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The impact of macroprudential policies on industrial growth*

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Abstract

This paper analyzes the causal impact of macroprudential policies on growth, using industry-level data for 93 countries in order to overcome reverse-causality issues. I find that macroprudential tightenings have a negative impact on manufacturing growth, especially in the long-term and for industries with high external finance dependence. This impact is stronger in periods of higher growth and for advanced economies. However, macroprudential tightenings, especially capital supply measures, also contribute to a reduction in the long-term growth volatility, with a larger impact in financially dependent industries. The policy trade-off between higher growth and lower volatility is substantial, especially for advanced economies.

Resumen

Este artículo estudia el impacto causal de las políticas macroprudenciales en el crecimiento económico, utilizando datos a nivel de industria para 93 países de forma a ultrapasar problemas de causalidad reversa. Se muestra que contracciones de las políticas macroprudenciales tienen un impacto negativo en el crecimiento de las manufacturas, sobre todo en el largo plazo y para industrias con mayor dependencia financiera externa. Este impacto es mayor en periodos de elevado crecimiento económico y para economías desarrolladas. Sin embargo, las medidas macroprudenciales contractivas, sobre todo las que afectan la oferta de capital, también implican una reducción de la volatilidad en el crecimiento económico, con mayor impacto en industrias financieramente dependientes. El trade-off entre mayor crecimiento y menor volatilidad es sustancial, especialmente en países desarrollados.

* Comments are welcome at carlosmadeira2009@u.northwestern.edu. All errors are my own.

1 Introduction

Macroprudential policies are increasingly in use by both advanced and emerging economies, especially after the global financial crisis (Alam et al. 2019, Cerutti et al. 2017). However, the discussion about their effects on either financial variables or the real economy is still ongoing, in particular due to the endogeneity between regulators' policy decisions and macroeconomic variables (Galati and Moessner 2018). Recent works find a negative impact of macroprudential policies (MaPPs) on the growth of housing prices, mortgages, total credit, household credit, corporate credit (Cerutti et al. 2017, Akinci and Olmstead-Rumsey 2018), a mild dampening effect on consumption (Alam et al. 2019) and a positive effect on income inequality (Frost and van Stralen 2018). Using cross-country data, Dell'Ariccia et al. (2012) find that macroprudential policy tools can reduce the incidence of credit booms and decrease the chance that booms end badly. The non-financial effects of macroprudential policies on the real economy are the most understudied and this paper aims to fill such gap. A recent study shows that in general the macroprudential policies do not have a significant impact on real GDP growth (Alam et al. 2019). A misleading reading from the literature could interpret this as evidence that macroprudential policies have a low cost in terms of economic growth (Alam et al. 2019), which could be rationalized in a world where regulators can target the negative externalities of excessive leverage without harming loans for productive activities (although the theory is unclear on whether several of the most widely used prudential policies are positive or harmful for growth, see Brunnermeier and Sannikov 2014).

This work studies the impact of macroprudential policies on the real growth of a panel of 23 manufacturing industries across 110 countries. The fact that each industry is small relative to the total 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. The results show that a tightening of macroprudential policies implicates a sizeable reduction in the countries' manufacturing growth rates. This industry-country-time analysis is robust to a wide range of omitted variables, which are accounted for with industry-country and industry-time fixed-effects. Furthermore, cross-industry heterogeneity in growth improves our understanding of the mechanisms behind how macroprudential policies affect the economy. In particular, I show that the growth of manufactures that are more dependent on external finance is more negatively affected by prudential policies. On the other side, I find evidence that macroprudential policies reduce the volatility of industrial growth, which implies a trade-off between growth and volatility for policy makers. This trade-off is particularly strong in advanced economies, which face both a larger reduction in growth and in volatility from a macroprudential tightening. These findings complement empirical studies in the growth literature that show that financial crises can introduce a trade-off between the benefits of financial development on growth (Levine 2005, Levchenko et al. 2009) at the cost of increased volatility (Rancière et al. 2008), especially in developed economies (Laeven and Valencia 2018, Bekaert and Popov 2019) and in sectors with higher needs for external finance (Popov 2014).

To estimate the effects of macroprudential policies on industry growth, I combine the UNIDO's Industrial Statistics Database with the integrated Macroprudential Policy (iMaPP) database (which aggregates data from the IMF, BIS, FSB and national authorities, see Alam et al. 2019). The iMaPP dataset allows to build macroprudential policies' indexes in terms of newly implemented policy measures in the current year and as a cumulative policy stance of all the measures implemented since 1990 (Alam et al. 2019, Akinci and Olmstead-Rumsey 2018). The data also separates the total macroprudential policy index in three categories, such as policies that are specific to Loans (such as LTV or DSTI), Financial Supply (ex: capital requirements), and Financial Institutions (such as taxes and stamp duties on banks, SIFI restrictions, stress tests or restrictions on dividends). The dynamic model of industrial growth is then estimated with controls for fixed-effects by industry-country and year, GDP per capita, plus the inflation and real GDP growth rates.

The results show that macroprudential policies reduce both the industrial growth rate and its volatility, especially in industries with higher external finance dependence (using the measure proposed by Rajan and Zingales 1998). This shows the value of using industry-level data, confirming that macroprudential policies can affect growth by restricting loans to industries that are particularly dependent on banks and financial institutions. An analysis across different policy categories shows that Financial Supply policy restrictions have a long-term negative impact on growth for all industries and also a short-term negative impact on the growth of external finance dependent industries. The Institutional macroprudential policies have an immediate negative impact on the growth of all industries, but do not have a long-term effect. Finally, the results do not show a statistically significant effect of Loan restriction policies on industrial growth, perhaps because such policies are more directed to households and real estate, rather than the manufacturing sector.

In terms of the effect on industrial volatility, Loan and Institutional prudential policies help to moderate the growth volatility of external finance dependent industries in the short-term, while Financial Supply restrictions increase their short-term growth volatility. However, the Financial Supply restrictions also contribute to reduce the long-term growth volatility of the external finance dependent manufactures. Therefore Financial Supply restrictions can harm volatility in the short-term, perhaps as industries adjust to new regulations and scarce credit, while introducing a moderating effect in the long-term as the manufactures settle at a lower but more stable growth rate.

This paper is related to a growing body of research on the impact of financial prudential policies, with most studies using a similar set of cross-country macroprudential policies' indexes collected by the International Monetary Fund (IMF). The closest work to this study is the one by Alam et al. (2019), who find a statistically significant impact on household credit and house prices (as in previous works, such as Cerutti, Claessens and Laeven 2017 or Akinci and Olmstead-Rumsey 2018), a milder negative effect on private consumption, but estimate a small and statistically insignificant coefficient on real GDP growth. Besides Alam et al. (2019), none of the other empirical studies of macroprudential policies (such as Bruno, Shim and Shin 2017, Cerutti, Claessens and Laeven 2017, Akinci and Olmstead-Rumsey 2018, Frost and van Stralen, 2018, Altunbas, Binici and Gambacorta, 2018) studied its impact on real GDP growth or industrial activity. Other country specific and international studies, such as those collected by Buch and Goldberg (2017), study how financial variables react to prudential policies at different moments of the business cycle, but the business cycle is taken as exogenous rather than an endogenous outcome affected by regulation. These studies of how macroprudential policies affect aggregate country outcomes such as GDP, house prices or total credit depend on two crucial time framework assumptions: i) it is assumed that new macroprudential policies do not affect contemporaneous aggregate outcomes; ii) macroprudential policies are predetermined relative to the current or future outcomes of the economy (that is the GDP, house prices or credit growth in either the current quarter or the future quarters have no impact on current financial policy). The second assumption is the most unrealistic, since it ignores forward-looking regulators that care about the impact of their decisions on the total economy.

Relative to Alam et al. (2019) I employ an analysis with 23 different industries at the country level, which shows higher credibility since each industry is small relative to the total economy and therefore financial policies are more likely to be exogenous to manufacturing growth. Furthermore, my empirical analysis is more comprehensive in terms of country coverage (93 countries relative to 63 countries). Finally, this paper complements the literature showing how external finance dependent industries are more strongly affected by factors impeding financial development (Rajan and Zingales 1998, Claessens and Laeven 2003, Raddatz 2006), recessions (Braun and Larrain 2005), sudden-stops (Cowan and Raddatz 2013) and capital flows (Alfaro et al. 2017). A clear policy implication from this study is that regulators should be aware that credit restriction policies impose a trade-off between higher stability and lower growth. A second policy implication is that credit policy effects are disproportionately felt by external finance dependent industries.

This paper is organized as follows. Section 2 describes the data sources and the empirical approach for determining the impact of macroprudential policies on industrial growth. Section 3 shows the main regressions and a number of robustness tests of how financial policies affect manufacturing, particularly in financial dependent industries. Section 4 conducts an analysis of different categories of macroprudential policies instead of a single index. Section 5 summarizes the policy implications of the models estimated in the previous sections. Finally, Section 6 concludes with a summary of the findings and its policy implications.

2 Data and empirical approach

2.1 Empirical approach and identification

The empirical approach consists of exploiting the differential behavior of each industry in countries and time periods with different macroprudential policies. Let $PP^k_{c,t}$ represent a new macroprudential policy of the type k implemented by the country c at time t, with positive values representing a tightening of the policy (i.e., more restrictive credit or financial conditions), null values denoting no change and negative values an easing of the prudential measure k. In practice most of the prudential policies k are in a dummy-type or unit measure, taking the values of $+1, 0, -1$, although in principle one could think of more continuous measures. Let $CPP^k_{c,t} = \sum_{t=1}^{t} PP^k_{c,t}$ be the cumulative stance of a country's macroprudential policy measures taken since period 1 until period t. This cumulative stance of the macroprudential policy is also preferred by some authors (such as Akinci and Olmstead-Rumsey 2018), since current policies may take a lag before becoming binding and because credit availability may be impacted by the total cumulative regulations already taken. The newly implemented policy $PP^k_{c,t}$ gives the immediate impact of the regulators' decision, while its cumulative stance $CPP^k_{c,t}$ is a better measure of its long-term effect. Finally, let the country's total macroprudential policy undertaken in a given period t and its total cumulative stance be represented by $TPP_{c,t} = \sum_k PP^k_{c,t}$ and $CTPP_{c,t} = \sum_k CPP^k_{c,t}$.

In this study I estimate a dynamic model of $g_{i,c,t}$, the growth rate of sector i in country c at the time t, using the following additive-linear form:

1) $g_{i,c,t} = \beta CPP^k_{c,t} + \gamma EFD_i \times CPP^k_{c,t} + \delta x_{ic,t} + f_{i,c} + f_t + \varepsilon_{i,c,t}$,

with EFD_i denoting the external financial dependence of sector i, $f_{i,c}$ being industry-country fixed-effects, f_t a set of time fixed-effects, $x_{ic,t}$ a vector of additional time-varying controls, and $\varepsilon_{i,c,t}$ represents an idiosyncratic unobservable term. Since the cumulative stance of the macroprudential policies to have a negative impact on industrial growth, especially for industries with more needs of external funds, therefore both β and γ are expected to be negative.

This sector-country-time panel model has a similar form to previous studies, which use dummy variables such as a recession (Braun and Larrain 2005) or a sudden-stop (Cowan and Raddatz 2013) in country c at time t, instead of using a macroprudential policy variable such as $CPP^k_{c,t}$. It is also a similar specification to studies of the impact of a country's financial development on industry growth (see Rajan and Zingales 1998, Claessens and Laeven 2003, Raddatz 2006, Raddatz 2010, although those studies only estimate an industry-country panel regression instead of using an industry-country-time panel dataset; therefore those studies only include a sum of industry and country fixed-effects, $f_i + f_c$, instead of using a bi-dimensional industry-country fixed-effect $f_{i,c}$ and a time fixed-effect f_t). A slightly different regression can consider both the newly implemented policy $PP^k_{c,t}$ and the cumulative stance to have different effects on industrial growth, since it is possible that regulators and companies are still adjusting to the more recent policies:

2) $g_{i,c,t} = \beta \left[PP^k_{c,t}, CPP^k_{c,t}\right] + \gamma EFD_i \times \left[PP^k_{c,t}, CPP^k_{c,t}\right] + \delta x_{ic,t} + f_{i,c} + f_t + \varepsilon_{i,c,t}$.

Note that it is possible that the newly implemented policies ($PP^k_{c,t}$) have a different impact from the cumulative policy stance. While one expects the coefficient of $CPP^k_{c,t}$ to be negative, the sign of the contemporaneous policy effect can either be negative, null (if the policy takes time to bind) or even positive. The positive sign could happen if forward-looking regulators happen to implement the policy during a period of high growth or if the agents decide to invest more in the current period in order to avoid worse credit conditions in the future.

An alternative to using the vector of new and cumulative policy $\left[PP^k_{c,t}, CPP^k_{c,t}\right]$ is to use $\left[PP^k_{c,t}, CPP^k_{c,t-1}\right]$, since $CPP^k_{c,t} = PP^k_{c,t} + CPP^k_{c,t-1}$ and therefore using the lag of the cumulative stance allows to isolate better the effect of the new policy. One can also do the regressions 1) and 2) using the total sum of the macroprudential policies, $TPP_{c,t}$ and $CTPP_{c,t}$, as controls. In the same way, one can estimate the dynamic industrial growth model using as controls the entire vector of macroprudential policies (say, $PP_{c,t} \equiv \left\{PP^k_{c,t}, k = 1, .., K\right\}$, $CPP_{c,t} \equiv \left\{CPP^k_{c,t}, k = 1, .., K\right\}$) or a subset of the possible list of macroprudential policies.

The other time-varying controls $x_{ic,t}$ include variables such as the $Share_{i,c,t-1}$ (the ratio of the value-added of the industry i relative to the country's total manufacturing value-added in the previous period[1], available from the UNIDO dataset), the ratio of domestic credit to the private sector over GDP and $\ln(GDP^{PPP,pc}_{c,t})$, the log of the country's GDP per capita in 2011 USD-PPP (variables available from the World Bank), plus the country's GDP real growth and inflation rates ($g^{GDP}_{c,t}$, $g^{GDP}_{c,t-1}$ and $inf^{GDP}_{c,t}$, variables from the Penn World Tables, see Feenstra et al. 2015).

The basic regression is estimated by OLS with fixed-effects, using the dependent and control variables in mean differences to eliminate the industry-country fixed-effect $f_{i,c}$. I also consider two additional panel econometric methods as a robustness analysis.

A second analysis goes further by including a lagged endogenous variable $g_{i,c,t-1}$ as a control and is estimated with the Blundell and Bond (1998) dynamic model GMM procedure (hence on denoted as BB-FE), since the lagged endogenous variable can be correlated with the unobservable terms. This dynamic model must be estimated using as instrumental variables the endogenous variable in level and first-difference with at least 2 lags, i.e., $g_{i,c,t-l}$, $\Delta g_{i,t-l}$, for $l = 2, ..., t-1$. Since the BB-FE method is computationally burdensome with too many moment conditions, then I only use the lags $l = 2, 3, 4$ as IV. This estimator can be considered more efficient than several alternative methods (Blundell and Bond 1998) and therefore has also been applied in previous studies of the impact of macroprudential policies on the aggregate economy (Alam et al. 2019).

[1] This control variable is also included in previous industry-country studies, such as Rajan and Zingales 1998, Claessens and Laeven 2003, Braun and Larrain 2005, Raddatz 2006, Raddatz 2010, Cowan and Raddatz 2013.

Finally, a third analysis considers that the impact of macroprudential policies can be heterogeneous according to whether industrial growth is high or low. Therefore I also report estimates of a Quantile Regression model with Fixed-Effects, using the quantiles 25, 50, 75, and 90, as measures of how macroprudential policies affect industrial growth from low to higher growth periods. For the QREG-FE estimator I use the method proposed by Machado and Santos-Silva (2019), which is valid under some regularity assumptions imposed on the conditional moments.

Note that the availability of a industry-country-time panel dataset allows to relax some of the identification assumptions used in past macroprudential studies (such as Cerutti et al. 2017, Akinci and Olmstead-Rumsey 2018, Alam et al. 2019). In several of the past studies, one wishes to estimate the impact of the lagged macroprudential policy $PP_{c,t-1}$ on an aggregate outcome $Y_{c,t}$. The identification of such models is valid only under an assumption of "no reverse causality" (Alam et al., 2019): $PP_{c,t}$ or $PP_{c,t-1}$ are not affected by $Y_{c,t}$ (also, it is assumed that the unobservable terms of $Y_{c,t}$ and $PP_{c,t}$ are uncorrelated). This assumption is problematic, since it excludes that policy makers are forward-looking and can anticipate some of the time series changes. In the case of an industry-country-time dataset, the assumption of "no reverse causality" is easier to accept, since regulators may not be taking into account each of the smaller industries in their decisions.

2.2 Variance analysis

Besides affecting the expected growth, it is possible that macroprudential policies have an impact on the growth variance of each industry:

$$3)\ \ln(\hat{V}(g_{i,c,t})) = \beta_v \left[PP^k_{c,t}, CPP^k_{c,t}\right] + \gamma_v EFD_i \times \left[PP^k_{c,t}, CPP^k_{c,t}\right] + \delta_v x_{ic,t} + \tilde{f}_{i,c} + \tilde{f}_t + \tilde{\varepsilon}_{i,c,t},$$

where the variance of industrial growth in each period is estimated by $\hat{V}(g_{i,c,t}) = (g_{i,c,t} - (\beta \left[PP^k_{c,t}, CPP^k_{c,t}\right] + \gamma EFD_i \times \left[PP^k_{c,t}, CPP^k_{c,t}\right] + \delta x_{ic,t} + f_{i,c} + f_t))^2$. Note that the sign of the macroprudential policies on the growth variance can be ambiguous. On the one hand, if the macroprudential policies are unexpected and involve harsh adjustments, one may expect the new policies $PP^k_{c,t}$ to increase the variance of industrial growth in this period. However, if regulators are acting towards stabilizing economic activity and moderating credit swings, then one expects that the cumulative policy stance $CPP^k_{c,t}$ to reduce the long-term industrial growth variance. In particular, Bloom et al. (2018) show that increased uncertainty alters the relative impact of government policies, making them initially less effective and then subsequently more effective.

This linear model is estimated for the log of the variance fluctuations in order that the variance estimates always remain positive. As in the analysis for industrial growth, the article reports estimates for the growth variance model in three variants: i) a baseline regression estimated by OLS with fixed-effects, ii) a BB-FE dynamic model (Blundell and Bond 1998), and iii) a set of quantile regressions with fixed-effects (using the method proposed by Machado and Santos-Silva 2019). The BB-FE allows to account for endogenous dynamics that impact $\hat{V}(g_{i,c,t-1})$. The QREG-FE allows to test that the effect of macroprudential policies on the growth variance is not just the effect of a few outliers and also gives information on whether macroprudential policies affect highly uncertain periods more than normal periods (Bloom et al. 2018).

Note, however, that the analysis of industrial growth volatility can understate the benefits of macroprudential policies on financial and economic stability, since a simple variance measure can miss the impact of large and abrupt financial crises. Such rare disasters can have huge costs on welfare (Barro 2006) and some empirical evidence shows that banking crises can be particularly large and last longer in developed economies (Laeven and Valencia 2018).

2.3 Data

The main data for the study comes from 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. I measure industrial growth as the log increase in the Index of Industrial Production (IIP), $g_{i,c,t} = \ln(\frac{IIP_{i,c,t}}{IIP_{i,c,t-1}})$, which takes into account sector-specific price indexes. The dataset is unbalanced with some pairs of countries-industries with missing data in several years, and also with some countries reporting fewer industries.

This industrial database is matched with country-level data for the macroprudential policies of the iMaPP (integrated Macroprudential Policy) database published by the IMF, which is thoroughly described in the work by Alam et al. (2019). The iMaPP dataset provides a set of 17 macroprudential indexes (with values +1,0-1, for tightening, no change and easing, respectively) for each country since 1990, with the 17 individual policies being: 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, measures to mitigate risks from Systemically Important Financial Institutions (SIFI), Other measures (such as stress testing, restrictions on profit distribution and limits on exposures between financial institutions). These measures can be grouped in 5 categories: Loan Demand (LTV, DSTI), Loan Supply (LCG, LLP, LoanR, LTD, LFC), Supply general (RR, Liquidity, LFX), Supply capital (LVR, CCB, Conservation buffer, Capital requirements), Institutional (Tax, SIFI, Other). These 5 categories can be further grouped in just 3 broad categories: Loan total (Loan Demand, Loan Supply), Supply total (Supply general, Supply capital), Institutional. Finally, the iMaPP database reports a Total Macroprudential Policy index ($TPP_{c,t} = \sum_k PP^k_{c,t}$), which corresponds to the sum of the individual 17 macroprudential policies. I then build cumulative policy stances for each one of these 17 macroprudential policies, its 5 categories, plus the 3 broader categories and the Total Macroprudential Policy index: $CPP^k_{c,t} = \sum_{t=1}^{t} PP^k_{c,t}$.

A third important data is the External Finance Dependence index (EFD_i) across the industrial sectors, which is obtained from Rajan and Zingales (1998). This variable is given by the industry median of the share of capital expenditures not financed with internal funds (capital expenditures minus cash flow from operations divided by capital expenditures) by U.S.-based publicly listed firms (available from Compustat)[2]. The basic index is measured from the U.S. company reports between 1980 to 1989, which is the standard option used in the literature (Rajan and Zingales 1998, Claessens and Laeven 2003, Braun and Larrain 2005, Raddatz 2010, Cowan and Raddatz 2013). Also, using the External Finance Dependence index estimated in the 1980s gives us a more predetermined measure of the state of the exogenous financial demands of each industry, since this variable is not affected by the macroprudential indexes that are measured only from 1990 onwards. Furthermore, the External Finance Dependence index gives similar results if one uses the values computed in the 1970s or the median values between 1970 to 1989 (Rajan and Zingales 1998,

[2] Other measures of financial constraints are possible, but those measures depend on variables such as the size and age of each firm (Hadlock and Pierce 2010) and can be less relevant at the industry level.

Braun and Larrain 2005). The intuition behind this index is that there are technological reasons why some industries need more external financing than others, such as longer projects, research and development investments, inventories or high working capital needs (Rajan and Zingales 1998, Raddatz 2006). Since the U.S. is a country on the technological frontier and with one of the most efficient capital markets, then the External Finance Dependence index estimated for large U.S.-listed companies should be valid as a rough estimate of an industry's demand for external financing (Rajan and Zingales 1998). This measure is not necessarily constant across time or countries, but Rajan and Zingales (1998) verify that similar results are obtained by using Canadian companies instead of US companies and that the index remains similar across different decades. Note also that including fixed-effects for industry-country pairs ($f_{i,c}$) can correct for the unobserved heterogeneity that may exist in industries across different countries (Claessens and Laeven 2003).

Finally, I use additional control variables available from the World Bank and the Penn World Tables. 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 2016. The dataset comprises 93 countries, including 34 Advanced Economies (AEs), 29 Emerging Markets (EMs) and 30 Low Income Countries (LICs)[3]. Table 1 summarizes the list of industries and countries available in the dataset. It shows a median sample size of 503 observations for an Advanced Economy, 414 observations for an Emerging Market and 215 observations for a Low Income Country. The Table also shows the mean external finance dependence of each country weighted by the value-added of each industry in 2016: $EFD_{c,t} = \sum_{i=1}^{I} EFD_i \times Share_{i,c,t}$. It shows that Advanced economies have a higher share of external financially dependent industries than Emerging markets and Emerging markets in turn have a higher composition of external finance industries in their manufacturing sector than Low income countries. This result makes sense, since due to the lack of available bank credit and market access the less developed countries are unable to sustain more industries that require large external funding (Rajan and Zingales 1998). The Table also shows the share of total manufacturing over GDP and the share of the largest manufacturing industry (ISIC 2 digit sector)

[3]Low income countries are defined as countries that have an average GDP per capita for the period 2011-2016 that is lower than 11,000 USD (in constant 2011 prices). Some exceptions are made for large economies that are traditionally classified as Emerging markets instead - see Cerutti et al. 2017.

in the country over GDP. For the median country the total manufacturing sector represents only 11.1% of the GDP, while the largest industry of the median country represents only 2.6% of GDP. Few countries have an industry that represents more than 5% of GDP or a total manufacturing sector that is above 23% of the GDP. This confirms that our identification is valid in the sense that regulators may make policy decisions while ignoring what happens in industries that represent less than 5% of the GDP. However, it also points out to a limitation of our study in the sense that the results will be limited to the manufacturing sector and the total manufacturing sector represents only 11% of the GDP for the median country and does not represent more than 34% of GDP even in the most industrialized country. Since the rest of the economy may be affected in a different way by the macroprudential policies, then it is possible that this study will not portray accurately the total impact of macroprudential policies on the overall economy.

Table 1 already shows that almost all the manufacture observations in the dataset are a fairly small portion of the national economy's GDP. Another aspect to analyze is how synchronized is each manufacture with the country's overall business cycle. The identification mechanism in this article assumes that each manufacture is a small part of the economy and therefore the regulators' decisions can be taken as exogenous. This identification strategy can fall apart if each manufacture is close to being a representative firm of the overall economy. For instance, if the representative model is literally true for some country, then even if all the industries and all the firms are small, the identification strategy would fail because all firms would behave just like the aggregate economy. For this reason I also report in Table 1 the distribution of the correlation of each industry's real growth ($g_{i,c,t}$) with the national economy ($g_{c,t}^{GDP}$). The results show that the median industry has a growth correlation of 40.8% with the national economy across the entire country sample. Even the industries more synchronized with the overall economy have a correlation value of 61.2% according to the percentile 75 of the sample. This means that while several industries are highly correlated with the business cycle, the synchronization is far from perfect and therefore one can expect that the industry-country level analysis includes several industries that were not among the regulators' decision targets. Furthermore, the analysis of the following sections includes controls for macroeconomic factors such as GDP per capital, inflation, plus both contemporaneous and lagged GDP growth, therefore the empirical analysis is robust to accounting for national level shocks in each period that may have affected the policy-makers' decisions.

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 (0.1135), 16 Tobacco products (-0.451), 17 Textiles (0.216), 18 Wearing apparel, fur (0.029), 19 Leather, leather products and footwear (-0.115), 20 Wood products (excl. furniture) (0.284), 21 Paper and paper products (0.1595), 22 Printing and publishing (0.204), 23 Coke, refined petroleum products, nuclear fuel (0.162), 24 Chemicals and chemical products (0.422), 25 Rubber and plastics products (0.608), 26 Non-metallic mineral products (0.260), 27 Basic metals (0.055), 28 Fabricated metal products (0.237), 29 Machinery and equipment n.e.c. (0.724), 30 Office, accounting and computing machinery (0.892), 31 Electrical machinery and apparatus (0.846), 32 Radio,television and communication equipment (0.943), 33 Scientific instruments, medical, precision and optical instruments (0.961), 34 Motor vehicles, trailers, semi-trailers (0.345), 35 Other transport equipment (0.300), 36 Furniture; manufacturing n.e.c. (0.232), 37 Other manufactured products and recycling (0.470).

Countries covered (93). Advanced Economies (34): 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, UK, USA.

Emerging markets (29): Algeria, Azerbaijan, Argentina, Bahrain, Brazil, Bulgaria, Belarus, Chile, China, Colombia, Costa Rica, Croatia, Hungary, Kazakhstan, Malaysia, Mauritius, Mexico, Oman, Peru, Poland, Romania, Russian Federation, Serbia, South Africa, Thailand, Trinidad, Turkey, North Macedonia, Uruguay.

Low income countries (30): Albania, Bangladesh, Armenia, Bosnia, Burundi, Sri Lanka, Ecuador, El Salvador, Ethiopia, Fiji, Honduras, India, Indonesia, Jamaica, Jordan, Kenya, Mongolia, Moldova, Morocco, Niger, Paraguay, Philippines, Senegal, Vietnam, Tunisia, Uganda, Ukraine, Tanzania, Yemen, Zambia.

Distribution of the number of observations (industry-years) across countries (percentiles):

N_c	**min**	**p5**	**p10**	**p25**	**p50**	**p75**	**p90**	**p95**	**max**
All countries	4	34	118	280	428	526	572	582	590
AEs	231	311	357	441	503	554	578	590	590
EMs	30	119	154	318	414	505	580	582	583
LICs	4	14	29	100	215	399	503	535	540

Distribution of the mean external finance dependence across countries in 2016:

$EFD_{c,t}$	**min**	**p5**	**p10**	**p25**	**p50**	**p75**	**p90**	**p95**	**max**
All countries	0.075	0.134	0.150	0.200	0.271	0.354	0.420	0.447	0.556
AEs	0.177	0.206	0.251	0.316	0.379	0.417	0.464	0.506	0.556
EMs	0.147	0.163	0.181	0.233	0.268	0.313	0.345	0.439	0.447
LICs	0.075	0.117	0.130	0.150	0.198	0.247	0.297	0.358	0.391

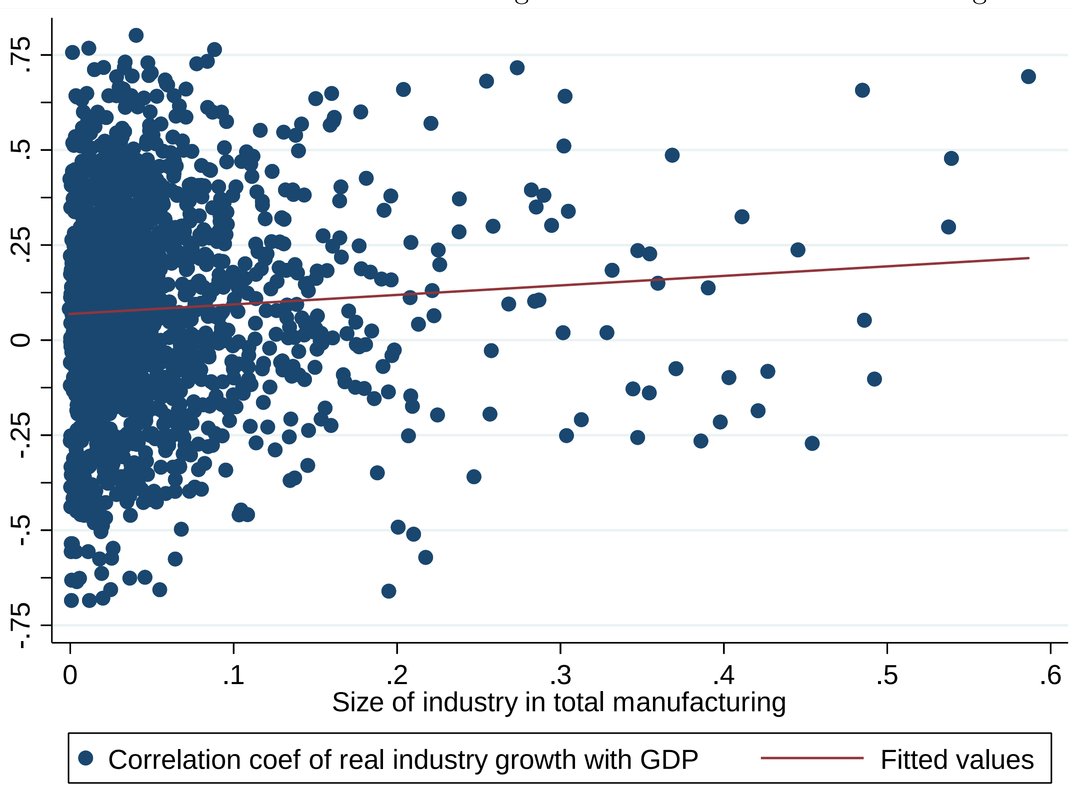
Distribution of the share of manufacturing value-added in GDP across countries in 2016:

$Share_{i,c,t}$	**min**	**p10**	**p25**	**p50**	**p75**	**p90**	**max**	**min**	**p10**	**p25**	**p50**	**p75**	**p90**	**max**
	Total manufacturing over GDP (%)							**Largest industry over GDP (% points)**						
All countries	1.38	5.31	8.70	11.1	14.6	21.3	34.0	0.26	1.28	1.83	2.58	3.68	4.77	28.9
AEs	1.38	6.00	9.14	11.8	16.1	18.4	34.0	0.42	1.58	1.76	2.28	3.63	5.08	14.5
EMs	4.99	9.26	10.3	12.2	15.6	23.0	32.6	1.21	1.79	2.30	2.76	4.11	4.77	28.9
LICs	2.33	4.47	6.64	8.65	11.7	19.7	27.2	0.26	0.64	1.45	2.64	3.48	4.22	7.33

Correlation between real manufacture growth and real GDP growth across countries:

$Corr(g_{i,c,t}, g_{c,t}^{GDP})$	**min**	**p5**	**p10**	**p25**	**p50**	**p75**	**p90**	**p95**	**max**
All countries	-0.706	-0.221	-0.094	0.154	0.408	0.612	0.750	0.802	0.908
AEs	-0.706	-0.008	0.093	0.303	0.478	0.647	0.765	0.804	0.908
EMs	-0.535	-0.173	-0.026	0.220	0.482	0.662	0.778	0.827	0.878
LICs	-0.689	-0.383	-0.256	-0.039	0.171	0.391	0.554	0.643	0.765

Figure 1: Size of each manufacturing industry by country (fraction of the total manufacturing sector) and the correlation of real manufacture growth with the national real GDP growth



3 Main results

This section starts by showing the effects of the country's total macroprudential policies ($TPP_{c,t}, CTPP_{c,t}$) on industrial growth. Table 2 shows the baseline results of this article by reporting the OLS-FE estimates for several models, according to their covariates. The first model which includes as covariates only the $TPP_{c,t}, CTPP_{c,t}$ and their interaction with the External Finance Dependence (EFD_i), besides $Share_{i,c,t-1}$ and the fixed-effects. The second model adds as covariates $\ln(GDP_{c,t}^{PPP,pc})$, $g_{c,t-1}^{GDP}$, $inf_{c,t}^{GDP}$, while the third model adds also the contemporaneous real GDP growth $g_{c,t}^{GDP}$. The fourth model excludes $TPP_{c,t}$ and includes just the cumulative policy stance $CTPP_{c,t}$. Model 5 includes both the new policy measures $TPP_{c,t}$ and $CTPP_{c,t-1}$, the cumulative policy stance from the previous year[4]. Finally, model 6 takes into account that the UNIDO data can have measurement error (Yamada 2005) and reports estimates for a dependent variable that is censored between the percentiles 5 and 95: $\tilde{g}_{i,c,t} = \min(_{p95}(g_{i,c,t}), \max(g_{i,c,t},_{p5}(g_{i,c,t})))$.

As expected, all the estimated models show that macroprudential policies have a stronger negative impact on the growth of external finance dependent industries, whether in terms of the new policy ($TPP_{c,t} \times EFD_i$) or the cumulative policy stance ($CTPP_{c,t} \times EFD_i$). The immediate impact of a new macroprudential policy ($TPP_{c,t}$) in the first two models is shown to be positive. However, this can be explained partially because regulators implement tightening during periods of high growth, since the coefficient is no longer significant and becomes much smaller in size after controlling for contemporaneous real GDP growth ($g_{c,t}^{GDP}$). The $Share_{i,c,t-1}$ is always with slower industrial growth, which is expected: industries that are already a large part of the economy tend to expand less due to fewer growth opportunities. Also, as expected overall GDP growth is associated with higher growth in each industry, while higher inflation is associated with lower growth.

Now Table 3 summarizes the coefficients of the Quantile regressions with fixed-effects, showing again that industries with higher External Finance Dependence are more negatively affected by the cumulative policy stance ($CTPP_{c,t} \times EFD_i$) and that this effect is stronger in periods of higher growth given by the quantiles 75 and 90. The quantile regressions use the percentiles of the

[4]Note that the model using the new policies plus the cumulative stance of last year ($TPP_{c,t}, CTPP_{c,t-1}$) has fewer observations, since it must drop the first observation year (1990) due to the lack of knowledge on the policies of the previous year. On the other hand, a possible flaw of the models with $TPP_{c,t}$ and $CTPP_{c,t}$ is that these fail to take into account that in the first year (1990) both the new and the cumulative policy stance have the same values.

Table 2: Effects on manufacture growth ($Y = g_{i,c,t}$) of the countries' total macroprudential policies ($TPP_{c,t}, CTPP_{c,t}$): OLS-FE

	(1)	(2)	(3)	(4)	(5)	(6)
Controls	Models with: $TPP_{c,t}, CTPP_{c,t}$			$CTPP_{c,t}$	$TPP_{c,t}, CTPP_{c,t-1}$	Censored p5-p95
$TPP_{c,t}$	0.00316***	0.00300***	0.000953		0.000868	0.000825
	(0.000786)	(0.000781)	(0.000772)		(0.000761)	(0.000597)
$CTPP_{c,t}$	5.07e-05	-0.000335	-8.75e-05	-3.26e-05		
	(0.000325)	(0.000346)	(0.000347)	(0.000338)		
$TPP_{c,t} \times EFD_i$	-0.00383**	-0.00392**	-0.00410**		-0.00345*	-0.00180
	(0.00194)	(0.00192)	(0.00192)		(0.00182)	(0.00142)
$CTPP_{c,t} \times EFD_i$	-0.00194***	-0.00194***	-0.00201***	-0.00206***		
	(0.000746)	(0.000726)	(0.000704)	(0.000697)		
$CTPP_{c,t-1}$					-0.000136	-0.000256
					(0.000350)	(0.000287)
$CTPP_{c,t-1} \times EFD_i$					-0.00197***	-0.00160***
					(0.000705)	(0.000569)
$Share_{i,c,t-1}$	-0.172***	-0.165***	-0.157***	-0.165***	-0.166***	-0.123***
	(0.0412)	(0.0402)	(0.0388)	(0.0400)	(0.0402)	(0.0290)
$\ln(GDP_{c,t}^{PPP,pc})$		-0.00243	-0.00494	-0.00486	-0.00808	-0.00483
		(0.00895)	(0.00917)	(0.00893)	(0.00951)	(0.00707)
$g_{c,t}^{GDP}$			1.133***		1.111***	0.894***
			(0.0458)		(0.0464)	(0.0349)
$g_{c,t-1}^{GDP}$		0.309***	-0.135***	0.314***	-0.118***	-0.0926***
		(0.0360)	(0.0362)	(0.0359)	(0.0371)	(0.0268)
$inf_{c,t}^{GDP}$		-0.0462***	-0.0267***	-0.0459***	-0.0340***	-0.0266***
		(0.00723)	(0.00588)	(0.00722)	(0.00704)	(0.00563)
N	35,401	35,401	35,329	35,401	34,701	34,701
R-2 (within)	0.101	0.112	0.162	0.111	0.161	0.187
Nr of id	1,730	1,730	1,730	1,730	1,730	1,730

Other controls: fixed effects for industry-country and year.
Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

industry-country pairs, therefore it is interesting to check whether the same results appear for the country's overall business cycle. Since the dataset is at a yearly frequency, then it is not possible to use standard expansion/recession dates, since the same years could have both an expansion and a recession. Therefore I classify each country's year into periods of low, median and high growth, according to whether the cyclical component of its real GDP growth Hodrick-Prescott residuals (with a smoothing parameter of 6.25 for annual data) is in the bottom 3 deciles, the deciles 4 to 7, and the top 3 growth deciles, respectively[5]. Again, the results for these three country growth stages show that the impact of the cumulative stance of the macroprudential policies on industrial growth is felt more strongly during the periods of median and high growth, particularly for the industries with high external finance dependence ($CTPP_{c,t} \times EFD_i$).

The quantile regression and growth stage results are consistent with some results of the previous literature. Cerutti et al. (2017) show that macroprudential policies have a stronger effect on real credit growth during periods of high growth. Alam et al. (2019) also show that macroprudential policies have a more negative impact on household credit, house price growth and real GDP growth during periods of high growth, but only in the Advanced Economies (AEs). Bruno et al. (2017) show that macroprudential policy tightenings are more effective when these coincide with monetary policy tightenings, which usually happen during economic expansions. Again, lagged real GDP growth is associated with higher industrial growth, while larger industries relative to the whole economy ($Share_{i,c,t-1}$) and inflation are associated with lower industry growth.

Table 4 reports the coefficients of the Blundell-Bond GMM dynamic model, which adds an endogenous lag for industrial growth ($g_{i,c,t-1}$) and applies instrumental variables (IV) to correct it. Again, all the estimated models show that macroprudential policies have a stronger negative impact on the growth of external finance dependent industries, whether in terms of the new policy ($TPP_{c,t} \times EFD_i$) or the cumulative policy stance and its lag ($CTPP_{c,t} \times EFD_i$ or $CTPP_{c,t-1} \times EFD_i$). Furthermore, all these IV models estimate a negative impact of the cumulative policy stance ($CTPP_{c,t}$ or its lag $CTPP_{c,t-1}$) on the industrial growth of all industries. Therefore it is clear from the IV Blundell-Bond estimates that macroprudential policies have a negative impact on

[5] The real GDP growth to compute these cyclical country growth components for the period 1951 until 2017 is again taken from the Penn-World Tables. Note that, while in the period 1951-2017 the growth stages of low, median and high growth are exactly 30%, 40% and 30%, in the period of 1990-2016 of the regression analysis there is a higher fraction of observations in the median growth stage due to several countries experiencing a Great Moderation stage.

Table 3: Effects on manufacture growth ($Y = g_{i,c,t}$) of the countries' overall macroprudential policies ($TPP_{c,t}, CTPP_{c,t}$): QREG-FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Quantile regressions with Fixed-effects				OLS-FE at different growth stages		
Controls	Q 25	Q 50	Q 75	Q 90	Low growth	Median growth	High growth
$TPP_{c,t}$	0.00392*	0.00297**	0.00207	0.00121	0.00793***	0.00136	0.00132
	(0.00226)	(0.00151)	(0.00160)	(0.00237)	(0.00206)	(0.00103)	(0.00211)
$CTPP_{c,t}$	-0.000587	-0.000327	-7.80e-05	0.000158	-0.00225***	0.000310	0.000965
	(0.000830)	(0.000554)	(0.000590)	(0.000870)	(0.000857)	(0.000419)	(0.000857)
$TPP_{c,t} \times EFD_i$	-0.00185	-0.00106	-0.000295	0.000427	-0.0175***	0.00110	0.00119
	(0.00542)	(0.00361)	(0.00385)	(0.00568)	(0.00459)	(0.00239)	(0.00535)
$CTPP_{c,t} \times EFD_i$	-0.000912	-0.00197*	-0.00299**	-0.00395**	-0.00105	-0.00372***	-0.00474**
	(0.00172)	(0.00115)	(0.00122)	(0.00180)	(0.00228)	(0.000893)	(0.00222)
$Share_{i,c,t-1}$	-0.146	-0.166***	-0.185***	-0.204**	-0.192***	-0.0944**	-0.188***
	(0.0890)	(0.0594)	(0.0633)	(0.0933)	(0.0680)	(0.0418)	(0.0695)
$\ln(GDP_{c,t}^{PPP,pc})$	0.0351	-0.00358	-0.0407**	-0.0758***	0.00810	-0.0460***	-0.0143
	(0.0237)	(0.0158)	(0.0169)	(0.0249)	(0.0175)	(0.0117)	(0.0157)
$g_{c,t-1}^{GDP}$	0.419***	0.306***	0.198***	0.0959	0.498***	0.295***	0.113**
	(0.0886)	(0.0591)	(0.0630)	(0.0929)	(0.0684)	(0.0506)	(0.0557)
$inf_{c,t}^{GDP}$	-0.0683***	-0.0455***	-0.0236	-0.00289	-0.0207*	-0.0941***	-0.0241***
	(0.0208)	(0.0139)	(0.0148)	(0.0218)	(0.0110)	(0.0109)	(0.00699)
N	35,401				9,135	17,338	8,840

Other controls: fixed effects for industry-country and year.

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

growth, especially for industries with higher needs of external funds. Two additional regressions also add the Domestic Credit to GDP ratio as a control variable. This shows that the negative impact of macroprudential policies on growth persists even after taking into account the total credit. This result is possible because industries do not have equal access to the aggregate credit and maybe not all economic sectors are equally affected by a certain regulation, which could encourage some rebalancing of credit to less-affected industries. Therefore it is possible that the credit restrictions of macroprudential policies affect more some industries even if it is from a different channel than the aggregate credit. For instance, a restriction on Loan-to-value could reduce the credit to households and the real estate sector, but banks could channel their funds into other industries. Conversely, loan restrictions that affect commercial loans and activities such as innovation and import-exports could encourage financial institutions to channel more funds to real estate and households.

Finally, Table 5 reports the estimates for the growth volatility models. All the models (OLS-FE, BB-FE, QREG-FE) show that macroprudential policies moderate the growth volatility of industries with higher external finance dependence ($EFD_i \times CTPP_{c,t}$). The newly introduced macroprudential policies ($TPP_{c,t}$) also seem to reduce the industrial growth volatility (although only for industries with low external finance dependence, since $EFD_i \times TPP_{c,t}$ is positive), especially in periods of median (quantile 50) and low volatility (quantile 25). Overall, the estimated models provide some evidence that macroprudential policies help to moderate volatility, therefore policy-makers may face a difficult trade-off between higher growth and lower volatility. This evidence is consistent with studies showing that countries with occasional financial crises experience higher growth (Rancière, Tornell and Westermann 2008). It is also a similar policy trade-off as the one found in the case of monetary policies leaning against financial instability (Gourio, Kashyap and Sim 2018).

In summary, the results show that macroprudential policies have a negative impact on industrial growth, especially in industries that are more dependent on external funds. This effect is both statistically significant and economically relevant. The OLS-FE regressions (Table 2) show that macroprudential policies have a small and insignificant effect on the industrial growth of industries with no external finance dependence, which makes sense since those industries can resort to internal funds generated from operational revenues. But for industries with a high external finance dependence, then the OLS-FE estimated coefficients show that on average each macroprudential policy measure has a negative effect of -0.6% in terms of log growth in the short-term (the sum

Table 4: Effects on manufacture growth ($Y = g_{i,c,t}$) of the countries' overall macroprudential policies ($TPP_{c,t}, CTPP_{c,t}$): Blundell-Bond FE (with one endogenous lag $g_{i,c,t-1}$)

	(1)	(2)	(3)	(4)	(5)	(6)
Controls	Models with $TPP_{c,t}, CTPP_{c,t}$ or $CTPP_{c,t-1}$			Models with $CTPP_{c,t}$		
$TPP_{c,t}$	0.00723***	0.00122	0.000609			
	(0.00113)	(0.00107)	(0.00107)			
$CTPP_{c,t}$	-0.00604***			-0.00727***	-0.00601***	-0.00591***
	(0.000996)			(0.00101)	(0.00103)	(0.00103)
$TPP_{c,t} \times EFD_i$	-0.00523**	-0.00942***	-0.00708***			
	(0.00225)	(0.00248)	(0.00238)			
$CTPP_{c,t} \times EFD_i$	-0.00752***			-0.0117***	-0.0112***	-0.0102***
	(0.00225)			(0.00252)	(0.00251)	(0.00243)
$CTPP_{c,t-1}$		-0.00602***	-0.00543***			
		(0.000981)	(0.000969)			
$CTPP_{c,t-1} \times EFD_i$		-0.00751***	-0.00662***			
		(0.00224)	(0.00216)			
$g_{i,c,t-1}$	-0.151***	-0.150***	-0.153***	-0.137***	-0.151***	-0.156***
	(0.0119)	(0.0119)	(0.0121)	(0.0115)	(0.0119)	(0.0122)
$Share_{i,c,t-1}$	-0.864***	-0.875***	-0.832***	-0.854***	-0.858***	-0.817***
	(0.146)	(0.148)	(0.144)	(0.155)	(0.145)	(0.140)
$\ln(GDP_{c,t}^{PPP,pc})$	-0.162***	-0.143***	-0.0852***		-0.165***	-0.0988***
	(0.0253)	(0.0240)	(0.0228)		(0.0256)	(0.0233)
$g_{c,t-1}^{GDP}$	0.300***	0.179***	0.116**		0.299***	0.200***
	(0.0499)	(0.0494)	(0.0495)		(0.0498)	(0.0497)
$inf_{c,t}^{GDP}$	-0.0897***	-0.103***	-0.0817***		-0.0883***	-0.0676***
	(0.0145)	(0.0139)	(0.0137)		(0.0146)	(0.0141)
$(Credit/GDP)_{c,t}$			-0.000610***			-0.000671***
			(0.000137)			(0.000140)
N	35,401	33,660	32,595	35,401	35,401	33,660
Nr of id	1,730	1,730	1,730	1,730	1,730	1,730

Other controls: fixed effects for industry-country and year.

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

Table 5: Effects on manufacture growth volatility ($\ln(\hat{V}(g_{i,c,t}) = \ln((g_{i,c,t} - \hat{g}_{i,c,t})^2)$ of the overall macroprudential ($TPP_{c,t}, CTPP_{c,t}$): OLS-FE, Blundell-Bond FE, QREG-FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Controls	OLS-FE		BB-FE		Q25	Q50	Q75
$TPP_{c,t}$	-0.0346**		-0.0373***		-0.0445**	-0.0311**	-0.0214
	(0.0146)		(0.0102)		(0.0211)	(0.0135)	(0.0156)
$CTPP_{c,t}$	0.00157	-0.0130*	0.0138	0.00583	0.000745	0.00186	0.00267
	(0.00695)	(0.00726)	(0.0137)	(0.0109)	(0.00850)	(0.00545)	(0.00630)
$EFD_i \times TPP_{c,t}$	0.0577*		0.0107		0.0759*	0.0512*	0.0334
	(0.0299)		(0.0297)		(0.0433)	(0.0278)	(0.0321)
$EFD_i \times CTPP_{c,t}$	-0.0330**	-0.0263**	-0.0350	-0.0999***	-0.0326**	-0.0331***	-0.0334***
	(0.0128)	(0.0131)	(0.0281)	(0.0319)	(0.0156)	(0.0100)	(0.0116)
$Variance_{i,t-1}$			-0.136***	-0.132***			
			(0.00757)	(0.00752)			
$Share_{i,c,t-1}$	-0.0542	-0.126	4.177***	3.847***	0.634	-0.298	-0.970*
	(0.630)	(0.609)	(1.314)	(1.347)	(0.730)	(0.468)	(0.541)
$\ln(GDP_{c,t}^{PPP,pc})$	-0.960***	-0.939***	-2.025***	-2.032***	-0.997***	-0.947***	-0.911***
	(0.136)	(0.137)	(0.305)	(0.279)	(0.166)	(0.106)	(0.123)
$g_{c,t-1}^{GDP}$	-2.309***	-2.369***	-0.153	0.287	-2.248***	-2.331***	-2.390***
	(0.417)	(0.412)	(0.483)	(0.497)	(0.574)	(0.368)	(0.425)
$inf_{c,t}^{GDP}$	0.602***	0.584***	0.431**	0.550***	0.614***	0.598***	0.587***
	(0.0744)	(0.0738)	(0.214)	(0.181)	(0.102)	(0.0651)	(0.0753)
N / Nr of id	35,396 / 1,725						
R-2 (within)	0.031	0.030					

Other controls: fixed effects for industry-country and year.

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

of the coefficients of $TPP_{c,t} \times EFD_i$ and $CTPP_{c,t} \times EFD_i$) and -0.4% ($CTPP_{c,t} \times EFD_i$) in the long-term. With the BB-FE instrumental variables approach (Table 4), the results have even more impact on the industries with high external finance dependence. For the industries with low external finance dependence the short-term impact of each additional macroprudential policy on industrial growth is again small (with the sum of $TPP_{c,t}$ and $CTPP_{c,t}$ being 0.1%). However, even for industries with zero external finance dependence the IV estimates an impact of -0.6% ($CTPP_{c,t}$) in terms of log-growth in the long-term. For industries that are high on external finance dependence then the short-term impact of an additional macroprudential policy on industrial growth is -1.1% (the sum of the coefficients $TPP_{c,t}$, $CTPP_{c,t}$, $TPP_{c,t} \times EFD_i$, $CTPP_{c,t} \times EFD_i$), while its long-run effect is -1.3% (the sum of the coefficients $CTPP_{c,t}$ and $CTPP_{c,t} \times EFD_i$).

4 Heterogeneity across different policy instruments and countries

The previous section analyzed the impact of the total sum of macroprudential policies on industrial growth and volatility. This section delves deeper on the mechanisms behind how different macroprudential policies affect industrial growth. As described in the data section, the Macroprudential indexes published by the IMF (Alam et al. 2019) can be aggregated into three broad categories: Loan Sum (which includes all the restrictions that directly affect loans, such as LTV, DSTI, restrictions on loans credit growth, loan to deposit ratios or foreign currency lending), Supply Sum (which includes requirements on reserves, capital, liquidity, foreign exposure and others) and Institutional (which includes taxes on financial institutions and capital gains, SIFI regulations, and other such as stress tests). Table 6 shows the impact of these broad categories on industrial growth. As in the previous section, the models control for industry-country and time fixed-effects, GDP per capita, current and lagged real GDP growth plus the inflation rates. I also present model alternatives with OLS-FE, QREG-FE for the median quantile (Q50), plus model regressions that control for the new policies and the contemporaneous cumulative policy stance ($PP^k_{c,t}, CPP^k_{c,t}$) while others control for the new policy and the lagged cumulative policy stance ($PP^k_{c,t}, CPP^k_{c,t-1}$). Note again that using the lagged cumulative policy stance implies dropping the first period, 1990. Finally, I show model alternatives that include all the categorical macroprudential policies in the same regression, while a second approach shows the result of including each category in a separate regression.

The results in Table 6 show that the new policies implemented in the Loan Sum category ($PP^k_{c,t}$ =Loan $\text{Sum}_{c,t}$) are positively correlated with industrial growth, possibly because new policies are announced during periods of high growth, since the coefficient falls in size when controlling for current GDP growth. Only the regression with just the Loan Sum Category (Regression) shows that the cumulative Loan Sum harms the growth in industries with high external finance needs. Perhaps the Loan prudential policies have a small impact on industrial growth, because such policies are more directed towards the households and real estate sector (Madeira 2018, 2019).

The coefficient estimates for the Supply Sum macroprudential policy show that the cumulative Supply Sum policy stance has a negative impact on industrial growth. Except for the median quantile regression, the newly introduced Supply Sum policies also have a negative impact on the industrial growth of industries with high external finance needs. The coefficient for the cumulative stance interacted with external finance dependence is also negative, but it is only statistically significant in the separate macroprudential policy regression (one each column).

The Institutional macroprudential policies do not display much in terms of statistical significance, which is perhaps due to such policies being implemented only in recent years and therefore there are few observations with a policy change (Alam et al. 2019). The newly introduced Institutional policies ($\text{Institutional}_{c,t}$) have a negative effect on industrial growth with a coefficient that is large in absolute value. There is also a more negative impact of the cumulative policy stance on the industries with higher external finance dependence, but the coefficient is statistically significant in the separate regression with just one macroprudential policy (one each column).

None of the coefficients in the median quantile regression in Table 6 are statistically significant, perhaps because macroprudential policies could have an impact only during periods of either low or high growth, rather than during the normal stage of the business cycle.

Now Table 7 shows the impact of different categories of macroprudential policies on the estimated logarithm of the variance of the residuals. The results show that both the newly implemented Loan Sum and Institutional policies help reduce the volatility of industrial growth in industries with high external finance needs (see the coefficients for $EFD_i\times$Loan $\text{Sum}_{c,t}$, $EFD_i\times\text{Institutional}_{c,t}$). The newly implemented Supply Sum policies on the other hand have a small (although statistically significant) negative impact on the growth volatility of industries with low external finance needs (see the coefficient for Supply $\text{Sum}_{c,t}$), but increase substantially the variance of industries with high

Table 6: The impact on industrial growth ($Y = g_{i,c,t}$) of different Macroprudential policy categories: regressions with all the three MaPP categories and with each MaPP separately

Model A: $PP^k_{c,t}, CPP^k_{c,t}$. Model B: $PP^k_{c,t}, CPP^k_{c,t-1}$.

Controls	Model A		Model B	
	OLS-FE	Q50-FE	OLS-FE	one each[a)]
	All MaPPs	All MaPPs	All MaPPs	Regression 1
Loan Sum$_{c,t}$	0.00296*	0.00291	0.00430***	0.00420***
	(0.00156)	(0.00243)	(0.00155)	(0.00148)
C(Loan Sum)$_{c,t'}$	0.00154*	0.00138	0.00129	0.000909
	(0.000796)	(0.00339)	(0.000807)	(0.000694)
$EFD_i \times$Loan Sum$_{c,t}$	0.000275	0.000240	-0.000904	-0.00247
	(0.00328)	(0.00577)	(0.00321)	(0.00311)
$EFD_i \times$C(Loan Sum)$_{c,t'}$	-0.00125	-0.00127	-0.00120	-0.00308**
	(0.00182)	(0.00207)	(0.00182)	(0.00143)
				Regression 2
Supply Sum$_{c,t}$	0.000686	0.000688	-0.000384	0.000182
	(0.00120)	(0.00168)	(0.00115)	(0.00112)
C(Supply Sum)$_{c,t'}$	-0.00120**	-0.00120	-0.00114**	-0.000936*
	(0.000571)	(0.000754)	(0.000577)	(0.000524)
$EFD_i \times$Supply Sum$_{c,t}$	-0.00598**	-0.00285	-0.00493*	-0.00562**
	(0.00290)	(0.00413)	(0.00279)	(0.00268)
$EFD_i \times$C(Supply Sum)$_{c,t'}$	-0.00201	-0.00201	-0.00193	-0.00263*
	(0.00163)	(0.00191)	(0.00165)	(0.00138)
				Regression 3
Institutional$_{c,t}$	-0.00869**	-0.00863	-0.00717**	-0.00383
	(0.00391)	(0.00602)	(0.00356)	(0.00342)
C(Institutional)$_{c,t'}$	0.00162	0.00163	0.00165	0.00182
	(0.00211)	(0.00283)	(0.00212)	(0.00207)
$EFD_i \times$Institutional$_{c,t}$	0.00587	0.00576	-0.00101	-0.00229
	(0.00832)	(0.0135)	(0.00702)	(0.00665)
$EFD_i \times$C(Institutional)$_{c,t'}$	-0.00687	-0.00692	-0.00691	-0.0106**
	(0.00527)	(0.00626)	(0.00531)	(0.00473)
N observations	35,329	35,329	34,701	34,701
R-square (within)	0.163		0.161	

a) OLS-FE with only one MaPP ($PP^k_{c,t}, CPP^k_{c,t}$) per regression.

Other Controls: FE (i,c), FE (t), $Share_{i,c,t-1}$, $\ln(GDP^{PPP,pc}_{c,t})$, $g^{GDP}_{c,t}$, $g^{GDP}_{c,t-1}$, $inf^{GDP}_{c,t}$.

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

external finance dependence (see the coefficient for $EFD_i \times$Supply Sum$_{c,t}$). The long-term effect of the cumulative policy stance of Supply Sum macroprudential policies, however, helps to reduce the industrial growth volatility of sectors with high external finance dependence (i.e., the coefficient for $EFD_i \times$C(Supply Sum$_{c,t}$) is negative). Therefore both the Loan Sum and Institutional policies help reduce the volatility of highly external finance dependent industries in the short-term, while the Supply Sum policies increase the industrial volatility of those industries in the short-term but help to moderate it over the long-term. This short versus long-term trade-off in the Supply Sum policies is possible, because perhaps the highly external finance dependent industries can suffer a large shock in the short-term and are unable to replace their source of funds, while over the long-term these industries settle at a lower but more stable growth rate. Future research will look into how macroprudential and monetary policies interact (Collard et al. 2017, Madeira and Madeira 2019) and into non-financial frictions such as sticky labor and wages (Madeira 2014).

Previous studies are inconclusive about whether macroprudential policies have a larger effect in advanced economies or not. Cerutti et al. (2017), Akinci and Olmstead-Rumsey (2018) and Alam et al. (2019) find that macroprudential policies have a stronger effect in the credit growth of emerging economies, but its impact on housing prices is stronger in advanced economies. However, Alam et al. (2019) find no impact of macroprudential policies on the private consumption or real GDP growth rates of either advanced economies or emerging markets. Since my analysis takes advantage of industry-level area then there is a more plausible identification of the real effects of macroprudential policies on growth. Table 8 shows the estimates of the dynamic OLS-FE model across 3 different country groups: Advanced economies (AEs), Emerging markets (EMs) and Low income countries (LICs). The regressions are similar to the ones reported for all countries in Table 2 (columns 3 and 5). The results again show that for all the three economies, the macroprudential policies only appear to have a strong negative impact on the growth of industries with high external dependence. Emerging markets only appear to suffer a short-term negative impact of macroprudential policies (given by the coefficient on $TPP_{c,t} \times EFD_i$). Advanced economies suffer a strong negative impact on growth both in the short-term (through $TPP_{c,t} \times EFD_i$) and over the long-term through the cumulative policy stance ($CTPP_{c,t} \times EFD_i$). The Low income countries (LICs), however, suffer a more ambiguous effect, since in the short-term the impact of new macroprudential policies can be positive ($TPP_{c,t} \times EFD_i$), but its long-term impact through the cumulative policy stance

Table 7: Variance ($\ln(\hat{V}(g_{i,c,t}) = \ln((g_{i,c,t} - \hat{g}_{i,c,t})^2)$ regressions with all the MaPP categories
Model A: $PP^k_{c,t}, CPP^k_{c,t}$. Model B: $PP^k_{c,t}, CPP^k_{c,t-1}$.

	OLS-FE		QREG-FE: Q50	
Controls	Model A	Model B	Model A	Model B
Loan Sum$_{c,t}$	0.0157	0.00892	0.00580	-0.00185
	(0.0312)	(0.0308)	(0.0284)	(0.0276)
C(Loan Sum)$_{c,t'}$	-0.0128	-0.0136	-0.0129	-0.0131
	(0.0162)	(0.0164)	(0.0123)	(0.0123)
EFD_i×Loan Sum$_{c,t}$	-0.134**	-0.119*	-0.112*	-0.104*
	(0.0652)	(0.0667)	(0.0584)	(0.0576)
EFD_i×C(Loan Sum)$_{c,t'}$	0.0179	0.0283	0.00976	0.0172
	(0.0306)	(0.0328)	(0.0238)	(0.0243)
Supply Sum$_{c,t}$	-0.0515**	-0.0435**	-0.0413**	-0.0346*
	(0.0201)	(0.0187)	(0.0185)	(0.0179)
C(Supply Sum)$_{c,t'}$	0.00279	0.00391	0.00361	0.00429
	(0.0104)	(0.0104)	(0.00844)	(0.00845)
EFD_i×Supply Sum$_{c,t}$	0.125***	0.0821**	0.107***	0.0693*
	(0.0394)	(0.0370)	(0.0385)	(0.0375)
EFD_i×C(Supply Sum)$_{c,t'}$	-0.0529**	-0.0447**	-0.0309*	-0.0304*
	(0.0227)	(0.0225)	(0.0180)	(0.0181)
Institutional$_{c,t}$	0.119	0.0970	0.124	0.103
	(0.0748)	(0.0733)	(0.0781)	(0.0694)
C(Institutional)$_{c,t'}$	-0.0193	-0.0179	-0.0172	-0.0165
	(0.0432)	(0.0445)	(0.0374)	(0.0373)
EFD_i×Institutional$_{c,t}$	-0.325*	-0.357*	-0.300*	-0.324**
	(0.170)	(0.191)	(0.167)	(0.151)
EFD_i×C(Institutional)$_{c,t'}$	-0.0242	-0.0530	-0.0205	-0.0428
	(0.0868)	(0.0905)	(0.0773)	(0.0782)
R-square	0.088	0.038		

Other controls: FE (i,c), FE (t), $Share_{i,c,t-1}$, $\ln(GDP^{PPP,pc}_{c,t})$, $g^{GDP}_{c,t}$, $g^{GDP}_{c,t-1}$, $inf^{GDP}_{c,t}$. N: 35,401.

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

Table 8: Effects on manufacture growth ($Y = g_{i,c,t}$) of the countries' overall macroprudential policies ($TPP_{c,t}, CTPP_{c,t}$) across country types (OLS-FE)

	Country types					
Controls	AEs		EMs		LICs	
$TPP_{c,t}$	0.000448	0.00132	0.000846	-0.000501	0.00268	0.00310
	(0.00127)	(0.00122)	(0.000969)	(0.00101)	(0.00255)	(0.00246)
$CTPP_{c,t}$	0.000749		-0.00133***		0.000494	
	(0.000558)		(0.000454)		(0.00124)	
$TPP_{c,t} \times EFD_i$	-0.00725**	-0.0101***	-0.00505**	-0.00597**	0.0146***	0.00812*
	(0.00329)	(0.00326)	(0.00223)	(0.00270)	(0.00483)	(0.00452)
$CTPP_{c,t} \times EFD_i$	-0.00259**		-0.000633		-0.00644**	
	(0.00111)		(0.000768)		(0.00283)	
$CTPP_{c,t-1}$		0.000789		-0.00137***		0.000345
		(0.000560)		(0.000456)		(0.00126)
$CTPP_{c,t-1} \times EFD_i$		-0.00259**		-0.000539		-0.00642**
		(0.00110)		(0.000780)		(0.00284)
N (observations)	16,500	16,186	11,369	11,166	7,460	7,349
R-square	0.215	0.215	0.162	0.156	0.042	0.041
Nr of groups	708	708	560	560	462	462

Other controls: FE (i,c), FE (t), $Share_{i,c,t-1}$, $\ln(GDP^{PPP,pc}_{c,t})$, $g^{GDP}_{c,t}$, $g^{GDP}_{c,t-1}$, $inf^{GDP}_{c,t}$.

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

($CTPP_{c,t} \times EFD_i$) is clearly negative and with an absolute value that is more than twice as big as for the Advanced economies. Perhaps this paradoxical result can be explained by a time delay in which policies are implemented in low income countries. If low income countries give a long time for financial companies and industry to adjust to the new regulations, then it is possible that in the beginning the impact on growth is positive as companies decide to rush their investment projects, while over the long-term their industrial growth is clearly affected by the tighter regulations. Overall, all country types are affected through their industries with high external finance dependence, confirming the credit channel of the macroprudential policies on growth.

In Table 9 I show the effects of each category of macroprudential policies across country types, either in a simultaneous regression with all categories of macroprudential policy or with each category included in a separate regression. Since the analysis for each country type has fewer observations and some categories of prudential policy are less used in some countries (for instance, less developed countries and emerging markets adopt more capital flow management measures, but have been slower to adapt to Basel standards), then obviously the results are statistically less significant and less robust than the ones in the previous sections. The results, however, are broadly similar to the ones found in the regressions for all countries in Table 6. Just like in the regressions for all countries (Table 6), in Table 9 there is no statistically significant impact of Loan prudential policies on industrial growth for each country type, although such measures have been found to impact household credit and housing prices, especially in advanced economies (Cerutti et al. 2017, Akinci and Olmstead-Rumsey 2018, Alam et al. 2019). Perhaps this result can be explained, because such measures are more directed to households and the real estate sectors and therefore may have little impact on manufacturing. Also, just like in the regressions for all countries (Table 6), I find that the cumulative stance of Supply policies has a negative impact for all industries (see the coefficient for C(Supply Sum)$_{c,t}$), although it is only statistically significant for the Emerging Markets and for the industries with high external finance dependence in Advanced Economies (see the coefficient for $EFD_i\times$C(Supply Sum)$_{c,t}$). Furthermore, the Supply policies have an immediate negative impact on the industries with high external finance dependence (see the coefficient for $EFD_i\times$Supply Sum$_{c,t}$) of both Advanced Economies and Emerging Markets. These results are robust if the regressions use the lagged value of the cumulative policy stance $CPP^k_{c,t-1}$ instead of $CPP^k_{c,t}$, with results available from the author upon request. Finally, just as in the regression for all countries, the estimates show that the Institutional prudential policies have an immediate negative impact on industrial growth, but only in Advanced economies (see the coefficient for Institutional$_{c,t}$). This result makes sense since policies such as SIFI and stress tests are only being used more recently after the Great Financial Crisis and the Advanced economies have adopted such measures more in recent years, while Emerging markets and Low income countries have been slower to adopt such measures. The results also show that the Institutional policies have a negative long-term impact on the industrial growth of Low Income countries, but only in industries with high external finance dependence (see the coefficient for $EFD_i\times$C(Institutional$_{c,t}$)), which again makes sense and emphasizes the credit channel through which prudential policies affect growth.

5 Policy implications

The estimates in the previous sections are heterogeneous across industries due to the level of external finance dependence (EFD_i). Therefore it is is hard to visualize the total impact of macroprudential policies in a given country, especially as countries differ substantially in their industrial composition,

Table 9: The impact on industrial growth ($Y = g_{i,c,t}$) of different Macroprudential policy categories ($PP^k_{c,t}, CPP^k_{c,t}$) across country types: regressions with all the three MaPP categories and with each MaPP separately (OLS-FE)

Controls	All MaPPs			one each[a)]		
	AEs	EMs	LICs	AEs	EMs	LICs
					Regression 1	
Loan Sum$_{c,t}$	0.00476**	0.00192	0.00158	0.00300	0.00284	0.00440
	(0.00206)	(0.00244)	(0.00561)	(0.00199)	(0.00235)	(0.00487)
C(Loan Sum)$_{c,t}$	0.00178*	-0.000501	0.00617	0.00194**	-0.00128	0.00476*
	(0.000994)	(0.00132)	(0.00388)	(0.000891)	(0.00119)	(0.00282)
$EFD_i \times$Loan Sum$_{c,t}$	-0.00689	0.00307	0.0183	-0.00447	0.00174	0.0221**
	(0.00439)	(0.00581)	(0.0118)	(0.00443)	(0.00500)	(0.00943)
$EFD_i \times$C(Loan Sum)$_{c,t}$	0.000403	-0.00155	-0.00797	-0.00258	-0.00206	-0.0139**
	(0.00232)	(0.00294)	(0.00818)	(0.00185)	(0.00214)	(0.00553)
					Regression 2	
Supply Sum$_{c,t}$	0.000464	0.000464	0.00320	0.00125	0.000780	0.00280
	(0.00229)	(0.00151)	(0.00414)	(0.00227)	(0.00135)	(0.00370)
C(Supply Sum)$_{c,t}$	-0.000197	-0.00172**	-0.00294	0.000262	-0.00167***	-0.000310
	(0.00123)	(0.000670)	(0.00228)	(0.00115)	(0.000594)	(0.00193)
$EFD_i \times$Supply Sum$_{c,t}$	-0.0149***	-0.00761**	0.0127	-0.0160***	-0.00696**	0.0166**
	(0.00509)	(0.00386)	(0.00785)	(0.00509)	(0.00330)	(0.00650)
$EFD_i \times$C(Supply Sum)$_{c,t}$	-0.00670*	0.000578	-0.00256	-0.00666**	-0.000341	-0.00779*
	(0.00355)	(0.00204)	(0.00577)	(0.00322)	(0.00139)	(0.00455)
					Regression 3	
Institutional$_{c,t}$	-0.0155***	0.00172	-0.0481	-0.0136***	0.00474	-0.0392
	(0.00497)	(0.00627)	(0.0345)	(0.00479)	(0.00598)	(0.0352)
C(Institutional)$_{c,t}$	0.00142	-0.00134	0.0417*	0.00401	-0.00285	0.0354
	(0.00282)	(0.00315)	(0.0240)	(0.00265)	(0.00285)	(0.0255)
$EFD_i \times$Institutional$_{c,t}$	0.0166	-0.00136	-0.00532	0.0161	-0.00254	0.0138
	(0.0101)	(0.0144)	(0.0498)	(0.00999)	(0.0140)	(0.0415)
$EFD_i \times$C(Institutional)$_{c,t}$	-0.00692	-0.00650	-0.0835*	-0.0118**	-0.00812	-0.0969**
	(0.00653)	(0.00887)	(0.0475)	(0.00598)	(0.00767)	(0.0393)
N observations	16,500	11,369	7,460	16,500	11,369	7,460
R-square (within)	0.218	0.163	0.043			

a) OLS-FE with only one MaPP ($PP^k_{c,t}, CPP^k_{c,t}$) per regression.

Other Controls: FE (i,c), FE (t), $Share_{i,c,t-1}$, $\ln(GDP^{PPP,pc}_{c,t})$, $g^{GDP}_{c,t}$, $g^{GDP}_{c,t-1}$, $inf^{GDP}_{c,t}$.

Robust standard-errors in (). ***,**,* denote 1%, 5%, 10% statistical significance.

with advanced economies being more specialized in industries with high external finance dependence (see Table 1). This section summarizes the policy implications by showing a simple estimate of the impact on industrial growth of a large regulatory change such as the Basel III standards.

The Basel III standards imply a complex package of new regulatory measures (BIS 2019): i) an increase in Capital Requirements in terms of Tier I capital, ii) a Conservation buffer, iii) an unweighted Leverage ratio (LVR), iv) a Liquidity Coverage Ratio (LCR), v) Net Stable Funding Ratio (NSFR), vi) a Countercyclical capital buffer (CCB), vii) higher loss absorbency requirements for Systemically important banks (SIBs or SIFIs), whether global (G-SIBs) or domestic (D-SIBs), viii) Stress testing, limits on exposures and disclosure requirements (Pillars 2 and 3). However, it is possible that several countries were already adopting many of the measures of Basel III before, such as stress testing, limits on exposure and disclosure requirements, while measures such as the additional Countercyclical capital (CCB) or SIFI measures may be legally adopted but without a practical implementation for the foreseeable future. Therefore for most countries the adoption of Basel III is best understood as requiring 5 additional macroprudential policies, which correspond to the first five regulations in the previous list (measures i to v).

For simplicity, I focus only on a long-term measure of impact of the macroprudential policies which uses only the cumulative policy stance ($CTTP$) coefficients and therefore ignores the additional short-term impact of the new policy measures (TPP) which has an effect only for one year. The measure of the macroprudential impact on each country's manufacturing growth is therefore given as the sum of the impact of each industry weighted by its value-added: $impact_{c,t} = 5 \times (\beta_{CTPP} + \sum_{i=1}^{I} \gamma_{CTPP} \times EFD_i \times Share_{i,c,t-1})$[6]. The results are shown in Table 10 for six different models estimating the impact of macroprudential policies on industrial growth (which include the OLS-FE, BB-FE, and QREG-FE estimates for the quantiles 25, 50, 75, 90) and of one model (OLS-FE) of the logarithm of the volatility of industrial growth. The second line of Table 10 indicates the table and column from which the impact estimate is obtained. Although the selected models do not have heterogeneous coefficients across countries (unlike the models in Tables 8 and 9), the results differ for each country due to the external finance dependence of its industries (see Table 1).

The OLS-FE estimates in Table 10 show that the negative impact on industrial growth of a

[6] For the special case of the BB-FE model, the estimate must be adjusted by the dynamic factor of the AR term $g_{i,c,t-1}$: $impact_{c,t} = \frac{1}{1-\delta_{g_{i,c,t-1}}} 5 \times (\beta_{CTPP} + \sum_{i=1}^{I} \gamma_{CTPP} \times EFD_i \times Share_{i,c,t-1})$.

Table 10: Estimated impact (in percentage points) of 5 additional macroprudential policies on the countries long-term manufacturing growth and its log-volatility for the year 2016

$$(impact_{c,t} = 5 \times (\beta_{CTPP} + \sum_{i=1}^{I} \gamma_{CTPP} \times EFD_i \times Share_{i,c,t-1}))$$

Dependent variable	Industrial growth						ln(growth-volatility)
Table (column) model	T2 (3)	T3 (1)	T3 (2)	T3 (3)	T3 (4)	T4 (1)	T5 (1)
Regression type	OLS-FE	Q25-FE	Q50-FE	Q75-FE	Q90-FE	BB-FE	OLS-FE
	All countries (percentiles) - 93 countries						
P10	-0.50	-0.55	-0.64	-0.73	-0.81	-4.09	-5.73
P25	-0.42	-0.50	-0.55	-0.60	-0.65	-3.83	-4.46
P50	-0.33	-0.45	-0.46	-0.47	-0.48	-3.55	-3.07
P75	-0.26	-0.41	-0.38	-0.36	-0.33	-3.32	-1.91
P90	-0.19	-0.37	-0.31	-0.26	-0.20	-3.11	-0.89
	Advanced economies (percentiles) - 34 countries						
P10	-0.57	-0.59	-0.72	-0.84	-0.96	-4.34	-6.94
P25	-0.49	-0.54	-0.63	-0.71	-0.79	-4.06	-5.57
P50	-0.45	-0.52	-0.58	-0.65	-0.71	-3.92	-4.91
P75	-0.37	-0.47	-0.50	-0.53	-0.56	-3.68	-3.73
P90	-0.30	-0.43	-0.42	-0.41	-0.41	-3.44	-2.52
	Emerging markets (percentiles) - 29 countries						
P10	-0.49	-0.54	-0.63	-0.72	-0.80	-4.08	-5.67
P25	-0.38	-0.48	-0.51	-0.54	-0.57	-3.70	-3.79
P50	-0.33	-0.45	-0.46	-0.47	-0.48	-3.55	-3.06
P75	-0.29	-0.42	-0.41	-0.40	-0.39	-3.41	-2.36
P90	-0.22	-0.39	-0.34	-0.30	-0.26	-3.20	-1.36
	Low income countries (percentiles) - 30 countries						
P10	-0.36	-0.47	-0.49	-0.52	-0.54	-3.66	-3.59
P25	-0.30	-0.43	-0.43	-0.42	-0.42	-3.45	-2.59
P50	-0.23	-0.39	-0.35	-0.31	-0.27	-3.22	-1.42
P75	-0.18	-0.36	-0.30	-0.23	-0.17	-3.06	-0.65
P90	-0.16	-0.35	-0.28	-0.21	-0.14	-3.00	-0.38

policy mix such as the adoption of the Basel III standards could be between -0.19% (for the least affected countries, as represented by the percentile 90th of the country distribution) to as high as -0.50% (as represented by the 10th percentile of the country distribution). Furthermore, Table 10 shows that the effects of adopting the Basel III standards are higher for the manufacturing sector of Advanced economies. In particular, Table 10 shows that in Advanced economies the impact on industrial growth ranges from as low as -0.30% to -0.45 and -0.57% for the least affected (percentile 90th), the median and the most affected countries (percentile 10th). In the case of Emerging markets' countries, the impact on industrial growth would be -0.22%, –0.33% and -0.49% for the least affected (percentile 90th), the median and the most affected countries (percentile 10th), respectively. Finally, the Low income countries receive the smallest reduction on growth, with an effect of -0.16%, -0.23% and -0.36% for the least affect, the median and the most affected countries. As mentioned before, these estimates are valid only for the manufacturing sector, which represents only 11% of the GDP for the median country (see Table 1). However, if one takes the manufacturing sector as representative of the wider economy, then it is worth mentioning that these estimates are substantially larger than the reduction in annual GDP growth of -0.05% to 0.15% estimated for the OECD countries in previous studies (Slovik and Cournède 2011).

The Quantile regressions with fixed-effects show an even stronger impact of the macroprudential policies. For the least-affected countries (percentile 90th), the quantile regressions show an impact of -0.37% during periods of low growth (as given by the quantile 25), -0.31% during periods of median growth (as given by the quantile 50) and -0.20% during periods of high growth (as given by the quantile 90). For the median country (percentile 50th), the quantile regressions show an effect of -0.45% to -0.48%, independently of whether there is low, median or high growth. For the most affected countries, however, the quantile regressions show estimates of -0.55%, -0.64 and -0.81% during periods of low, median and high growth (as given by the quantiles 25, 50 and 90). Again, the Quantile regressions also confirm that the Advanced economies are substantially more affected by a large macroprudential reform than the Emerging markets and that the Emerging markets in turn are more affected than the Low income countries. Finally, the instrumental variable estimates given by the BB-FE model show very high estimates ranging from -3.1% to 4.1% for the adoption of the Basel III standards on growth. Such estimates of the BB-FE approach are unreasonably high, which can be due to the instrumental variables only explaining the policy measures for a few countries and in practice overweighting a few observations around financial crisis events (see Wooldridge 2010 for a review of the strengths and weaknesses of IV-GMM estimators).

Finally, the estimates show that there can be substantial benefits from a large macroprudential reform as well, especially in Advanced economies. The volatility of industrial growth after a BIS reform falls between -0.9% to -3.1% and -5.7%, for the countries least affected (percentile 90th), the median and the most affected countries (percentile 10th), while in Advanced economies such impact would be -2.5%, -4.9% and -6.9%. For Emerging Markets and Low income countries the median country impact would be -3.% and -1.4%, respectively.

Overall, the results in Table 10 confirm that the estimates of the models in the previous sections are economically meaningful in terms of lost average industrial growth and also in terms of the trade-off between lower mean growth and a more stable growth rate.

6 Conclusions

Due to the simultaneity and reverse-causality issues between policy choices and aggregate outcomes, past studies have been unclear about the effects of macroprudential policies on economic activity. Since regulators' choices are more likely to ignore the events in small industries, this study uses industry-level data for 93 countries to identify the impact of macroprudential policies on growth.

The results show that a tightening of macroprudential policies has a substantial impact on manufacturing growth, especially in industries with higher external finance dependence and in periods of higher growth. Furthermore, the macroprudential policy impact on growth is long-lasting and not just a temporary effect. The negative impact of macroprudential policies on growth is stronger in advanced economies, which is partially explained by its industrial composition with industries that are more dependent on external finance. Although the lower income countries have a lower share of industries with high external finance dependence, our analysis shows that such industries suffer more from policy tightenings in those economies. Therefore this study may undervalue the negative impact on developing countries, since such countries have not yet adopted some high growth industries that require substantial financial funds (Rajan and Zingales 1998).

The data in this article lacks information on non-manufacturing sectors, which limits a full welfare analysis. My baseline estimates show that a large macroprudential reform such as the adoption of the Basel III standards would reduce total manufacturing growth substantially, with a negative impact of -0.33% and -0.45% for the median country and the median advanced economy in the study sample. Finally, the results also show a substantial trade-off between growth and low volatility, since the estimates show that a large macroprudential reform could also contribute to reducing the volatility of industrial growth by -3.07% for the median country. Analyzing different prudential policies shows that financial supply measures (such as requirements of capital, liquidity and unweighted leverage ratios) have a larger impact on long term growth and volatility.

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