if the Covid pandemic is accounted for. However, prudential tightening has a negative effect on the growth of externally finance dependent industries, especially in advanced economies and emerging markets. This effect is economically significant and has some persistence, since it is observed for two years in emerging markets and over three years for advanced economies. For the low-income countries (LICs) it is harder to measure the growth of the industries, due to a much smaller number of observations. The estimates show that macroprudential policies increase industrial growth for all industries in the current period, but after two years this effect becomes negative. One possible explanation for this finding would be if the industries increase investments and economic activity before the macroprudential policy tightening enters into effect, therefore increasing activity in the current period and then decreasing growth later.

5 Prudential policy effects across the business cycle

Now I examine the effects of the macroprudential policies through different stages of the business cycle. In the first exercise, I separate the sample in three, according to the real GDP growth rate of the countries in year t. Using World Bank data for the period 1960-2022, I classify countries' growth periods as "Low growth years" (if $g_{c,t}^{GDP}$ was equal or below the country's percentile 30 of growth), "High growth years" (if $g_{c,t}^{GDP}$ was equal or below the country's percentile 70 of growth) and "Middle growth years" (if $g_{c,t}^{GDP}$ was between the country's percentiles 30 and 70 of growth).

The results in Table 6 show that for externally dependent industries, a prudential policy tightening has a negative effect on growth. However, this effect appears with a different lag according to the business cycle stage. For the Low growth years, the effect happens immediately in the current year of the tightening decision. For the Middle growth years, the effect happens with a lag of one and two years. For the High growth years, the effect is only observed after two years. This result makes some sense, as policy makers in a high growth period may wish to control for excess credit and aim for their policies to reduce growth after some time. In the case of the Low growth years, financial authorities may wish to implement an easing that benefits growth immediately.

Computing the effects for externally dependent industries over a three year period ($\sum_{l=0}^{L} \gamma_l$), then the reduction in growth is 0.05%, 1.39% and 0.43% for periods of low, middle and high growth, respectively. It makes sense that prudential policy has a stronger effect during middle and high

growth. In periods of low growth there are fewer reasons to make investments, therefore even externally dependent industries have lower needs for funding. This result also fits well with the literature that shows that macroprudential policies are more effective in controlling credit growth during expansions rather than in recessionary periods (Galati and Moessner 2018).

Table 6: Effects on industries' growth of macroprudential policies at different business cycle stages: Panel OLS-FE

	Low growth years		Middle growth years		High growth years	
Controls	(1)	(2)	(3)	(4)	(5)	(6)
$TPI_{c,t}$	0.185*	0.182*	0.0264	-0.0164	0.338**	0.306**
	(0.101)	(0.101)	(0.0856)	(0.0904)	(0.160)	(0.156)
$TPI_{c,t-1}$		0.0452		-0.00436		-0.129
		(0.130)		(0.110)		(0.154)
$TPI_{c,t-2}$		-0.165		0.136		0.221
		(0.148)		(0.0920)		(0.216)
$TPI_{c,t} \times EFD_i$	-0.356**	-0.354*	-0.416**	-0.0938	-0.0367	0.0867
	(0.180)	(0.181)	(0.182)	(0.179)	(0.382)	(0.380)
$TPI_{c,t-1} \times EFD_i$		0.287		-0.801***		0.333
		(0.271)		(0.219)		(0.316)
$TPI_{c,t-2} \times EFD_i$		0.0148		-0.500**		-0.854*
		(0.304)		(0.211)		(0.463)
$ShareManVA_{i,c,t-1}$	-0.267***	-0.278***	-0.159***	-0.151***	-0.390***	-0.382***
	(0.0755)	(0.0768)	(0.0524)	(0.0545)	(0.113)	(0.114)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-5.333***	-5.313***	-3.489**	-3.593**	-3.768*	-3.819*
	(1.684)	(1.782)	(1.434)	(1.464)	(1.981)	(2.012)
Other controls:						
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
N	10,791	10,520	14,620	14,394	5,896	5,859
R^2 (overall)	0.398	0.399	0.213	0.216	0.307	0.308

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and year (omitted).

Finally, in the online appendix, Table A.5 an exercise that shows the differential effect of the business cycle growth stage (Low, Middle, High) according to each country group (advanced economies, emerging markets, low-income countries), using for simplicity only the contemporaneous prudential policy effect (that is, $L = 0$, no policy lags included). Table A.5 shows that for externally dependent industries (i.e., with $EFD_i > 0$) there is a negative growth effect of macroprudential

policy tightening in periods of Low growth for either advanced economies or emerging markets and during periods of Middle growth for advanced economies. This negative effect is especially strong for emerging markets during periods of Low growth and for advanced economies during periods of Middle growth.

Table 7: Effects on industries' growth of the macroprudential policies, according to different quantiles of industry-country growth: Panel QR-FE

Quantiles:	Q50	Q75	Q90	Q50	Q75	Q90
Controls	(1)	(2)	(3)	(4)	(5)	(6)
$TPI_{c,t}$	0.123*	0.145*	0.166			
	(0.0714)	(0.0815)	(0.119)			
$TPI_{c,t-1}$	0.0395	0.0347	0.0301			
	(0.0699)	(0.0798)	(0.117)			
$LTV_{c,t}$				-0.0259	-0.0304	-0.0347
				(0.0196)	(0.0265)	(0.0382)
$TPI_{c,t} \times EFD_i$	-0.291*	-0.391**	-0.488*			
	(0.163)	(0.186)	(0.272)			
$TPI_{c,t-1} \times EFD_i$	-0.293*	-0.332*	-0.369			
	(0.162)	(0.185)	(0.271)			
$LTV_{c,t} \times EFD_i$				0.113**	0.151**	0.189**
				(0.0467)	(0.0632)	(0.0911)
$ShareManVA_{i,c,t-1}$	-0.246***	-0.310***	-0.371***	-0.230***	-0.304***	-0.375***
	(0.0432)	(0.0493)	(0.0721)	(0.0474)	(0.0642)	(0.0926)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-5.225***	-9.027***	-12.70***	-5.173***	-8.784***	-12.26***
	(0.789)	(0.901)	(1.318)	(0.894)	(1.211)	(1.745)
Other controls:						
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
N	31,316	31,316	31,316	27,624	27,624	27,624

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country (omitted).
All regressions include dummies for the periods 1991-2006 (Great Moderation), 2007-2009 (Great Financial Crisis), 2010-2014 (European Sovereign Debt Crisis), and 2020-2021 (Covid Pandemic).

Now I show the results of the Quantile regressions with fixed effects in Table 7. These regressions use a different criterion for growth, since the quantiles are defined in terms of the industry-country growth rather than the national GDP. Table 7 shows the results only for the Quantiles 50, 75 and 90, which represent median and high growth periods. The regressions show that for externally

dependent industries there is a reduction in growth for each policy tightening that was implemented this year or the previous year. The coefficients are all statistically significant at the 10% or 5% levels, except for the coefficient of the previous year ($TPI_{c,t-1} \times EFD_i$) in the quantile 90. This coefficient is larger than for the quantiles 50 and 75, but insignificant due to its large standard error. This result is not surprising, because quantile regressions are less precise for the extreme quantiles (Machado and Santos Silva 2019). Again, the results confirm that the effect of prudential policies is stronger for periods of high growth. The negative effect on the growth of fully dependent industries over a period of two years is 0.58%, 0.72% and 0.86% for the quantiles 50, 75 and 90, respectively.

The same results are valid if the Loan to Value is used as the macroprudential measure. Table 7 shows that there is a reduction in the growth of externally dependent industries by 0.11%, 0.15% and 0.19% for each percentage point of a lower Loan to Value (that is, a tighter policy).

The coefficients for the lower growth quantiles (Q10, Q25) are small and not statistically significant, as shown in Table A.3 in the online appendix. This fits the interpretation that there is low demand for funds to invest during low growth periods, which attenuates the effect of prudential policies. The same pattern of a weaker and insignificant effect of prudential policy during periods of low national growth or lower quantiles is also present for the period 1990 to 2016 (Madeira 2020).

Now I study the effects of prudential policies during Banking Crises and according to the prudential policy tightening/easing cycles. Table 8 estimates the models using interaction dummies for periods without and with a Banking Crisis (according to the Laeven and Valencia 2020 data). The results for the model using the Total Prudential Policy Index ($TPI_{c,t}$) show that, in the case of a normal year with no banking crisis, then a prudential policy tightening implies a reduction in growth for externally dependent industries. The coefficient for periods with no banking crisis is only statistically significant for the previous year ($MacroPru_{c,t-1} \times EFD_i$), although the values are negative for all the periods ($l = 01, 2$). Over a period of three years, fully external dependent industries lose 0.69% in growth (the sum $\sum_{l=0}^{L} \gamma_l$) for each prudential policy tightening.

Table 8: Effects on industries' growth of the macroprudential policies during banking crises: Panel OLS-FE

$MacroPru_{c,t} =$	$TPI_{c,t}$	$TPI_{c,t}$	$TPI_{c,t}$	$LTV_{c,t}$
Controls	(1)	(2)	(3)	(4)
Controls interacted with $BankingCrisis_{c,t} = 0$				
$MacroPru_{c,t}$	0.124**	0.121**	0.127**	-0.0427**
	(0.0575)	(0.0593)	(0.0592)	(0.0176)
$MacroPru_{c,t-1}$		-0.00825	-0.0280	
		(0.0588)	(0.0601)	
$MacroPru_{c,t-2}$			0.0959	
			(0.0743)	
$MacroPru_{c,t} \times EFD_i$	-0.244**	-0.177	-0.181	0.118**
	(0.122)	(0.123)	(0.122)	(0.0484)
$MacroPru_{c,t-1} \times EFD_i$		-0.344***	-0.300**	
		(0.120)	(0.121)	
$MacroPru_{c,t-2} \times EFD_i$			-0.212	
			(0.158)	
Controls interacted with $BankingCrisis_{c,t} = 1$				
$MacroPru_{c,t}$	0.638**	0.634**	0.646**	0.00677
	(0.300)	(0.302)	(0.299)	(0.0425)
$MacroPru_{c,t-1}$		0.147	0.143	
		(0.389)	(0.389)	
$MacroPru_{c,t-2}$			-0.0789	
			(0.397)	
$MacroPru_{c,t} \times EFD_i$	-2.144***	-2.132***	-2.312***	0.0906*
	(0.639)	(0.644)	(0.644)	(0.0469)
$MacroPru_{c,t-1} \times EFD_i$		0.0205	-0.164	
		(0.827)	(0.820)	
$MacroPru_{c,t-2} \times EFD_i$			-2.458***	
			(0.831)	
Controls without interactions				
$ShareManVA_{i,c,t-1}$	-0.248***	-0.244***	-0.246***	-0.228***
	(0.0500)	(0.0506)	(0.0516)	(0.0539)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-4.104***	-4.240***	-3.986***	-5.005***
	(0.839)	(0.844)	(0.854)	(0.853)
$BankingCrises_{c,t}$	-0.995***	-1.039***	-0.911**	-4.793
	(0.353)	(0.354)	(0.355)	(4.183)
Other controls:				
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	Yes	Yes	Yes	Yes
N	31,526	31,313	30,979	27,623
R^2 (overall)	0.248	0.248	0.248	0.289

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and year (omitted).

It is relevant to note, however, that during banking crises, the policy makers are more likely to implement an easing of the prudential policies, instead of a tightening. Therefore, the coefficients should be adequately read as evidence for the power of easing policies. The negative effects of prudential tightening on the growth of externally dependent industries are much stronger during banking crisis. This is equivalent to saying that an easing of the prudential policies has a much stronger positive effect during a banking crisis. Fully dependent industries in a banking crisis increase its growth by 2.31% and 2.46% for each prudential policy easing implemented this year and two years before, respectively. Over a three year period, fully external dependent industries gain 4.93% in growth for each policy easing. It is worth emphasizing some caution, since the standard errors are big due to the small number of banking crises in the sample.

Finally, note that the dummy for Banking Crisis (with no interactions) is around -1, implying a loss in growth around 1% for all the manufacturing industries.

The Loan to Value regression does not show much difference in periods with or without a banking crisis. In a year with no banking crisis, an easing of the Loan to Value (that is, an increase in the LTV) increases the growth of a fully externally dependent industries by 0.12% for each percentage point of easing. In a year with a banking crisis, this coefficient would be 0.0%, slightly lower. Perhaps the reason for the small difference in the role of the Loan to Value during a banking crisis is that the collateral could be equally valuable in both situations.

The exercise with Tightening and Easing prudential cycles is summarized in Table 9. Note that this exercise is difficult in statistical terms, because there were few easing cycle in the last 30 years (as shown in Figure 1) and therefore the standard errors for easing periods are large. The exercise considers an interaction with a constant, a tightening country-year dummy and an easing dummy. Both the tightening and easing dummies are expressed in terms of the Total Prudential Policy index of the country for the current year. Perhaps the most valuable lesson from this exercise is that macroprudential policy is more effective during tightening cycles. The effects interacted with a constant show that there is a negative effect on the growth of externally dependent industries from prudential policy tightening implemented in the previous year and two years before. These effects are statistically significant and similar in size to Table 3. There is also a negative effect on the growth of externally dependent industries from the cumulative policy stance.

There is a negative effect on growth of externally dependent industries during tightening

years. This implies that in tightening years, the reduction in growth of fully externally dependent industries is an additional 0.2% to 0.3% for each tightening measure. None of the interactions of external finance dependence with a dummy for Loosening periods is significant. Finally, the role of Loan to Value does not differ much in Tightening versus Easing periods. The Loan to Value has almost the same values as the standard exercise in Table 3. In the online appendix, Table A.6 shows a similar exercise which also includes interactions of the coefficients in the previous year and two years before with the tightening and easing dummies, but the results are qualitatively similar to Table 9.

Table 9: Growth effects during tightening and loosening years: Panel OLS-FE

$MacroPru_{c,t} =$	$TPI_{c,t}$	$TPI_{c,t}$	$TPI_{c,t}$	$TPI_{c,t}$	$LTV_{c,t}$
Controls	(1)	(2)	(3)	(4)	(5)
Controls interacted with $Constant = 1$					
$MacroPru_{c,t-1}$			0.0111	-0.00115	-0.0163
			(0.0596)	(0.0618)	(0.0200)
$MacroPru_{c,t-2}$				0.108	
				(0.0787)	
$CumulativeTPI_{c,t-1}$	0.0191				
	(0.0234)				
$MacroPru_{c,t-1} \times EFD_i$			-0.301**	-0.242*	0.106**
			(0.121)	(0.125)	(0.0478)
$MacroPru_{c,t-2} \times EFD_i$				-0.376**	
				(0.175)	
$CumulativeTPI_{c,t-1}$	-0.114**				
$\times EFD_i$	(0.0574)				
Controls interacted with $Tighten_{c,t} = 1(TPI_{c,t} > 0) = 1$					
$MacroPru_{c,t}$	0.0737	0.0888	0.0710	0.0518	-0.0274*
	(0.0830)	(0.0835)	(0.0849)	(0.0839)	(0.0155)
$MacroPru_{c,t} \times EFD_i$	-0.318**	-0.365**	-0.257*	-0.204	-0.00277
	(0.159)	(0.159)	(0.156)	(0.152)	(0.00711)
Controls interacted with $Loosen_{c,t} = 1(TPI_{c,t} < 0) = 1$					
$MacroPru_{c,t}$	0.428***	0.391**	0.399**	0.442***	-0.0135
	(0.158)	(0.157)	(0.157)	(0.159)	(0.0198)
$MacroPru_{c,t} \times EFD_i$	-0.379	-0.299*	-0.332	-0.449	0.0113
	(0.273)	(0.160)	(0.267)	(0.281)	(0.0112)
N	31,313	31,526	31,313	30,979	27,623
R^2 (overall)	0.247	0.247	0.247	0.247	0.288

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance. Clusters by industry-country. All regressions include controls for $ShareManVA_{i,c,t-1}$, $\ln(GDP^{PPP,pc}_{c,t-1})$, $g^{GDP}_{c,t-1}$, $inflation_{c,t-1}$, $g^{GDP}_{c,t}$, $inflation_{c,t}$, $MPR_{c,t}$, $ZLB_{c,t}$, $Tighten_{c,t}$, $Loosen_{c,t}$, fixed effects by industry-country and year (omitted).

Finally, I show the model estimates that consider an interaction with different periods, such as the Great Moderation (1990-2006), the Great Financial Crisis (2007-2009), the European Sovereign Debt Crisis (2010-2014) and the Covid-19 Pandemic (2020-2021). The results in Table 10 show that the coefficients with no interaction (that is, with a constant being interacted with the variables) are similar to the standard model (which is shown in the first column). Furthermore, there are no significant coefficients from the interaction terms with the Great Moderation or the European Sovereign Debt Crisis dummies. The Great Financial Crisis, however, shows a positive growth effect on all the industries for each net tightening measure implemented one year before. The Covid-19 Pandemic interaction terms show that fully externally dependent industries experienced a positive growth effect for tightening measures implemented one and two years before. These results could be interpreted as a positive effect of prudential policies, since policies implemented before the crisis have a positive impact on industrial growth.

In summary, the evidence shows that prudential policies are more effective during high growth periods (whether at the national or industry level), tightening years and during banking crises. At the same time, results from the GFC and the Covid-19 pandemic show that in these stress episodes, the previous implementation of macroprudential policies increased growth in these industries, thus helping to shield them from shocks.

6 Researching the channel of the macroprudential effects on industries

We now inquire into how the effects of macroprudential policies happen. Table 11 shows the results of different types of macroprudential policies on the growth of the manufacturing industries. The exercise focuses on 2 families of financial policy. The first family corresponds to "Loan restrictions", which can be divided into "Borrower restrictions" and "Lender restrictions" besides its net sum. The second family corresponds to "Supply, capital and other restrictions", which can be divided into "General supply requirements", "Capital requirements", and "Other requirements". The category of "Other requirements" (which includes SIFI measures, Taxes, restrictions on dividends, stress tests and other policies) is only used for a few countries and only for the most recent years. Therefore, this third category is not reported separately and instead Table 11 reports the net sum of all the three categories. Note that for all the groups of prudential policies analysed there are negative effects

Table 10: Effect on industries' growth of the macroprudential policies interacted with the individual period dummies in separate regressions (using the Total Prudential Policy Index): Panel OLS-FE

Interaction $S_t =$	No interaction	Great Moderation	Great Financial Crisis	European Sov. Debt Crisis	Covid-19 Pandemic
Controls	(1)	(2)	(3)	(4)	(5)
Controls interacted with $Constant = 1$					
$TPI_{c,t}$	0.146**	0.150**	0.174***	0.141**	0.0824
	(0.0593)	(0.0615)	(0.0611)	(0.0670)	(0.0700)
$TPI_{c,t-1}$	-0.0139	-0.0135	-0.0832	-0.0402	0.0798
	(0.0618)	(0.0651)	(0.0659)	(0.0744)	(0.0715)
$TPI_{c,t-2}$	0.0894	0.116	0.0689	0.124	0.0473
	(0.0776)	(0.0811)	(0.0844)	(0.0862)	(0.0792)
$TPI_{c,t} \times EFD_i$	-0.290**	-0.268**	-0.325***	-0.267*	-0.237*
	(0.124)	(0.120)	(0.125)	(0.146)	(0.142)
$TPI_{c,t-1} \times EFD_i$	-0.228*	-0.170	-0.242*	-0.162	-0.363**
	(0.127)	(0.122)	(0.128)	(0.155)	(0.163)
$TPI_{c,t-2} \times EFD_i$	-0.347**	-0.339**	-0.321*	-0.343*	-0.409**
	(0.170)	(0.169)	(0.174)	(0.184)	(0.176)
Controls interacted with $S_t = 1$					
$TPI_{c,t}$		-0.00741	-0.164	0.0346	0.136
		(0.200)	(0.147)	(0.137)	(0.161)
$TPI_{c,t-1}$		0.0385	0.512***	0.121	-0.409***
		(0.187)	(0.184)	(0.136)	(0.149)
$TPI_{c,t-2}$		-0.166	0.139	-0.217*	0.270
		(0.292)	(0.181)	(0.123)	(0.202)
$TPI_{c,t} \times EFD_i$		-0.172	0.314	-0.125	0.519
		(0.482)	(0.370)	(0.263)	(0.340)
$TPI_{c,t-1} \times EFD_i$		-0.530	-0.0132	-0.302	0.759**
		(0.486)	(0.456)	(0.248)	(0.331)
$TPI_{c,t-2} \times EFD_i$		-0.102	-0.358	-0.0555	0.552*
		(0.626)	(0.353)	(0.274)	(0.334)
Controls without interactions					
$ShareManVA_{i,c,t-1}$	-0.245***	-0.248***	-0.245***	-0.244***	-0.245***
	(0.0516)	(0.0517)	(0.0516)	(0.0515)	(0.0514)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-3.936***	-4.024***	-3.752***	-3.882***	-4.020***
	(0.854)	(0.859)	(0.857)	(0.857)	(0.860)
Other controls: all the regressions include controls for $g^{GDP}_{c,t-1}, inflation_{c,t-1}$, $g^{GDP}_{c,t}, inflation_{c,t}, MPR_{c,t}, ZLB_{c,t}$					
N	30,979	30,979	30,979	30,979	30,979
R^2 (overall)	0.247	0.247	0.247	0.247	0.247

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed-effects by industry-country and year (omitted).

on externally dependent industries ($MacroPru_{c,t-l} \times EFD_i$) for all the lags estimated ($l = 0, 1, 2$, i.e., current year, previous year, two years before).

Table 11: Effects on industries' growth of different macroprudential policies: Panel OLS-FE

	Loan restrictions			Supply, capital and other restrictions		
$MacroPru_{c,t} =$	Borrower restrictions	Lender restrictions	All loan restrictions	General supply req.	Capital requirements	Supply, capital & other restric.
Controls	(1)	(2)	(3)	(4)	(5)	(6)
$MacroPru_{c,t}$	0.182	0.515***	0.287**	0.125	0.168	0.135*
	(0.176)	(0.174)	(0.111)	(0.116)	(0.159)	(0.0789)
$MacroPru_{c,t-1}$	0.115	0.217	0.104	-0.0115	0.132	-0.0469
	(0.217)	(0.174)	(0.119)	(0.107)	(0.162)	(0.0767)
$MacroPru_{c,t-2}$	0.172	0.262	0.156	0.198*	0.131	0.0969
	(0.229)	(0.222)	(0.152)	(0.117)	(0.212)	(0.0854)
$MacroPru_{c,t} \times EFD_i$	-0.454	-0.777**	-0.527**	-0.333	-0.670**	-0.294*
	(0.446)	(0.362)	(0.251)	(0.307)	(0.304)	(0.167)
$MacroPru_{c,t-1} \times EFD_i$	-1.065**	0.321	-0.207	-0.679**	-0.316	-0.420***
	(0.513)	(0.408)	(0.276)	(0.273)	(0.271)	(0.161)
$MacroPru_{c,t-2} \times EFD_i$	-0.760	-0.984*	-0.690*	-0.519*	-0.277	-0.296
	(0.546)	(0.523)	(0.361)	(0.291)	(0.421)	(0.194)
$ShareManVA_{i,c,t-1}$	-0.254***	-0.256***	-0.254***	-0.253***	-0.253***	-0.246***
	(0.0520)	(0.0522)	(0.0519)	(0.0520)	(0.0520)	(0.0518)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-4.078***	-4.086***	-3.871***	-4.178***	-4.056***	-3.967***
	(0.858)	(0.856)	(0.854)	(0.859)	(0.857)	(0.852)
	Other controls:					
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
N	30,927	30,927	30,979	30,927	30,927	30,979
R^2 (overall)	0.246	0.246	0.246	0.247	0.246	0.247

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and year (omitted).

Using the total effect of the prudential policy tightening onexternally dependent industries over a period of three years (i.e., $\sum_{l=0}^{L} \gamma_l$), the strongest policy group is given by "Borrower restrictions". This policy group reduces growth of fully dependent industries by 2.3% for each prudential tightening. The second strongest policy is the "General supply requirements", which reduces the growth of externally dependent industries by 1.53% over a three year period. The third strongest groups of policies are the "Lender restrictions" and the "All loan restrictions", which

reduce growth by 1.44% and 1.42% over a three year period. Finally, the weakest group of policies are the "Capital requirements" and the sum "Supply, capital and other restrictions", which reduce growth by 1.26% and 1.01% over a three year period.

One difference is the lag of time that takes for the policies to act. Borrower restrictions only have an effect with a lag of one year, while the lender restrictions have an immediate effect in the current year and still show a strong effect two years afterwards. This result makes sense, because regulators are more likely to enforce quickly financial restrictions on the large financial institutions than for the smaller borrowers. The capital requirements on financial institutions reduce the growth of fully externally dependent industries by 0.67% in the current year of being taken. Restrictions of general capital supply do not have an immediate effect, but these reduce the growth of fully externally dependent industries by 0.68% and 0.52% one and two years later. This result may be due to the stronger complexity of these regulations taking a longer time before coming into its full effect.

Now I study the credit channel of the prudential policies. Table 12 shows a model with an interaction that has both a constant (as in the traditional regressions) and the change in the Domestic credit to private sector between the previous year and this year (as a percentage of GDP). For the controls interacted with a constant, the results are fairly similar to the coefficients in the basic models reported in Table 3. The results for the controls interacted with a constant can be interpreted as being of a country with no growth in credit (i.e., $\Delta Domestic\ Private\ Credit\ Over\ GDP_{c,t} = 0$), for instance a country that reached its steady state in financial development.[10] For such a steady state country, externally dependent industries suffer a negative reduction in growth for each prudential policy tightening, especially the ones implemented in the previous year and two years before. Over a period of three years (i.e., $\sum_{l=0}^{L} \gamma_l$), fully finance dependent industries would experience a reduction in growth of 0.91% for each policy tightening.

[10] Some countries have a strong valuation of corporate equity and debt markets. However, several countries in the UNIDO data do not have the variable of market capitalization over GDP. Table D.1 in the online appendix shows that only 49 countries in the UNIDO data have the market capitalization over GDP variable, which is just half of the sample. In any case, Table D.1 shows that, of the countries that have a high market capitalization over GDP, around 77% (10 countries in a total of 13) also have a high domestic private credit over GDP. The other remaining 23% (3 in 13) of the countries with a high market capitalization have at least a middle level of domestic private credit. Table D.3 in the online appendix uses both private credit and market capitalization to GDP as additional regressors.

Table 12: Effect on industries' growth of the macroprudential policies interacted with the domestic private credit over GDP ratio: Panel OLS-FE

$MacroPru_{c,t} =$	$TPI_{c,t}$	$TPI_{c,t}$	$TPI_{c,t}$	$LTV_{c,t}$
Controls	(1)	(2)	(3)	(4)
Controls interacted with $Constant = 1$				
$MacroPru_{c,t}$	0.176***	0.158**	0.164***	-0.0446**
	(0.0616)	(0.0624)	(0.0626)	(0.0189)
$MacroPru_{c,t-1}$		-0.0325	-0.0492	
		(0.0623)	(0.0639)	
$MacroPru_{c,t-2}$			0.0911	
			(0.0876)	
$MacroPru_{c,t} \times EFD_i$	-0.273**	-0.156	-0.150	0.138***
	(0.134)	(0.135)	(0.134)	(0.0525)
$MacroPru_{c,t-1} \times EFD_i$		-0.416***	-0.368***	
		(0.127)	(0.127)	
$MacroPru_{c,t-2} \times EFD_i$			-0.387**	
			(0.197)	
Controls interacted with $\Delta DomesticPrivateCreditOverGDP_{c,t}$				
$MacroPru_{c,t}$	-0.0112*	-0.0109	-0.00942	0.000110
	(0.00676)	(0.00707)	(0.00704)	(0.000164)
$MacroPru_{c,t-1}$		-0.000912	-0.0123	
		(0.00949)	(0.0103)	
$MacroPru_{c,t-2}$			0.0179***	
			(0.00693)	
$MacroPru_{c,t} \times EFD_i$	0.0112	-0.00487	-0.00736	-0.000194
	(0.0161)	(0.0182)	(0.0179)	(0.000359)
$MacroPru_{c,t-1} \times EFD_i$		0.0719**	0.0783**	
		(0.0312)	(0.0337)	
$MacroPru_{c,t-2} \times EFD_i$			0.00818	
			(0.0155)	
Controls without interactions				
$ShareManVA_{i,c,t-1}$	-0.263***	-0.263***	-0.263***	-0.204***
	(0.0615)	(0.0617)	(0.0623)	(0.0636)
$\ln(GDP^{PPP,pc}_{c,t-1})$	-4.651***	-4.930***	-4.898***	-6.078***
	(0.937)	(0.940)	(0.957)	(0.926)
$DomesticPrivate$	-0.000662	-0.00161	-0.00181	-0.000982
$CreditOverGDP_{c,t-2}$	(0.00419)	(0.00420)	(0.00422)	(0.00436)
Other controls:				
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	Yes	Yes	Yes	Yes
N	25,068	24,942	24,776	22,219
R^2 (overall)	0.260	0.262	0.263	0.298

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and year (omitted).

The controls interacted with the growth in domestic credit show that there is a positive effect on externally dependent industries ($MacroPru_{c,t-1} \times EFD_i$), which attenuates the negative effect of prudential policy tightening. This result makes sense and supports the idea that indeed the effect of prudential policies is through a credit channel. The result also fits well with the previous literature, which shows that externally dependent industries have a higher growth rate (relative to other industries) in periods of rapid financial development and credit growth (Rajan and Zingales 1998, Claessens and Laeven 2003). Note also that the coefficient interactions with domestic credit changes for the industries without external finance dependence are small, even if a few coefficients are statistically significant. This shows that industries that can use their own funds are not much affected by the aggregate domestic credit growth. Again, this result makes sense and fits well with the previous literature (Rajan and Zingales 1998, Claessens and Laeven 2003).

Table D.3 in the online appendix shows a similar exercise with a constant and domestic private credit growth interactions, and market capitalization to GDP and institutional quality variables as additional controls. Institutional quality can be relevant, because countries may have *de jure* regulations that are not strongly applied. The regressions include the World Governance Indicators published by the World Bank, including Control of Corruption, Government Effectiveness, Political Stability and Absence of Violence/Terrorism, Regulatory Quality, Rule of Law, Voice and Accountability. The sample size of this exercise is just two thirds of the sample in Table 12, because the World Bank only collects the World Governance Indicators since 1996 and some countries are not evaluated by these indicators. Table D.3 in the online appendix shows results very similar to Table 12. Over a three year period (i.e., $\sum_{l=0}^{L} \gamma_l$), fully externally dependent industries would lose 0.69% in growth for each policy tightening. None of the World Governance Indicators are statistically significant. This result makes sense, because all the regressions control for the log of the GDP per capita in constant USD PPP. Table D.2 in the online appendix shows that all the World Governance Indicators are strongly correlated with GDP per capita, which is a good measure of overall development.

Finally, I analyse the effect of macroprudential policies on the number of establishments and the average wages per worker (in log) of the industry-countries over time (variables available in the UNIDO data). The number of establishments can either be the number of companies or the number of plants,[11] depending on the tax information given to UNIDO by each country. Since

[11] Some firms can have several plants. The number of plants can be more informative, because a firm that faces

operating a plant is costly and requires funds, then an effect on the number of establishments could be an indicator of whether prudential policy tightening may increase credit frictions (Levine 2005). The average wages per worker can be seen as a measure of labor productivity or capital per worker, which is a factor that can also be harmed by credit constraints (Levine 2005).

Table 13: Effects on the growth of establishments and wages per worker (in log) of the manufactures of the countries' macroprudential policies: Panel OLS-FE

Growth rate of:	Establishments (firms or plants)				Wages per worker (log)	
Controls	(1)	(2)	(3)	(4)	(5)	(6)
$TPI_{c,t}$	-0.0851	-0.0512	-0.211*	-0.196	0.0270	0.0504
	(0.139)	(0.152)	(0.119)	(0.135)	(0.107)	(0.115)
$TPI_{c,t-1}$			-0.407***	-0.267*	0.0807	-0.00481
			(0.147)	(0.157)	(0.103)	(0.111)
$TPI_{c,t} \times EFD_i$	-0.417*	-0.454*	-0.392*	-0.408*	-0.523*	-0.408
	(0.248)	(0.264)	(0.223)	(0.242)	(0.278)	(0.299)
$TPI_{c,t-1} \times EFD_i$			0.406	0.398	0.384	0.532
			(0.323)	(0.335)	(0.297)	(0.323)
$ShareManVA_{i,c,t-1}$	-0.279***	-0.515***	-0.294***	-0.531***	-0.128**	-0.0792
	(0.0643)	(0.0931)	(0.0638)	(0.0957)	(0.0529)	(0.0729)
$\ln(GDP^{PPP,pc}_{c,t-1})$	0.911	3.825***	1.715*	3.601***	-5.628***	-6.918***
	(1.019)	(1.349)	(0.998)	(1.336)	(0.686)	(0.806)
Other controls:						
$g^{GDP}_{c,t-1}, inflation_{c,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$g^{GDP}_{c,t}, inflation_{c,t}$	Yes	Yes	Yes	Yes	Yes	Yes
$MPR_{c,t}, ZLB_{c,t}$	No	Yes	No	Yes	No	Yes
N	40,560	30,283	39,755	29,921	47,034	33,791
R^2 (overall)	0.056	0.074	0.061	0.072	0.319	0.362

Robust standard errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.
Clusters by industry-country.
All regressions include fixed effects by industry-country and year (omitted).

Table 13 shows that externally dependent industries experience a substantial reduction in the number of establishments. Each prudential policy tightening reduces the number of establishments for all industries even for those with no financial dependence. An industry with no finance dependence (i.e., with $EFD_i = 0$) faces a reduction in the number of establishments of 0.27% for each policy tightening implemented in the previous year. For fully externally dependent industries, each policy tightening reduces the number of establishments by an additional 0.4% number.

financial frictions may decide to close just some of its plants. Note that UNIDO does not inform on whether the number of establishments changes due to lower firm entry or higher firm exit.

The regressions show a negative effect of 0.4% in the wage growth of externally dependent industries for policies implemented this year, but the standard error is big and statistically insignificant after accounting for monetary policy controls. Furthermore, the coefficient for the previous year's policies has the opposite sign and a big standard error. Therefore, prudential policies have a significant effect on the number of establishments, but its effect on wages is unclear.

7 Conclusions and policy implications

Due to the simultaneity and reverse-causality issues between policy choices and aggregate outcomes, past studies may be unclear about the effects of macroprudential policies on economic activity. Since authorities are more likely to ignore smaller industries in their policy decisions, this study uses industry-level data for 89 countries to identify the impact of macroprudential policies on growth.

The results show that a tightening of macroprudential policies has a substantial impact on the manufacturing growth, but only for industries with a high external finance dependence. The effect is both statistically and economically significant. Furthermore, the effect of financial policies on the growth of externally dependent industries has some persistence, with measurable impacts even after two years. Industries with full external finance dependence would lose 0.29% and 0.87% in growth after one and three years, respectively, for each prudential policy tightening measure. This result fits well with previous literature showing that externally dependent industries experience more negative effects from credit frictions and lower financial development. This finding shows that authorities should examine the heterogeneous effects of financial regulations on industries.

Prudential policies have a much stronger effect during banking crises and also in periods of higher growth (whether at the national or at the industry level). This makes sense because credit frictions are much tighter during banking crises. Higher demand for funds during periods of high growth may also be attenuated due to prudential regulations. The negative impact of macroprudential policies on growth is stronger in advanced economies. Fully dependent industries over a period of three years would experience a reduction in growth of 1.07% and 0.68% in an advanced economy and emerging market, respectively, for each policy tightening.

During the Covid-19 pandemic there was a positive growth effect from prudential policies implemented in the previous two years, showing that these policies may mitigate the effects of

crises. There was a similar (but statistically insignificant) effect during the Great Financial Crisis.

Finally, prudential policy effects on industrial growth are shown to act through a credit channel. Higher credit growth mitigates the negative effects of prudential policies on externally dependent industries. Policies such as borrower and lender restrictions, supply restrictions and capital requirements impact growth. Especially borrower restrictions have strong effects. Furthermore, prudential policies impact the number of establishments, which is a sign of credit frictions.

Future research should focus on studying prudential policy effects on other sectors besides manufacturing, which is required for a fuller picture of the effects of prudential policies.

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