Financial Management

Liquidity Constraints, Competition, and Markup Cyclicality

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This article provides evidence on the relation among financial constraints, competition, and the cyclicality of markups. Based on a long series of industry data from a large number of countries, we find that markups increase in conjunction with the business cycle in environments with higher short-term financial constraints (liquidity constraints) and more competition. The evidence also suggests that these two elements complement each other: the procyclicality of markups in firms facing both high competition and high liquidity constraints is higher than that explained by each determinant independently.

There is ample evidence that financial constraints affect the production of firms experiencing shocks (see, e.g., Gertler and Gilchrist, 1994; Bernanke, Gertler, and Gilchrist, 1996). As stressed by Braun and Larrain (2005), the response of firms to negative shocks depends on their reliance on financial markets. In this situation, financially constrained firms that are unable to raise funds for investment in physical or working capital are forced to trim production or even shut down entirely. The flipside of this mechanism is that these firms will also likely try to raise as much internal funds as possible when facing difficulties. One way of doing it is through pricing. This implies that the behavior of prices and markups around the business cycle will likely depend on the degree of financial constraints faced by firms.[1]

The competitive environment is another major determinant of this behavior, as pricing and markup decisions are critically affected by the strategic interaction between a firm and its competitors. Moreover, these two elements are not necessarily independent because the market structure may alter the ability or willingness of firms to ease liquidity constraints through pricing decisions. For instance, if firms build market share by keeping prices artificially low during normal times, markups should decline less during downturns for firms whose financial constraints become binding. This is because the incentive of these firms to invest in market share declines during recessions (Chevalier and Scharfstein, 1995, 1996). However, it is also possible that price wars that take place during downturns cause markups to decline more in downturns as firms race to the bottom to create revenues. These price wars can be triggered by cyclical changes in the elasticity of demand or other changes in the competitive environment, but they may also be part of the strategy of some firms that try to drive financially weaker competitors off the market, as proposed by the "long purse" view of predation. Under this view, the presence of a financially constrained competitor during a downturn may prompt its financially unconstrained rivals to pursue predatory strategies to capture the market, also leading to markups that are more

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[1] Of course, the cyclical behavior of marginal costs also matters.

procyclical in industries with these characteristics (Telser, 1966; Bolton and Scharfstein, 1990; see also Xu and Byoun, 2015).

This article relies on a large international cross-industry data set to study how the presence of short-term financial constraints (henceforth, *liquidity constraints*) and the degree of product market competition increase or reduce the cyclicality of markups. We follow a difference-in-differences identification strategy based on Rajan and Zingales (1998) to provide systematic empirical evidence on whether the strength of financial constraints makes markups more or less pro- or countercyclical and how this phenomenon relates to the competitive environment prevalent in each industry.

Understanding how firms' pricing decisions respond to the financial restrictions they face under different competitive environments provides relevant information on the type of firms that are most affected by lack of proper financing. This is important for correctly interpreting and quantifying the well-documented effects of financial constraints on real variables such as growth, investment, and capital structure, as firms that are better able to alter their pricing and markup behavior in response to financial constraints during the aggregate business cycle may be less forced to alter production and investment plans.

Despite relying on a variety of empirical approaches, various ways of measuring markups, and different levels of data aggregation, the existing empirical evidence on the relation between markup cyclicality and financial constraints is still inconclusive.[2] For instance, Chevalier and Scharfstein (1995, 1996) and Campello (2003) find that markups are more countercyclical in more financially constrained environments, or when industry debt is high. However, Botasso and Sembenelli (2001) and Busse (2002) show that firms facing tighter financial constraints are more likely to cut prices and start price wars. A few recent papers study how market structure and financial conditions jointly determine firms' nonfinancial decisions and document a relation between these two dimensions (Hoberg and Phillips, 2010; Makaew and Maksimovic, 2013). Some of them suggest that the cyclicality of profitability is higher when the degree of competition is higher and financial constraints are more prevalent (Pontuch, 2011).

Using data from a large number of countries with different degrees of financial market depth provides much more variation in the degree of financial constraints and product market competition than used in previous single-country studies. This increases the power of statistical tests and reduces external validity concerns. It also allows us to tackle some of the measurement issues that plague this literature because the additional dimensions of the data can be used to control for some sources of measurement problems in nonparametric ways. Indeed, any measurement problem that affects similarly the cyclicality of markups for all industries in a given country or the same industry across countries can be controlled for in our setting.

Our results show that markups, as measured by an industry's price-cost margin, are procyclical on average, with an estimated cyclicality of 1.2. This means that a 1 percentage point increase (decrease) in the real gross domestic product (GDP) growth rate is associated with a 1.2% increase (decrease) in the level of markups. We also find that markups are more procyclical in industries facing a higher level of competition, which is consistent with models where dynamic collusion is more difficult to sustain when markets are booming. Markups are also more procyclical in industries facing higher liquidity constraints (i.e., those with high needs for short-term external financing that are located in less financially developed countries). This is consistent with either a setting where constrained firms are willing to lower prices during recessions to generate cash or a setting where a few unconstrained firms prey on their constrained competitors who are unable to fight off competition. The estimated cyclicality increases from 0.45 to 1.39 when

[2] In fact, there is not even agreement on whether markups are pro- or countercyclical.

moving from a state of low liquidity constraints and low competition to one with more financially constrained firms and higher competition. This heterogeneity could explain the differences in findings across studies focusing on various countries or industries. For instance, US industries may be more countercyclical than our average industry because of their lower degree of liquidity constraints.[3] A large set of robustness checks indicate that these findings are unlikely to be driven by mechanisms different from the interaction among liquidity constraints, competition, and markup cyclicality.

Also, some of our results suggest that the two forces at play—competition and finance—are not independent. In particular, we show that liquidity-constrained industries facing higher competition have more procyclical markups than those facing weaker competition. We also find that the presence of financially unconstrained firms with a relatively low market share in an industry tends to make markups more procyclical, especially when the average firm in that industry is likely to be liquidity constrained. These results are in line with the presence of predatory incentives in liquidity-constrained industries with high competition. Financially stronger firms in these industries have higher incentives to lower their prices during recessions to predate their weaker competitors.

Our analysis of the data provides evidence in favor of many of the traditional models. However, none of them can explain all of our results at the same time. Instead, our findings indicate that several mechanisms proposed by the theoretical literature are relevant in explaining the cyclicality of markups.

In the next section we provide the theoretical background for our research questions. Section II describes the data and methodology used in our analysis. Section III presents and discusses the main results. Section IV provides some robustness exercises. Section V extends our results to address the mechanisms behind our main findings. We discuss how our results relate to the theoretical literature in Section VI and then conclude in Section VII.

I. Theoretical Underpinnings

The cyclical behavior of markups has long been of interest to various fields of economics. In macroeconomics, it has been recognized at least since Keynes that a countercyclical markup may help reconcile the countercyclical marginal product of labor under fixed technology with the procyclical real wages observed in the data. In industrial organizations, the behavior of markups is closely tied to the literature on dynamic oligopoly and price wars, and in corporate finance, the role of financial constraints and product market competition on markups and profits has been a focus of attention. In this section, we review the theoretical models that relate competition and financial constraints to markup cyclicality to establish a theoretical basis for the interpretation of our results.

A. Competition and Markup Cyclicality

In a perfectly competitive environment, firms charge their marginal cost and there are no markups. Thus, most theories of markup cyclicality come from models of imperfect competition.

[3] Our study of the determinants of markup cyclicality across many countries is itself a contribution because few papers explore these determinants in a systematic way. One notable exception is Oliveira Martins and Scarpetta (1999). After correcting for a number of measurement problems, they conclude that markups are strongly countercyclical in the United States but not so much in the other G-5 countries they study. As mentioned above, our broader sample includes countries where the average firm is much more likely to be financially constrained than in theirs, which gives us much more variation in this dimension and is a relevant extension of their work.

In a seminal paper, Rotemberg and Saloner (1986) build a model that tries to determine the highest prices that a set of firms with identical constant marginal costs, and that repeatedly compete in a market subject to serially uncorrelated demand shocks, can sustain in a collusive equilibrium. They show that under some parameter configurations, those prices could yield countercyclical markups, which in their setting means that prices are lower in expansions than in recessions. The reason is that a firm that deviates from the collusive equilibrium and charges a marginally smaller price can capture the whole market. Thus, firms have a higher incentive to deviate during expansions, when the market is larger, than in recessions. To reduce these incentives and enforce collusion, firms collude in a lower price during expansions. Overall, this model indicates that countercyclical markups are more likely when the number of firms is relatively small, that is, when markets are more concentrated and there is less competition, and the firm's discount factor for future profits is high.

Despite its impact, the Rotemberg and Saloner (1986) model has not been free of criticisms from a theoretical standpoint. Using a similar model, Haltiwanger and Harrington (1991) argue that the Rotemberg and Saloner (1986) result depends heavily on its assumption of serially uncorrelated demand shocks. They show that when demand shocks are serially correlated, the incentives to deviate from the collusive equilibrium are lower in expansions because the punishment from deviating is more likely to take place in a high state of demand. This makes it possible to sustain higher collusive prices during expansions, potentially resulting in procyclical markups.

In sum, these theoretical models of markup cyclicality from industrial organization relate markups to the degree of competition, but they may predict either procyclical or countercyclical markups depending on the detailed characteristics of the strategic interaction among firms and of the economic environment. In particular, they indicate that the degree of serial correlation of the state of a country's business cycle also affects markup cyclicality. Countries where bad times are more likely to be followed by further bad times tend to have a markup cyclicality that is more dependent on the degree of liquidity constraints faced by the average firm in an industry.

B. Financial Constraints and Markup Cyclicality

In a couple of well-known articles, Chevalier and Scharfstein (1995, 1996) argue that financial constraints make markups more countercyclical because firms usually keep prices below the static optimum to build market share. In this view, pricing decisions have an "investment" component (market share), and the incentives to invest by keeping prices depressed are lower for constrained firms that would like to raise prices to increase cash flows and internal funds.

In a contrasting view, models of price wars (Greene and Porter, 1984) or strategic models with equilibrium prices above the static optimum during downturns would result in financial constraints, making markups more procyclical. Among these types of models, one that has been broadly discussed in the literature is the "long purse" view of predation (Telser, 1966; Bolton and Scharfstein, 1990). A firm's dependence on external financing may hinder its ability to fight competition, prompting its financially unconstrained rivals to pursue predatory strategies to capture the market. Thus, although constrained firms within a market would like to reduce investment in market share during a downturn, unconstrained firms find in these situations a relatively lower cost of building market share at the expense of constrained firms. This type of model implies that markups could be more procyclical in industries where the average firm faces tighter financial constraints, if enough unconstrained firms push for relatively lower equilibrium prices to displace constrained firms from the market.

In sum, existing theoretical models propose that if firms keep prices artificially low to build market share, markups should be more countercyclical for financially constrained firms or industries. Alternatively, if firms keep prices artificially high for strategic considerations (as in some models of dynamic collusion) financially constrained firms would reduce prices during downturns, resulting in relatively more procyclical markups. In any of these settings, serial correlation in downturn periods would tend to make markups more procyclical (less countercyclical). Finally, predation theories predict an interaction between financial constraints and reduced competition within an industry in the determination of markups. Markups would tend to be more procyclical in markets with intense competition between financially unconstrained and constrained firms.

II. Methodology and Data

A. Empirical Approach

We use industry-level panel data for a large number of countries to characterize the average cyclicality of markups and to test how the presence of liquidity constraints and the strength of product market competition affect this cyclicality. To this end, we estimate the parameters of the following empirical specification:

$$\ln(Mkup_{c,i,t}) = \alpha_{c,i} + \alpha_t + \delta Activity_{c,t} + \gamma Activity_{c,t} \times Liquidity\ Constraints_{i,c} + \eta Activity_{c,t} \times Limited\ Competition_{i,c} + \psi X_{i,c,t} + \varepsilon_{c,i,t}, \quad (1)$$

where $Mkup_{c,i,t}$ is a measure of the markup charged by industry i in country c at time t, and $Activity_{c,t}$ is a measure of the fluctuations in GDP of country c at time t, and alternatively of the fluctuations in value added or output of industry i in country c at time t (in all cases measured by their rate of growth). Therefore, the coefficient δ captures the average cyclicality of markups in the sample. The variables $Liquidity\ Constraints_{i,c}$ and $Limited\ Competition_{i,c}$ measure the degree of liquidity constraints and the degree to which competition is limited (the inverse of the intensity of competition) in industry i of country c, respectively. The parameters accompanying their interaction with the measure of GDP fluctuations capture how changes in these variables affect markup cyclicality. For instance, a positive (negative) coefficient on the interaction of *Liquidity Constraints* and *Activity* (γ) implies that liquidity-constrained industries are relatively more procyclical (countercyclical). The vector $X_{i,c,t}$ includes controls that vary at the country, industry, and time levels, including the interaction of other country-industry variables with the measure of activity used to control for the possibility that the measures of liquidity constraints and competition may be capturing the relation between other variables and markup cyclicality. The coefficient $\alpha_{i,c}$ is a country-industry fixed effect that captures average differences in markups across these two dimensions, and α_t is a year fixed effect that captures global fluctuations in markups. Variations on the main specification conducted as part of the robustness analysis include fixed effects of higher dimension (e.g. industry-time and country-time). The variable $\epsilon_{i,c,t}$ is a random error that may be correlated across industries within a country.

The parameters of Equation (1) are estimated by ordinary least squares, correcting the standard errors for heteroskedasticiy and clustering them at the country-year level.[4] The identification strategy is akin to that of the differences-in-differences approach pioneered in the financial development literature by Rajan and Zingales (1998). We similarly rely on industry and country data but focus on the cycle rather than on growth. Braun and Larrain (2005) implement the

[4] The results are robust to clustering at the industry and at the country-industry levels.

method in a business-cycle context similar to ours. The main parameters (γ and η) are identified using mainly the within-country, across-industry dimension of the data. That is, the identification comes from differences in the response of markups to cyclical fluctuations (the treatment) between industries with high and low degrees of liquidity constraints (intensity of treatment). For this reason, it is also recommendable to cluster the standard errors at the treatment level (country-year), as suggested by Bertrand, Duflo, and Mullainathan (2004). Notice too that the use of detailed industry data reduces the concerns about endogeneity arising from a possible relation between markups and GDP fluctuations at the aggregate level. For our identification strategy to work, we only require that variations in industry-level markups do not affect country-level fluctuations.[5]

The specification described in Equation (1) allows us to estimate in one step the relation among liquidity constraints, competition, and cyclicality. Alternatively, this relation could be estimated in two steps as follows: first, estimate the cyclicality of markups at the country-industry level as the parameter $\beta_{i,c}$ in:

$$\ln(Mkup_{i,c,t}) = \alpha_{i,c} + \beta_{i,c} Activity_{c,t} + \varepsilon_{i,c,t}, \ \forall\ (c, i), \tag{2}$$

and then estimate how this parameter relates to measures of liquidity constraints:

$$\hat{\beta}_{i,c} = \alpha + \gamma Liquidity\ Constraints_{i,c} + \eta Limited\ Competition_{i,c} + \psi Y_i + \delta Z_c + \varepsilon_{i,c}. \tag{3}$$

Notice that Equation (3) does not include country and industry fixed effects, so that the coefficient on financial constraints γ is comparable to the one obtained by estimating (1), but includes country and industry variables to control for the omission of these fixed effects. This is the approach followed by Chevalier and Scharfstein (1995).

Because this two-step approach gives full flexibility to the parameter for industry cyclicality ($\beta_{i,c}$), it is less efficient than the one-step approach, conditional on the determinants of cyclicality to be given by Equation (3). However, using this two-step approach we can easily plot the relation between the estimated cyclicality ($\hat{\beta}_{i,c}$) and liquidity constraints ($Liquidity\ Constraints_{i,c}$) across industries and countries. For this reason, we present graphic evidence obtained from this two-step approach along with our more efficient one-step estimators.

B. Measurement and Data

1. Markups

The appropriate measurement of markups has been a permanent challenge in the literature on markup cyclicality. Marginal costs are usually not observed and have to be inferred from other data. Under the assumptions that firms minimize costs and factor markets are competitive, markups can be derived from each margin over which firms optimize. For instance, on the labor margin, the real markup corresponds to the inverse of the ratio of the salary paid to the last employee to its marginal productivity. Analogous derivations can be obtained from capital or materials margins. Markup cyclicality is, therefore, be determined by the cyclicality of real factor payments and the marginal product of each factor.

[5] This assumption is more realistic when one correlates firm-level data with GDP growth because no single firm is likely to be big enough to have a significant impact on the economy. Industries are larger (or more influential) relative to the economy than firms, of course, but in practice probably are not sufficiently large: in our sample the average share of an industry in the economy is 4.1%, with a standard deviation of 6.3%. In any case, in unreported results, we dropped from the sample all industries that represent more than 15% in the economy and the results were basically unchanged.

In most of our analysis we consider two measures of markups: the price-cost margin (PCM), defined as:

$$PCM = \frac{Value\ Added - Total\ Wages}{Total\ Output}, \tag{4}$$

and the labor share, defined as:

$$Lshare = \frac{Total\ Wages}{Total\ Output}. \tag{5}$$

If the production function is Cobb-Douglas and there are no factor market imperfections, both measures properly capture markup variation, although the PCM is positively related to markups and the labor share is negatively related. However, both measures have pitfalls when one relaxes these assumptions. Biases can arise, for instance, because of possible cyclical variations in the capital or labor elasticity of output, or the presence of overhead labor costs or the other types of factor market imperfections that result in cyclical variation in the use of capital, hoarding of labor, and so on. The empirical literature on markup cyclicality has devoted a lot of effort to correct for these biases.[6] Correcting every potential bias in the proxies we use here for a large sample of countries is implausible. Most papers focus in a single country (typically the United States) and exploit many sources of information to try to address these issues, which are normally unavailable for a sample like ours.

Instead, we follow a three-pronged strategy to address these concerns. First, we use two measures of markups that are not trivially related. The relation between markups and PCM depends on the capital elasticity of output, and on the labor elasticity of output for the labor share. Because PCM and labor shares are calculated on a total output basis, these two elasticities are not tied by the constant returns to scale and Euler equations. The wedge between them relates to the cyclicality of the output elasticity of material inputs.

Second, the high dimensionality of our data allows us to control for all sources of bias that are common within a country and to base our identification strategy only on how the within-country variation in the measures of cyclicality relates to factors such as financial conditions.

Third, we focus primarily on explaining *changes* in the cyclicality due to *changes* in liquidity constraints and competition. In this sense, the way we measure markups is not so important as long as the way we measure markup cyclicality is correctly correlated with the real (unobservable) cyclicality.[7] As stressed by Nekarda and Ramey (2013), different measures of markup cyclicality are highly correlated with each other, even after complicated (and sometimes heroic) adjustments and assumptions. Indeed, the correlation of our measure of markup cyclicality for the United States with that of Oliveira Martins and Scarpetta (1999), who use the same level of industry aggregation, is strong (0.55) and significant (p-value of 0.0226).

Data for constructing the measures of markups come from the United Nations Industrial Development Organization (UNIDO) Industrial Statistics (INDSTAT) database (United Nations, 2005). This database contains information on total output, value added, wages, employment, number of firms, capital formation, and production indexes for 28 industries at the three-digit International Standard Industrial Classification (ISIC) (Revision 2) level of aggregation for a

[6] Nekarda and Ramey (2013) survey some of the measures that have been used and the assumptions needed for these to capture markups correctly.

[7] As stressed by Cowling and Waterson (1976), the omitted variable problem is less severe when analyzing changes instead of levels; that is, it is less heroic to assume that industries' characteristics hold over time than that they hold every period.

large sample of countries. We cleaned the data by dropping all observations that had one of the following characteristics: 1) negative value added, wages, or output; 2) value added smaller than wages; 3) output smaller than value added; or 4) growth in the number of establishments greater than 50% or less than −50%.

Data on aggregate output come from the World Development Indicators (WDI) (World Bank, 2009). We keep in our baseline sample those country-industry pairs for which, at the country level, we have more than 10 industries with more than 20 years of data. This criterion increases the balance of the panel and leaves us with country-industry pairs with relatively long time series, which is important for analyzing cyclical fluctuations.[8] The final database contains data for 57 countries and 28 manufacturing sectors, from 1963 to 2002.

2. Liquidity Constraints

We measure liquidity constraints as the interaction between an industrial proxy for working capital or liquidity needs and a country proxy for financial development. This gives us a proxy that varies at the country-industry level. We build *Liquidity Needs* based on the cash conversion cycle (CCC) for US firms, which measures the length in days between the moment a firm pays for its raw materials and the moment it is paid for the sale of its final output during the normal course of operations (see Richards and Laughlin, 1980; Raddatz, 2006).[9] Although this measure is probably the most commonly used in financial analysis to measure the liquidity position of a firm, it is not the only one. One advantage of using it in our industry setting is that it has an important technological, exogenous component that justifies aggregating firm data into sectors and assuming that this component can be extrapolated to other countries.[10] Because we use US data to identify the working capital needs of an industry, we have excluded the United States in all the regressions (Rajan and Zingales, 1998).[11] Data on the CCC come from Raddatz (2006). Relying on a measure that is not country specific and is at least partly technologically determined also eases concerns about reverse causality. Indeed, firm's choices of investment, liquidity, capital structure, inventories, and trade credit policies might be affected by the anticipation of predation and the narrowing of margins during recessions. Measuring liquidity constraints with this country-industry interaction allows controlling for both country and industry characteristics that may be missing in the specification.

At the country level, we build *Financial Underdevelopment*, constructed as (1 − Average (Private Credit by Deposit Money Banks/GDP)). We use the ratio of average (1960-2000) private credit to GDP for each country to capture the underlying level of financial development. This means that we do not exploit the time variation of this characteristic within a country for identification. We discard this variation despite counting with the yearly data because we believe it is more related to credit cyclicality than to financial development.[12] The way markups relate to the

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[8] Constraining the countries-industries in our sample to have at least 30 years of continuous data yields similar results.

[9] The CCC is defined as inventories $*$ 365/(cost of goods sold) + receivables $*$ 365/total sales – payables $*$ 365/costs of goods sold. See Raddatz (2006) and Braun and Raddatz (2008) for a comprehensive description of the CCC.

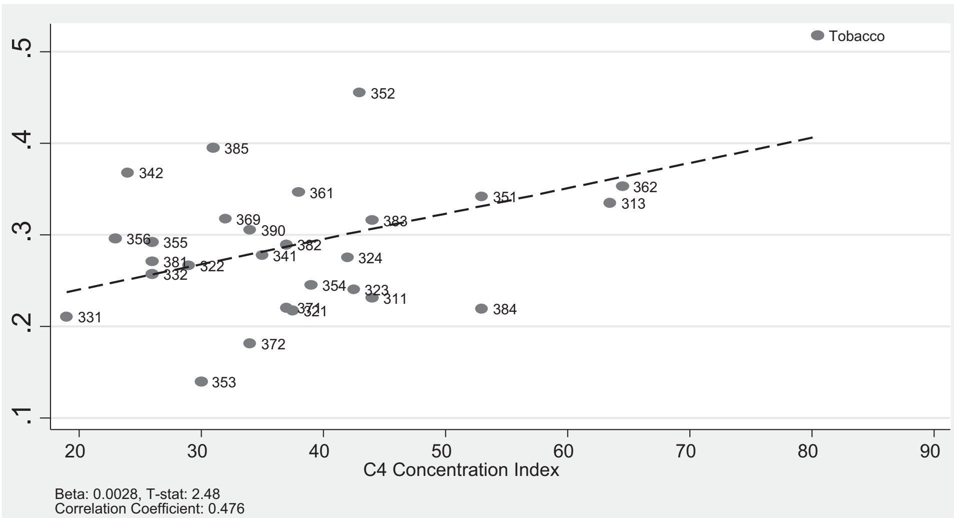
[10] The fact that analysts typically compare this indicator of a given firm with the average in the industry suggests that they believe that the measure has a relevant industry component.

[11] As pointed out by Ciccone and Papaioannou (2010), using benchmark industry characteristics to proxy for global industry characteristics might induce what they call an "amplification bias." We address this point using a global measure of CCC, and results do not change in a statistical sense. For simplicity and "tradition" we use the benchmark CCC for the United States in the analysis, as this amplification bias seems not to be of much importance in our case.

[12] Because this average includes data that were not known at each time point, this could induce some look-ahead bias. This issue is in practice of lesser importance in our setting given the persistence of financial development. Using only past data at each time point does not alter the results (unreported).

Figure 1. C4 Concentration Index and PCM for the United States

This figure shows the relation between the C4 Concentration Index (share of the biggest four firms in the industry) for US industries and average price-cost margin (PCM), for the 28 three-digit International Standard Industrial Classification (ISIC) industries in the United States. Averages are taken over 1963-2002. Standard errors are robust.



financial cycle is an interesting question but is not the focus of this article. We obtain these data from the WDI and World Bank's Financial Statistics (FinStats) databases.

3. Competition

We use the average level of PCM in each country-industry in our sample as our proxy for limited competition. This measure has been shown to have a strong positive correlation with measures of concentration across industries (see, e.g., Collins and Preston, 1969; Encaoua and Jacquemin, 1980; Clarke, Davies, and Waterson, 1984; Domowitz, Hubbard, and Petersen, 1988; Chevalier and Scharfstein, 1995). Figure 1 shows the relation between the C4 Concentration Index with the average PCM for each industry in the United States, a country for which we can measure the former. The positive correlation is clear and is present even when the tobacco industry (314) is excluded from the sample.

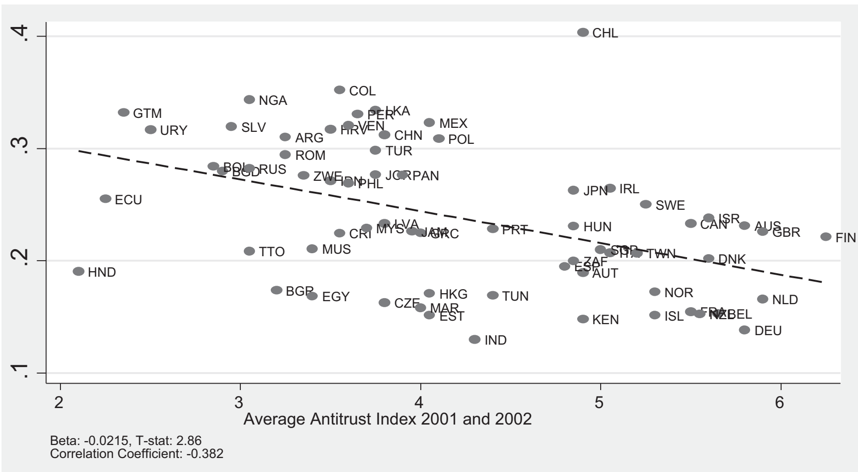
This relation between average PCM and proxies for competition also holds across countries. Some authors have used measures of antitrust policies and regulation quality as proxies for competition across countries (see, e.g., Rotemberg and Saloner, 1986; Chevalier and Scharfstein, 1995).[13] Panels A and B of Figure 2 show that average PCM is indeed lower in countries with higher values of antitrust indexes or in countries with better regulation of market competition.

[13] Because these country characteristics change very slowly or not at all, they provide pervasive variation on degrees of competition and, therefore, on the conditions that may lead to predation and collusion.

Figure 2. Regulation and Competition across Countries

This figure shows the relation between a country's average price-cost margin (PCM) and measures of its intensity and quality of regulation. Panel (A) plots the average PCM against the average antitrust index for 2001 and 2002, a measure of the quality of the antitrust regulation obtained from the Global Competitiveness Report published by the World Economic Forum. Panel (B) plots a country's average PCM against its average regulatory quality for 1996-2002, which is a measure that summarizes the perceptions of firms, citizens, and experts regarding the government's ability to formulate and implement sound policies and regulations that permit and promote private sector development, and was obtained from the World Bank's Worldwide Governance Indicators (www.govindicators.org). Standard errors are robust.

Panel A. Antitrust Index



Panel B. Regulatory Quality

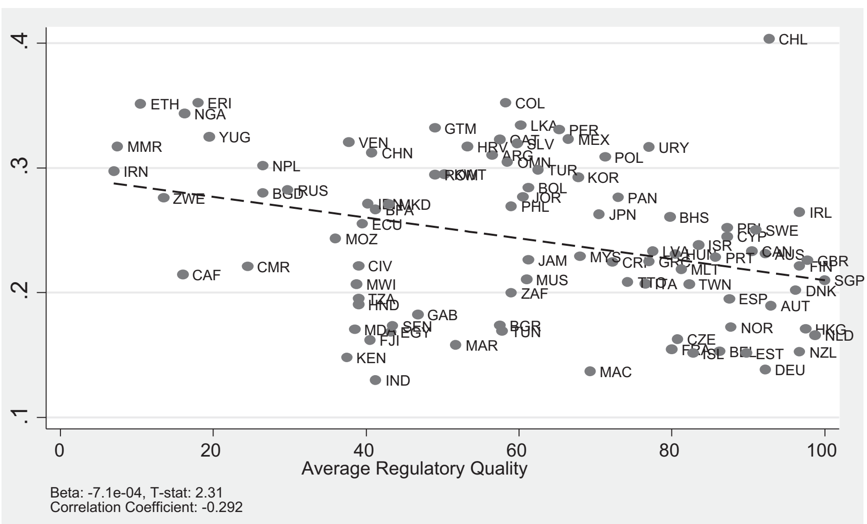


Table I. Average Estimated Cyclicality

The table presents the average across all country-industries of the estimated cyclicality of two measures of markups: price-cost margins (ln(*PCM*)) and labor shares (ln(*Labor Share*)), obtained by estimating the ordinary least squares coefficient of a regression between each measure and GDP growth (from World Bank) for each country-industry pair in our sample. The entire sample corresponds to data from 1963 through 2002, and the 30-year sample includes only countries-industries that have at least 30 years of continuous data. Constant included (not shown). Standard errors clustered at the country-year are in parentheses.

	ln(*PCM*)		ln(*Lshare*)	
	Entire Sample	**30-Year Sample**	**Entire Sample**	**30-Year Sample**
GDP growth	1.231***	1.246***	−0.581***	−0.599***
	(0.051)	(0.056)	(0.033)	(0.035)

***Significant at the 0.01 level.

These results are in line with the idea that more competition lowers the margins of firms and indicate that average PCM is a plausible proxy for competition for our analysis.[14] Tables A1 through A3 summarize basic features of the data.

III. Results

We start by documenting the average cyclicality of the two markup measures in our sample. Table I reports the results of estimating the specification described in Equation (2) with a common slope parameter β. The results show that, regardless of the sample, average markups are procyclical, with an estimated pass-through of 1.2, meaning that a 1-percentage-point increase in real GDP growth increases the *level* of markups by 1.2%. The way to select the sample does not affect the estimated cyclicality in a material way.[15] Regarding the cyclicality of the labor share, we find that it is negative and significant, a result that has been found in other papers as well (see Rotemberg and Woodford, 1999).

The estimated cyclicality of markups is correlated with the level of liquidity constraints. Table II presents the results of the two-step approach that consists of estimating Equation (3) using the markup cyclicality obtained by implementing Equation (2). Because we do not include fixed effects, we control for the levels of financial underdevelopment and liquidity needs to identify the coefficient for the interaction with the differential effect of having long CCCs in countries with high and low levels of financial development, the two components of our constraints measure. There is a clear significant relation between markup cyclicality and our measure of liquidity constraints: an increase in liquidity constraints makes our markup measures more procyclical (Columns (1) and (4)). A 1-standard-deviation increase in liquidity constraints increases the cyclicality of PCM (labor share) by 0.8 (−0.5), corresponding to 0.22 (−0.19) standard deviations of the empirical distribution of this variable. This positive relation is also

[14] This variable is not mechanically linked to the dependent variable. The latter measures the percentage deviation around the cycle and varies at the industry, country, and time levels, and the former is its average level in time and uses variation only at the industry and country levels. The log of the markup for a given industry can be negatively or positively correlated with that of other sector, and with the cycle, and yet both series can have exactly the same mean.

[15] We estimated all specifications in this article using both samples (not reported), obtaining similar results. This eases concerns that the results may be driven by outliers or by the "unbalancedness" of the data.

Table II. Average Cyclicality, Liquidity Constraints, and Competition: Two-Step Estimation

This table presents, for each country-industry in our sample, the relation between the estimated cyclicality of its markups (its estimated ordinary least squares relation with a country's GDP growth) and a series of variables related to the degree of competition and financial status of the firms. *Liquidity Needs*, measured at the industry level, corresponds to that industry's cash conversion cycle (from Raddatz, 2006). A country's *Financial Underdevelopment* corresponds to (1 − (Private Credit)/GDP). *Limited Competition* is the average of the price-cost margin of an industry in each country. *Liquidity Constraints* is the interaction between *Financial Underdevelopment* and *Liquidity Needs*. Columns (1) to (3) use price-cost margins (*PCM*) as the proxy for markups, and Columns (4) to (6) use the cyclicality of labor shares (*Labor Shares*) as dependent variable. Robust standard errors are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
	Cyclicality of ln(*PCM*)			Cyclicality of ln(*Lshare*)		
Liquidity Constraints	2.361**		2.167**	–1.397**		–1.344**
	(0.866)		(0.864)	(0.666)		(0.666)
Limited Competition		–6.097***	–6.024***		1.683	1.638
		(1.106)	(1.108)		(1.067)	(1.066)
Liquidity Needs	–2.048***	–0.534**	–1.789**	0.880**	0.031	0.809*
	(0.598)	(0.254)	(0.589)	(0.444)	(0.216)	(0.440)
Financial Underdevelopment	–3.514***	–1.020**	–3.045***	1.879**	0.496**	1.752**
	(0.932)	(0.322)	(0.910)	(0.718)	(0.246)	(0.705)
Observations	1,425	1,425	1,425	1,425	1,425	1,425
R^2	0.018	0.039	0.043	0.007	0.008	0.011

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

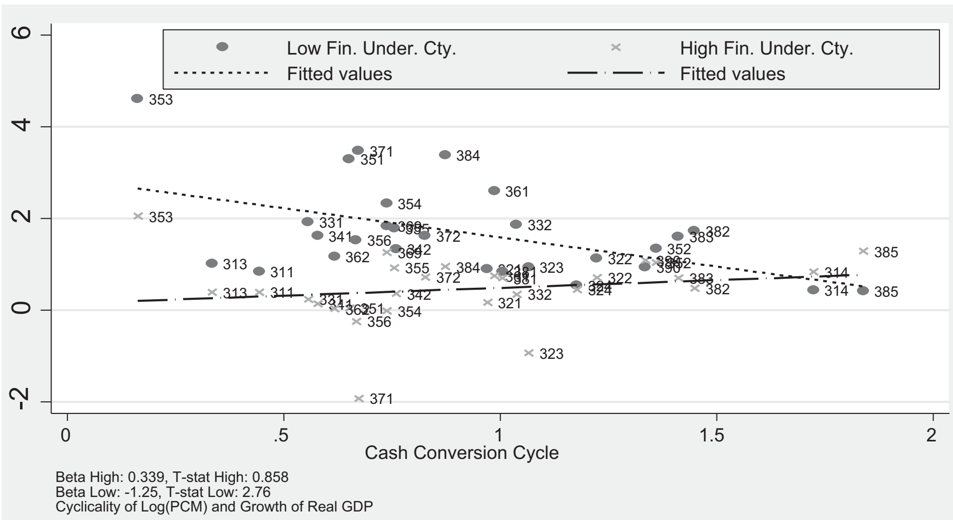
apparent in Figure 3, which depicts the partial effect of liquidity constraints on PCM. It shows that having long CCCs makes markups relatively more procyclical where the financial system is less developed. The sign, magnitude, and significance of this relation persist after controlling for our measure of industry competition (Columns (3) and (6)).

The coefficients for the relation between industry competition and markups imply that less competition yields more countercyclical markups, both unconditionally and conditional on liquidity constraints (Columns (2), (3), (5), and (6)). They are also statistically significant in all PCM measure specifications. A 1-standard deviation increase in the competition metric is associated with an increase of 0.58 in the cyclicality of PCM. This is consistent with Chevalier and Scharfstein (1995), who argue that in the United States, more concentrated sectors are more countercyclical (i.e., less procyclical).

Although we focus on competition and liquidity constraints, these are not the only factors relevant to the cyclicality of markups. The richness of our data allows us to explore the role of imperfections in factor markets, which have been the focus of recent research (Askildsen and Nilsen, 2007; Fariñas and Huergo, 2000). In particular, we use the ample variation across countries in the institutions that regulate these markets. In Table III we add to the specification above different proxies for factor market rigidities. We rely on measures included in the World Bank Doing Business data set. We use the 2005 figures because this is the earliest year for which there are data for a significant number of countries.

Figure 3. Cyclicality of Margins, Liquidity Needs, and Financial Development

This figure shows the relation between the average cyclicality of an industry and its cash conversion cycle, which is a measure of an industry's liquidity needs from Raddatz (2006), in countries with high and low financial underdevelopment (i.e., with private credit to GDP below and above the countries median, respectively). The cyclicality of an industry in a country corresponds to the correlation between the logarithm of the industry's price-cost margin (log(PCM)) and the growth of the country's GDP.



From a theoretical perspective, the sign of the relation between factor market rigidities and markup cyclicality depends critically on the detailed form taken by these rigidities and their consequences for the cyclical variation of factor quantities and prices. For instance, rigidities associated with convex costs of adjusting upward a given factor will make marginal costs more pr-ocyclical and markups, in turn, relatively more countercyclical. In contrast, rigidities that attenuate fluctuations in factor prices—such as labor unions that try to stabilize wages or the wage bill—may make marginal costs relatively less procyclical and markups relatively more so. It is also possible that factor rigidities that result in capacity constraints may also make markups more procyclical in models of collusive agreement because they reduce the incentives of firms to deviate from cooperation, especially during upturns when capacity constraints are more binding. Thus, the sign of the relation between factor rigidities and markup cyclicality is an empirical matter.

Our results show that the difficulty in adjusting the labor input makes both markup measures relatively more procyclical (Table III). We consider four indicators of the rigidity in the regulation of employment: hiring rigidity, firing rigidity, the flexibility of working hours, and an index of employment rigidity that includes all three indicators. All but one of the coefficients indicate an increase in procyclicality and most of the time are also statistically significant.

We found the same pattern when looking at capital adjustment costs: our proxy for the rigidity in adjusting physical capital is the time required for a small or medium-size business to obtain the approvals needed to build a simple commercial warehouse and connect it to water, sewer, and

Table III. Average Cyclicality, Liquidity Constraints, and Competition: Factor Market Rigidities

This table presents the relation between the cyclicality of an industry markup in a given country (estimated by its ordinary least squares relation with the country's GDP growth) and a series of indicators for a country's degree factor markets rigidities that are added to the specification presented in Table II. Factor market rigidities variables measure hiring rigidity, firing rigidity, the flexibility of adjusting working hours, an index of employment rigidity that includes all the previous three, as well as an indicator of the costs of adjusting physical capital (the time required for a small or medium-size business to obtain the approvals needed to build a simple commercial warehouse and connect it to water, sewerage and a fixed telephone line), all from the World Bank Doing Business data set. Robust standard errors are in parentheses.

	Cyclicality of ln(*PCM*)						Cyclicality of ln(*Lshare*)			
	(1) Hiring	(2) Firing	(3) Labor Hours	(4) Employment	(5) Capital Adjustment Costs	(6) Hiring	(7) Firing	(8) Labor Labor	(9) Employment	(10) Capital Adjustment Costs
Liquidity Constraints	2.183**	2.192**	2.115**	2.153**	2.255**	−1.224*	−1.225*	−1.176*	−1.214*	−1.188*
	(0.886)	(0.881)	(0.882)	(0.877)	(0.888)	(0.653)	(0.656)	(0.661)	(0.653)	(0.648)
Limited Competition	−5.985***	−5.510***	−6.213***	−5.790***	−5.901***	1.451	1.581	1.676	1.428	1.506
	(1.150)	(1.120)	(1.161)	(1.132)	(1.118)	(1.090)	(1.091)	(1.101)	(1.096)	(1.071)
Liquidity Needs	−1.871**	−1.893**	−1.808**	−1.859**	−1.893**	0.723*	0.717	0.680	0.718*	0.716*
	(0.613)	(0.609)	(0.602)	(0.604)	(0.613)	(0.435)	(0.436)	(0.437)	(0.434)	(0.432)
Financial Underdevelopment.	−3.274***	−3.249***	−3.579***	−3.633***	−3.164***	1.544**	1.458**	1.830**	1.671**	1.524**
	(0.952)	(0.935)	(0.930)	(0.935)	(0.943)	(0.700)	(0.700)	(0.702)	(0.696)	(0.694)
Factor Rigidity	0.009*	0.008**	0.024***	0.027***	0.418**	−0.001	0.004	−0.015***	−0.007**	−0.666***
	(0.005)	(0.004)	(0.004)	(0.006)	(0.156)	(0.003)	(0.003)	(0.002)	(0.003)	(0.115)
Observations	1,355	1,355	1,355	1,355	1,376	1,355	1,355	1,355	1,355	1,376
R^2	0.045	0.045	0.064	0.057	0.045	0.008	0.009	0.027	0.010	0.025

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

a fixed telephone line. This includes all inspections and certificates needed before, during, and after construction of the warehouse.

Overall, these results indicate that, on average, factor market rigidities tend to make markups relatively more procyclical. This could be because rigidities reduce the cyclicality of real factor prices or because they result in capacity constraints that strengthen the ability of firms to coordinate around static optimal collusive prices. The cross-country proxies for factor rigidities we use capture both potential dimensions. Thus, our data do not allow us to separate the relative importance of these two explanations. More research is needed to advance on this front.

The inclusion of these country-level institutional features does not have a major impact on the effect of liquidity constraints and competition. The differences in the coefficients are small, the signs are always the same, and the economic effect is of the same order of magnitude. We do not include these variables in the analysis that follows to maintain the focus of our article. However, the benchmark results for competition and financial constraints are robust to this choice.

Results from the more efficient one-step procedure (Equation (1)) confirm the basic findings of the two-step approach and yield several additional insights (Table IV). The positive (negative) coefficient for the interaction between real GDP growth and PCM (labor share) indicate that markups are procyclical on average. They are more procyclical in countries-industries with more liquidity constraints (Columns (1) and (5)), and they are more countercyclical in less competitive industries (Columns (2) and (6)). Regressions including both liquidity constraints and competition as explanatory variables yield similar results (Columns (3) and (7)). As in the two-step estimation, although the coefficients are always of the right sign, the statistical significance of the competition proxy when using the labor share metric is dependent on the conditioning set. When one takes into account that the competition effect changes with the degree of financial development and CCC, the coefficient turns very significant. This suggests that the effect of competition and liquidity constraints on the cyclicality of markups should not be taken as independent from each other.

We also used our empirical framework to test for the presence of an interaction effect of liquidity constraints and competition on markup cyclicality, that is, whether liquidity constraints make markups more procyclical in less competitive environments. The results, reported in Columns (4) and (8) of Table IV, indicate that an increase in average PCM renders relatively more countercyclical those industries facing higher liquidity constraints. Said differently, liquidity-constrained industries operating in a very competitive environment are the most procyclical industries. For instance, they experience a relatively larger markup decline (or a smaller increase) during recessions. This finding may be interpreted in light of the predation story of markup cyclicality with the caveat that this story relates to the distribution of the firms' liquidity constraints and market power *within* an industry, not necessarily *across* sectors. The results suggest that in situations where firms compete intensively in an industry where the average firm is liquidity constrained, it may be profitable for liquidity-unconstrained firms to engage in predation during downturns. In these situations, a decline in markups during a downturn may lead an important part of the industry into difficulties and improve significantly the position of unconstrained firms. Although plausible and interesting, this finding is not fully robust to changes in the sample and the way we measure competition and liquidity constraints. Therefore, in what follows we report results using the specification in Columns (3) and (7) of Table IV as the baseline, that is, with no interaction between liquidity constraints and competition. Results in Section IV provide further evidence consistent with the long purse view of predation and its consequences for markup cyclicality using measures of firm heterogeneity within industries.

To quantify the economic magnitude of the estimated coefficients, we compute the change in estimated markup cyclicality when varying our key independent variables from a context with fewer liquidity constraints and low competition to a context with important constraints and high

Table IV. Cyclicality, Liquidity Constraints, and Competition: One-Step Estimation

This table shows how the relation between industry markups (as measured with the log of price-cost margins (ln(*PCM*)) in Columns (1)-(4) and the log of labor shares (ln(*Labor Share*)) in Columns (5)-(8)) and country growth vary with liquidity constraints. *GDP Growth* corresponds to the log-change in a country's GDP in constant local currency (from the World Bank). *Liquidity Needs*, measured at the industry level, corresponds to that industry's cash conversion cycle (from Raddatz, 2006). A country's financial underdevelopment corresponds to (1 − (Private Credit)/GDP). *Limited Competition* is the average of the price-cost margin of an industry in each country. *Liquidity Constraints* is the interaction between *Financial Underdevelopment* and *Liquidity Needs*. Country-sector and year fixed effects are also included (not shown). Standard errors in parentheses are robust and clustered at the country-year level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			ln(*PCM*)				ln(*LShare*)	
GDP Growth	1.549***	1.395***	2.211***	4.448***	−1.155***	−0.837***	−1.292***	−3.601***
	(0.330)	(0.226)	(0.359)	(0.866)	(0.304)	(0.192)	(0.335)	(0.652)
GDP Growth × *Liquidity Constraints*	1.503***		1.331**	2.374**	−1.021**		−0.986**	−2.845***
	(0.423)		(0.420)	(0.960)	(0.343)		(0.343)	(0.774)
GDP Growth × *Limited Competition*		−3.608***	−3.543***	−13.434***		0.754	0.735	11.068***
		(0.701)	(0.712)	(3.109)		(0.753)	(0.744)	(2.788)
GDP Growth × *Liquidity Constraints* × *Limited Competition*				−5.190*				7.872**
				(2.829)				(3.276)
GDP Growth × *Liquidity Needs*	−1.163***		−0.995***	−2.417***	0.528**		0.493**	1.694***
	(0.262)		(0.260)	(0.598)	(0.212)		(0.211)	(0.508)
GDP Growth × *Financial Underdevelopment*	−1.433**		−1.093**	−3.387**	0.989**		0.918**	4.463***
	(0.501)		(0.498)	(1.246)	(0.461)		(0.456)	(0.922)
GDP Growth × *Liquidity Needs* × *Limited Competition*				6.078**				−5.268**
				(1.921)				(2.212)
GDP Growth × *Financial Underdevelopment* × *Limited Competition*				10.903**				−15.481***
				(4.121)				(3.869)
Observations	46,399	46,399	46,399	46,399	46,399	46,399	46,399	46,399
R^2	0.565	0.565	0.565	0.565	0.705	0.705	0.705	0.705

***Significant at the 0.01 level.
**Significant at the 0.05 level.

Table V. Economic Magnitude of the Effect of Liquidity Constraints and Competition

This table shows how markup cyclicality changes when moving from a low liquidity constraints and low competition context to a high constraints and high competition situation (using the 75th and 25th percentiles of each variable and keeping all the other variables at the 50th percentile). The effect is measured based on the coefficients reported in Columns (4) and (8) of Table III.

	Initial Cyclicality	Final Cyclicality	Difference
	Panel A. ln(PCM)		
Low to high *Liquidity Constraints*	0.679	1.196	0.516***
Low to high *Competition*	0.352	0.775	0.422****
Low to high *Liquidity Constraints* and *Competition*	0.459	1.399	0.939***
	Panel B. ln(Lshare)		
Low to high *Liquidity Constraints*	−0.692	−1.074	−0.382***
Low to high *Competition*	−0.600	−0.687	−0.087
Low to high *Liquidity Constraints* and *Competition*	−0.646	−1.110	−0.470***

***Significant at the 0.01 level.

competition. We define low and high degrees of constraints and competition for each variable at the 25th and 75th percentile levels of distribution, respectively (CCC*Fin. Under. and average PCM, respectively). We do this for each variable separately and for both variables considered together. The results are summarized in Table V. Increasing the liquidity constraints faced by an industry from the 25th to 75th percentile increases cyclicality by 0.516, from 0.679 to 1.196. Remember from equation (1) that the parameters estimated for the cyclicality of markups are semi-elasticities. Therefore, this means that the percentage increase in PCM in response to a 1-point increase in GDP almost doubles when moving between these two states. When changing the average PCM from the 75th to the 25th percentile, the estimated cyclicality increases 0.422, from 0.352 to 0.775. Finally, when changing these two variables together—that is, when moving to a high-competition, high-liquidity-constraints context from a low-competition, low-constraints context—the estimated cyclicality increases from 0.459 to 1.399. All differences are statistically significant at conventional levels.

As for the change in marginal cost cyclicality (i.e., the labor share) the effects are larger, but this is because of the smaller variance in estimated cyclicality. These results should be interpreted only as upper-bound effects.

IV. Robustness

Our baseline results rely on a series of reasonable, yet arbitrary, choices of proxies for the different variables of interest. We also look at a limited set of potential determinants of markup cyclicality. This section explores the robustness of the results to these choices. We first focus on alternative measures for key control variables and next address alternative explanations for markup cyclicality.

A. Alternative Measures for Key Control Variables

A first aspect to consider is the activity measure used to capture the state of the business cycle. Our benchmark uses GDP growth because it is the simplest measure of all, but other proxies are available. We consider the detrended log of real GDP, a recession indicator constructed by Braun and Larrain (2005), an indicator that equals 1 during a period of GDP contraction and 0 otherwise, and the cumulative drop in GDP when this indicator is falling.

Columns (1) through (4) of Table VI display the estimated coefficients. For brevity, we report only the results obtained when using PCM as the markup variable, but the findings are similar when relying on labor shares. In all four cases, the results mimic the baseline results and imply more procyclical markups for firms in industries that face tougher financial conditions and more intense competition. Not surprisingly, because of the source of identification we are using, the cyclical component of GDP yields virtually the same coefficients as before (Column (1)). Recessions are associated with declines in PCMs, and these are larger among industries that are more exposed to competition and financial fragility (Column (2)). The same conclusions are reached when using output contractions or the cumulative drop in GDP in absolute value (Columns (3) and (4)).

The finding that PCMs shrink during output contractions, even after controlling for the size of the contraction, may lead one to think that it is periods of recessions that are behind their cyclicality, with PCMs being relatively flat or less cyclical during expansions. This could be the case if recessions offer something special to help firms move their markups. For example, interfirm coordination may become more effective after a trough (Baker and Woodward, 1998). We formally tested for this possibility by exploring whether the relation between GDP growth and PCMs reported in our baseline results is asymmetric, adding the interaction between GDP growth and output contraction (and its interaction with all the other variables included in the baseline specification). To conserve space we do not report the results. However, we find no evidence of asymmetry. Although the pattern of markup cyclicality is the same as in the baseline specification, there is no additional boost to PCM cyclicality during output contractions. We find some evidence of asymmetry when using labor shares as the measure of markups, but only for the average effect (unreported).

Up until now, we have used country-level measures of output fluctuations because we want to explore the evolution of markups around the business cycle. However this approach may lead to the concern that the cyclicality of markups in a sector is larger or smaller than in other sectors simply because its output reacts differently to aggregate fluctuations. This is not a first-order concern because our approach does not rely on the level of the cyclicality but rather on its variation across financial and competitive conditions, while also controlling for industry effects at the country level. Nonetheless, the estimates in Column (5) of Table VI show that the result persists when using industry growth as the cycle variable: markups are more procyclical in more competitive industries and in sectors with more liquidity-constrained firms.

The downside of the specification used in Column (5) of Table VI is that a sector's output growth is endogenous to the evolution of prices, as they are codetermined in a demand-supply system. Indeed, the estimated cyclicality of markups with respect to this measure is significantly smaller than the baseline. One way to get around this problem is to instrument industry growth with GDP growth. As long as sectors are not very large relative to the entire economy, this can be safely taken as exogenous to the evolution of production in a given industry. When we instrument industry growth with GDP growth, in Column (6) we still get positive and significant coefficients. We can then conclude that the component of industry growth related to aggregate business-cycle fluctuations is partly behind the results for markup cyclicality documented in this article.

Table VI. Robustness to Different Cycle Measures

This table presents a series of robustness exercises for the regression results presented in Column (3) of Table IV using different measures of the state of the business cycle. Each column uses the measure of the state of the business cycle that is described at its top. That measure should replace the generic *Cycle variable* label in the various rows. The rest of the variables are defined as follows: *Liquidity Needs*, measured at the industry level, corresponds to that industry's cash conversion cycle (from Raddatz, 2006). A country's *Financial Underdevelopment* corresponds to (1 − (Private Credit)/GDP). *Limited Competition* is the average of the price-cost margin of an industry in each country. *Liquidity Constraints* is the interaction between *Financial Underdevelopment* and *Liquidity Needs*. Country-sector and year fixed effects are also included (not shown). Standard errors in parentheses are robust and clustered at the country-year level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Cyclical GDP	**Recession**	**Output contraction**	**Cummulative output contraction**	**Industry output growth**	**Industry growth instrumented w/GDP growth**
Cycle variable	1.519***	−0.114**	−0.202***	1.294	0.114**	0.202***
	(0.432)	(0.043)	(0.052)	(1.073)	(0.043)	(0.052)
Cycle variable × Liquidity Constraints	1.433**	−0.094*	−0.130*	2.899**	0.094*	0.130*
	(0.530)	(0.054)	(0.071)	(1.406)	(0.054)	(0.071)
Cycle variable × Limited Competition	−1.455**	0.236**	0.418***	−2.694***	−0.236**	−0.418***
	(0.687)	(0.084)	(0.100)	(0.634)	(0.084)	(0.100)
Cycle variable × Liquidity Needs	−1.095**	0.067**	0.103**	−1.978*	−0.067**	−0.103**
	(0.352)	(0.033)	(0.043)	(1.050)	(0.033)	(0.043)
Cycle variable × Financial Underdevelopment	−1.258**	0.028	0.045	−0.341	−0.028	−0.045
	(0.627)	(0.064)	(0.079)	(1.518)	(0.064)	(0.079)
Observations	46,209	46,209	45,298	45,298	46,209	45,298
R^2	0.564	0.565	0.569	0.569	0.565	0.569

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

The literature has used a broad set of proxies to measure liquidity constraints and competition across firms, industries, and countries. Regressions in Columns (1) through (4) of Table VII explore the consequences of considering four industry-level measures of liquidity constraints proposed in the literature: a global measure of CCC, the Rajan and Zingales (1998) measure of external financial dependence, the industry-level ratio of inventory to sales (Raddatz, 2006), and the degree of assets tangibility (Braun, 2003). The first three measures should yield results with the same sign as those obtained with the CCC, as they are measures of working capital needs. However, because assets tangibility is a measure of the pledgeability of collateral, the relevant parameters should have the opposite sign of those in the baseline correlation. Thus, we use the inverse measure (i.e., asset intangibility) to avoid confusion.

The results consistently show that, regardless of the proxy used to capture liquidity constraints, the sign of its coefficient remains unaltered. The coefficients are also statistically significant in all but the external finance dependence case. Based on this last (non) result, one could argue that it is not the overall ability to raise external finance that matters for markups, but rather the capability of getting financed in particular moments of distress, such as downturns. Markups react to liquidity and not necessarily to solvency. Of course, the insignificance may also be due to noise in the computation of the variable. As for the competition measure, it remains negative and significant.

The robustness of the results to different proxies for the degree of competition is studied in the remaining columns in Table VII. Instead of using the average PCM of a given industry in a given country, the proxies used in this table are based on the interaction of industry-level (constant across countries) and country-level (constant across industries) measures. In particular, we consider the following two combinations: 1) the interaction of an industry's US-based tradability index (from Braun, 2003) and a country's degree of trade openness (volume of trade to GDP, from WDI), and 2) the interaction of an industry's inverse value of its C4 Concentration Index in the United States and a country's index of antitrust regulation effectiveness (from the Global Competitiveness Report, 2001-2002; World Economic Forum, 2002). Consistent with the baseline results, the regressions show that less competition is associated with more countercyclical markups. Industries that have a natural tendency toward concentration are more countercyclical when located in countries that are not particularly fond of competition (Column (6)). Similarly, industries that are more heavily exposed to foreign competition are more procyclical (Column (5)).

We also checked whether the presence of outliers may be driving the results in Table VIII. The regression in Column (1) excludes sectors 314 (tobacco) and 353 (petroleum refineries) from the sample because there is evidence that financial development has a major impact on their margins (see Braun and Raddatz, 2008). Columns (2) and (3) exclude the three industries with the highest CCC and the three industries with the lowest CCC, and Columns (4) and (5) exclude the countries that are at the top and bottom 10% of the cross-country distribution of financial underdevelopment. These exercises aim to check whether extreme values of the variables that influence an industry's liquidity constraints are driving the baseline findings. Finally, regressions in Columns (6) and (7) perform a similar robustness check for our measure of industry competition by excluding the three industries in the top and bottom of the distribution of average PCM.

In all cases, the results are qualitatively similar to the baseline case: markups are more procyclical when liquidity constraints are tighter and when competition is higher. This supports the view that our main findings are not driven by individual observations, countries, or industries.

Table VII. Robustness to Different Liquidity Needs and Limited Competition Measures

This table presents a series of robustness exercises for the regression results presented in Column (3) of Table IV, using different measures of liquidity needs and limited competition. *GDP Growth* corresponds to the log-change in a country's GDP in constant local currency (from World Bank). In Columns (1)-(4), *Liquidity Constraints* is the interaction between *Financial Underdevelopment* and the measure of *Liquidity Needs* described at the top of the column, and in Columns (5)-(6) the interaction is with the default measure of liquidity needs (cash conversion cycle (CCC)). A country's *Financial Underdevelopment* corresponds to (1 − (Private Credit)/GDP). In Columns (1)-(4), *Limited Competition* is the average of the price-cost margin of an industry in each country, and in Columns (5)-(6) it corresponds to the variable described at the top of each of those columns. Country-sector and year fixed effects are also included (not shown). Standard errors in parentheses are robust and clustered at the country-year level.

	Different Financial Need and Competition Measures					
	(1)	(2)	(3)	(4)	(5)	(6)
	Global CCC	Financial Dependence	Inventories to Sales	Assets In-tangibility	Industry Tradability × Country Openness	(1/US C4 Concentration) × Country Antitrust
GDP Growth	1.193***	1.437***	2.867***	3.702***	0.904**	0.977**
	(0.293)	(0.306)	(0.386)	(0.648)	(0.340)	(0.433)
GDP growth × Liquidity Constraints	0.485**	0.426	10.705**	3.397**	1.332**	1.292**
	(0.224)	(0.527)	(3.316)	(1.390)	(0.420)	(0.428)
GDP Growth × Limited Competition	−3.718***	−3.755***	−3.629***	−3.514***	79.061**	4.470**
	(0.708)	(0.715)	(0.707)	(0.711)	(27.809)	(1.796)
GDP Growth × Liquidity Needs	−0.651***	−0.574*	−9.684***	−3.444***	−1.026***	−1.061***
	(0.126)	(0.322)	(1.904)	(0.855)	(0.264)	(0.266)
GDP Growth × Financial Underdevelopment	0.250	0.079	−1.581**	−2.250**	−0.920*	−1.254**
	(0.347)	(0.374)	(0.579)	(1.033)	(0.487)	(0.524)
Observations	46,399	46,399	46,399	46,399	45,458	41,012
R^2	0.565	0.565	0.565	0.565	0.565	0.573

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

Table VIII. Robustness to the Sample Used

This table presents a series of robustness exercises for the regression results presented in Column (3) of Table IV, using different samples. Column (1) excludes petroleum refineries. Columns (2) and (3) drop the three industries with the highest and lowest *Liquidity Needs*, respectively. Columns (4) and (5) exclude the bottom and top 10% of countries ranked by *Financial Underdevelopment*, respectively. Finally, Columns (6) and (7) drop the three industries with the lowest and highest degrees of competition, respectively. The dependent variable is the log of an industry's price-cost margin (log(*PCM*)) in each country-year. *GDP growth* corresponds to the log-change in a country's GDP in constant local currency (from World Bank). *Liquidity Needs*, measured at the industry level, corresponds to that industry's cash conversion cycle (from Raddatz, 2006). A country's *Financial Underdevelopment* is computed as (1 − (Private Credit)/GDP). *Limited Competition* is the average of the price-cost margin of an industry in each country. *Liquidity Constraints* is the interaction between *Financial Underdevelopment* and *Liquidity Needs*. Country-sector and year fixed effects are also included (not shown). Standard errors in parentheses are robust and clustered at the country-year level.

	Countries or Industries Excluded from the Sample						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Petroleum Refineries	High *Liquidity Needs*	Low *Liquidity Needs*	Least *Financial Underdev.*	Most *Financial Underdev.*	Lowest Degree of Competition	Highest Degree of Competition
GDP Growth	1.828***	1.977***	2.496***	3.271***	1.986***	2.436***	2.614***
	(0.394)	(0.456)	(0.372)	(0.826)	(0.394)	(0.396)	(0.410)
GDP Growth × *Liquidity Constraints*	1.047**	1.381**	1.235**	2.953**	1.609***	1.610***	1.364**
	(0.405)	(0.510)	(0.470)	(1.086)	(0.469)	(0.454)	(0.470)
GDP Growth × *Limited Competition*	−3.629***	−3.156***	−4.397***	−3.680***	−2.180**	−3.389***	−4.997***
	(0.855)	(0.826)	(0.854)	(0.810)	(0.861)	(0.729)	(1.023)
GDP Growth × *Liquidity Needs*	−0.660**	−0.819**	−1.167***	−1.926**	−1.145***	−1.215***	−1.182***
	(0.255)	(0.318)	(0.286)	(0.686)	(0.272)	(0.280)	(0.297)
GDP Growth × *Financial Underdevelopment*	−0.774	−1.190*	−0.974*	−2.893**	−1.144**	−1.404**	−0.998*
	(0.502)	(0.628)	(0.504)	(1.257)	(0.556)	(0.544)	(0.552)
Observations	43,462	41,459	41,648	38,834	39,124	41,134	41,500
R^2	0.545	0.537	0.558	0.568	0.529	0.560	0.537

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

B. Alternative Mechanisms behind Markup Cyclicality

Our identification strategy eases concerns about omitted variable bias. However, it is always possible that, for instance, the interaction of the proxy for liquidity needs (CCC) and the measure of financial underdevelopment is correlated with other characteristics that determine industry markup cyclicality through a totally different mechanism.

In addition to the strategic interaction among firms in oligopolistic markets, markups may exhibit cyclical fluctuations if the elasticity of demand varies in a cyclical way, or if there is cyclical entry and exit of firms. Regarding the possibility of cyclical fluctuations in the elasticity of demand, the entry of price-sensitive consumers during booms and their exit during busts could induce procyclicality in markups. This phenomenon could explain our findings if it is more pronounced for consumers (buyers) of industries that are more liquidity constrained. It is difficult to think of a reason for this pattern. One may argue that the elasticity of demand can be more procyclical in less financially developed countries if credit is more procyclical and the marginal borrower is more price sensitive in all dimensions (including credit demand). However, this would be a country-level, aggregate phenomenon instead of an industry-level phenomenon.

Nonetheless, one way of addressing this issue is to control for the exposure of an industry in a given country to foreign competition. Arguably, the demand of industries that export a larger fraction of their production should be less sensitive to fluctuations in demand driven by the domestic business cycle. The results discussed above that use the interaction of an industry's measure of tradability with a country's measure of trade openness as a measure of an industry's degree of competition (Column (5) of Table VII) indirectly tackle this issue. These results indicate that industries more exposed to international competition are more procyclical, consistent with the results using average PCM, but they preserve the sign and significance of the coefficient capturing the cyclicality of liquidity-constrained industries.

Furthermore, directly controlling for the markup cyclicality of industries relatively more exposed to international competition, in addition to our standard measure of domestic competition, does not change our main results. This is shown in the regression reported in Column (1) of Table IX, which adds to our benchmark specification the interaction between our measure of activity and an index of the revealed comparative advantage (RCA) of a country-industry pair. This new variable is computed as in Balassa (1965) using data from Nicita and Olarreaga (2006). The results show that industries with higher exposure to international markets are not significantly more procyclical than those that rely more on the domestic market, and that the cyclicality of liquidity-constrained industries is not affected by controlling for this characteristic. Because it could also be that, regardless of its average exposure to international competition, an industry's exposure may fluctuate cyclically, we include a time-varying measure of RCA. This reduces the sample but does not change importantly the findings regarding the coefficient on liquidity constraints (Column (2)). Finally, industries that produce differentiated goods may face demands that are more inelastic. If that relatively lower elasticity is preserved during the cycle, these industries may be relatively more procyclical. It is difficult to find good proxies for the degree of differentiation of the goods produced by an industry. A rough proxy is the number of subindustries that it comprises according to the industrial classification system. Controlling by this proxy, we find that more diverse industries, likely to produce more differentiated goods, have markups that are slightly more countercyclical than the average industry. However, this does not affect the cyclicality of markups of liquidity-constrained industries (Column (3)).

Controlling for the cyclicality of firm entry into an industry is more difficult. The reason is that there is clear scope for reverse causality. As argued above, entry may increase competition and lower markups in booms ceteris paribus, but high markups may also induce entry. We provide

Table IX. Robustness to Alternative Mechanisms

This table presents a series of robustness exercises that add various controls to the regression presented in Column (3) of Table IV. The dependent variable is the log of an industry's price−cost margin (log(*PCM*)) in each country-year. *GDP Growth* corresponds to the log-change in a country's GDP in constant local currency (from World Bank). *Liquidity Needs*, measured at the industry level, corresponds to that industry's cash conversion cycle (from Raddatz, 2006). A country's *Financial Underdevelopment* is computed as (1 − (Private Credit)/GDP). *Limited Competition* is the average of the price-cost margin of an industry in each country. *Liquidity Constraints* is the interaction between *Financial Underdevelopment* and *Liquidity Needs*. The *Revealed Comparative Advantage* is a country-industry measure based on Balassa (1965) (Column (1) uses its average value in a country-industry and Column (2) allows it to vary over time). *Product Diversity* corresponds to the number of subsectors in each industry's three-digit International Standard Industrial Classification (ISIC) code. *Growth of Establishments* is the log annual change in the number of establishments in a given country-year. In Column (6), this variable is instrumented with the interaction between the cyclicality of the number of establishments in the United States and a country's real GDP growth. Country-sector and year fixed effects are also included (not shown). Standard errors in parentheses are robust and clustered at the country-year level.

	(1)	(2)	(3)	(4)	(5)	(6)
GDP Growth	2.204***	2.266***	2.301***	1.782**	1.069*	1.934***
	(0.361)	(0.577)	(0.373)	(0.581)	(0.553)	(0.508)
GDP Growth × *Liquidity Constraints*	1.310**	1.462**	1.306**	2.504**	2.221**	2.387**
	(0.428)	(0.684)	(0.418)	(0.876)	(0.812)	(0.737)
GDP Growth × *Limited Competition*	−3.586***	−3.489**	−3.717***	−2.175*	0.057	−2.441**
	(0.726)	(1.133)	(0.743)	(1.163)	(1.266)	(0.857)
GDP Growth × *Liquidity Needs*	−0.979***	−0.907**	−0.923***	−1.504**	−1.041**	−1.452**
	(0.262)	(0.397)	(0.261)	(0.540)	(0.440)	(0.470)
GDP Growth × *Financial Underdevelopment*	−1.060**	−1.382*	−1.060**	−1.626*	−1.846**	−1.679**
	(0.497)	(0.786)	(0.495)	(0.871)	(0.815)	(0.756)
GDP Growth × *Average Revealed Comparative Advantage*	−0.006					
	(0.025)					
Revealed Comparative Advantage		0.002				
		(0.001)				
GDP Growth × *Diversity*			−0.007*			
			(0.004)			
Growth of Establishments				0.091**		−0.143
				(0.035)		(0.100)
Lag of *Growth of Establishments*					−0.026	
					(0.035)	
Observations	45,360	25,334	46,399	18,015	16,899	17,767
R^2	0.555	0.632	0.565	0.668	0.676	0.058

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

two types of evidence. First, we simply add to our baseline regression the growth in the number of establishments in each country industry each year, assuming that entry precedes markups (Column (4) in Table IX). Second, we include the lagged value of this variable (Column (5)). In neither case is the coefficient of the cyclicality of liquidity constraints affected. Moreover, there is a positive correlation between the growth in the number of establishments and PCM, indicating that the latter tends to be higher when there are more firms, contrary to the competition argument.

Because this finding may be driven by the reverse causality argument, we instrument the growth in the number of establishments with the interaction between the cyclicality of the number of establishments in the United States and a country's real GDP growth. The results are qualitatively similar (Column (6)).

Finally, beyond these two alternative mechanisms we addressed the broader concern that our liquidity constraints variable may be capturing a different, yet unspecified, mechanism behind industry-level markup cyclicality in a pragmatic manner. We ran regressions where we added to the baseline specification the interaction of several industry-level characteristics with a country's measure of financial underdevelopment, and with cyclical activity. This is a tough robustness check because there is no reason to think that the way a given industry's characteristic affects its cyclicality is mediated through financial underdevelopment. Thus, by proceeding this way we are maximizing the possible correlation between our baseline measure of liquidity constraints and the added variables. We consider the following industry characteristics as potential determinants of markup cyclicality: capital per worker, assets' durability, assets' tangibility, information asymmetry, products diversity, and average sector cyclicality.[16] The results (unreported) confirm the findings of our baseline estimation. The coefficients for both the liquidity constraints and the competition measures are robust to the inclusion of the other industrial controls.[17]

V. Business-Cycle Persistence and the Long Purse View of Predation

As mentioned above, the degree of serial correlation of a country's aggregate demand and the degree of asymmetry of firms within a market have consequences for the competition and strategic interaction among firms that are behind markup behavior. In this section we dig deeper in our findings by looking at how these mechanisms affect our results for the relation between liquidity constraints and markup cyclicality.

We explore Haltiwanger and Harrington's (1991) model by first computing the serial correlation of our activity measure (real GDP growth) for each country in our sample. We then separate countries into groups for which this correlation is above and below the cross-country median, and estimate the parameters of the baseline specification for each group separately. The higher markup procyclicality of liquidity-constrained industries is particularly strong in countries with relatively high serial correlation of real growth, as can be seen in Columns (1) and (2) of Table X. This indicates that positive serial correlation reinforces the incentives of liquidity-constrained firms to lower markups during downturns. In these countries, bad states of nature are more likely followed by other bad states. Thus, a liquidity-constrained firm needs to quickly raise resources and cannot simply rely on the expectation of better times tomorrow. Price cuts are thus more frequently used.

[16] We take capital per worker, asset tangibility, and asset durability from Braun (2003). Product diversity is based on the number of subsectors in the ISIC classification. Information asymmetry is measured as the average number of listed (from Worldscope) over total (UNIDO) firms in each country sector, the idea being that it is more difficult for firms in sectors with high asymmetry to become publicly listed. Average sector cyclicality is the cyclicality of markups of the industry in the United States. Of course, some of these are far from perfect proxies. More details are available from the authors.

[17] When splitting the samples using the median value of the control variable, all of the coefficients for the liquidity constraints were positive and those for competition were negative (only one was not significant). This robustness table and the correlations between these industry controls and the financial constraint proxy are excluded for brevity. They are available from the authors by request.

Table X. Robustness to Splits of Business-Cycle Serial Correlation and Asymmetry with Listed Firms

This table presents a series of robustness exercises that splits the sample used in the regression presented in Column (3) of Table IV according to the degree of business-cycle serial correlation (Panel A) and the degree of asymmetry among firms within an industry (Panel B). The dependent variable is the log of an industry's price-cost margin (log(*PCM*)) in each country-year. *GDP Growth* corresponds to the log-change in a country's GDP in constant local currency (from World Bank). *Liquidity Needs*, measured at the industry level, corresponds to that industry's cash conversion cycle (from Raddatz, 2006). A country's *Financial Underdevelopment* is computed as (1 − (Private Credit)/GDP). *Limited Competition* is the average of the price-cost margin of an industry in each country. *Liquidity Constraints* is the interaction between *Financial Underdevelopment* and *Liquidity Needs*. Business-cycle serial correlation is the correlation between a country's GDP growth and its lagged value. Columns (3)-(4) split the sample based on whether the ratio of the average number of firms listed in Worldscope (for a given country-industry pair) to the average number of firms in UNIDO INDSTAT (for the same pair) is above (high heterogeneity) or below (low heterogeneity) the median. Columns (5)-(6) restrict the sample to the countries-industries meeting the condition listed at the top of each column. Country-sector and year fixed effects are also included (not shown). Standard errors in parentheses are robust and clustered at the country-year level.

	Panel A. Business-Cycle Serial Correlation		Panel B. Long Purse			
	Below Median	Above Median	Industry Heterogeneity		No. Listed Firms in Country-Industry	
			Low	High	≥ 1	None
	(1)	(2)	(3)	(4)	(5)	(6)
GDP Growth	2.204***	2.048***	3.988***	2.533***	2.864	1.402
	(0.472)	(0.596)	(0.880)	(0.470)	(1.943)	(0.903)
GDP Growth × *Liquidity Constraints*	0.587	2.610***	2.297*	0.232	2.048	1.120
	(0.537)	(0.633)	(1.182)	(0.507)	(2.293)	(1.140)
GDP Growth × *Limited Competition*	−4.459***	−1.972	−5.343***	−5.565***	−2.051	−2.130**
	(0.866)	(1.226)	(1.583)	(1.021)	(1.768)	(0.838)
GDP Growth × *Liquidity Needs*	−0.730**	−1.567***	−2.403**	−0.812**	−0.585	−0.608
	(0.338)	(0.383)	(0.774)	(0.275)	(1.493)	(0.803)
GDP Growth × *Financial Underdevelopment*	−0.581	−1.461*	−2.559**	0.022	−4.216	−0.673
	(0.663)	(0.803)	(1.242)	(0.640)	(2.714)	(1.264)
Observations	23,724	22,675	11,489	11,779	8,962	22,488
R^2	0.606	0.520	0.635	0.665	0.554	0.510

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

Another potential reason for procyclical markups is the long purse theory of predation (Tesler, 1966; Bolton and Scharfstein, 1990). This theory requires two dimensions of heterogeneity across firms. First, some firms should have long purses, that is, should be relatively less financially unconstrained than others. Second, all firms should be relevant competitors in product markets. For instance, a single large and financially unconstrained firm that captures 95% of the market would have little incentive to engage in price cuts to get rid of a fringe of firms.

Testing the long purse view of predation with industry-level data is difficult because the theory is about within-market heterogeneity across firms. Our previous result indicating that markups are relatively more procyclical in industries with higher liquidity constraints and higher relative levels of competition (Columns (4) and (8) in Table IV) is consistent with this view. However, the results do not directly address how heterogeneity within an industry affects markup cyclicality. To advance on this front, we gathered firm-level data for countries in our sample from Worldscope (WS) and constructed two measures of within-industry heterogeneity. First, we computed the ratio of the average number of firms listed in WS in a given country-industry pair to the average number of firms in the same pair in UNIDO INDSTAT. Second, we computed a similar ratio for total sales. The ratios are computed using the average of each of these variables in each data set (WS and UNIDO INDSTAT) during 1991-2000 to maximize the intersection of the data.[18]

The motivation for constructing these ratios is that WS contains information on a country's listed firms, which are arguably the largest firms and have the easiest access to credit. These firms are candidates to have a long purse. The incentives of these firms to predate on their constrained rivals would be larger the larger the market share of these rivals, that is, the lower the ratio of sales of listed firms to the sales of the whole industry.

Results presented in Columns (3) to (6) of Table X show that among country-industry pairs that have at least one firm listed in WS, the procyclicality of the markups of liquidity-constrained industries is higher when the share of sales of listed firms is relatively lower (compare results in Columns (3) and (4)). Furthermore, comparison of the results in Column (3) with those in Columns (5) and (6) shows that the procyclicality of the markups of liquidity-constrained industries with low sales of listed firms is also higher than among country-industry pairs where there are no listed firms in WS, regardless of whether we consider only countries where there is at least one industry with WS data (Column (5)) or not (Column (6)).[19] These results suggest that the markups of liquidity-constrained industries tend to be relatively more procyclical if the listed firms in those industries capture, on average, a relatively smaller share of the sales. This is consistent with the long purse view of predation, although, of course, firmly establishing this mechanism requires exploiting only firm-level data, which is beyond the scope of this article.

[18] We cannot use these firm-level data to formally test for the long purse theory for three reasons. First, markup measures cannot be computed from balance sheet information. Second, in many countries with less developed stock markets, most, if not all, listed firms are large and are unlikely to be constrained. The set of listed firms is unlikely to be representative of the whole industry, especially of firms that are more likely to be liquidity constrained. Third, constructing measures of cyclical behavior requires long time series (covering at least a few business cycles), which is harder with international listed firm data.

[19] Although in Column (5) the coefficient for the marginal effect of liquidity constraints on markup cyclicality is only slightly smaller than in Column (3), notice that the average cyclicality of the industries in Column (3) is much higher than those in Column (5).

VI. Discussion

As previously discussed, a number of theories have been proposed to explain markup cyclicality. Different assumptions and mechanisms predict either pro- or counter-cyclicality of markups. Our analysis of the data provides evidence in favor of many of the traditional models. However, none of them can explain all of our results. Instead, our findings suggest that when looking at much more data than usual, and from a different standpoint, several theories are indeed relevant and complementary. In particular, our results confirm that the degree of product market competition and liquidity constraints are critical determinants of markup cyclicality.

Our finding that markups are, on average, procyclical is not unusual. Indeed, Nekarda and Ramey (2013) argue that it is the most usual result. This result alone is not enough to rule out or confirm any of the views, as this average cyclicality can potentially be due to many confounding factors. It simply indicates that, in our broad sample, the forces that push markups into being more procyclical dominate those that induce counter-cyclicality. There is also the measurement element: depending on the adjustment made to the simple proxies of markups, the literature has shown that average cyclicality may change. Our contribution comes from identifying the differential effects of competition and financial constraints. The fact that competition is robustly and significantly related to markup cyclicality supports the basic premise of most of the models reviewed. It states that the cyclical behavior of markups is not just a matter of the nature of productivity shocks. This lends support to Keynesian explanations.

Our finding that a lack of competition is associated with more countercyclical markups is also consistent with models based on the sustainability of collusive agreements. For instance, it is consistent with the models of Rotemberg and Saloner (1986) and Rotemberg and Woodford (1991, 1992), which have dynamically optimal prices that are below the profit-maximizing prices in a static context. Also supporting the market power theories, we find that markups in industries less exposed to international competition and those producing more differentiated goods are more countercyclical.

This does not mean that these models cannot be complemented. Indeed, we find that other elements can interact with the basic mechanism. For instance, our findings support Haltiwanger and Harrington's (1991) argument that Rotemberg and Saloner's (1986) result depends on having demand shocks that are not serially correlated.

However, not all of the elements that have been added to the basic competition models appear to matter. For instance, we find no evidence of asymmetry between upturns and downturns. Although the pattern of industrial cyclicality is the same as in the baseline specification, there is no additional boost to PCM cyclicality during output contractions. This could have been the case if recessions were special in terms of the ability of firms to move their markups, for example, if interfirm coordination had become more effective after a trough (Baker and Woodward, 1998). Likewise, endogenous firm entry in response to high markups does not seem to limit the lack of competition argument. The cyclical growth in establishments may be positively related to markups but considering this factor does not eliminate the competition results.

On the role of capital markets, we find strong evidence for a positive relation between markup cyclicality and liquidity constraints. Liquidity-constrained firms appear to gather as much internal funds as possible when facing difficulties. As mentioned in Section I, this may result in bigger or smaller markups depending on whether dynamic equilibrium prices are above or below the price that maximizes current profits. Our data favor the latter. Moreover, the higher markup procyclicality of liquidity-constrained industries is particularly strong when these are located in countries with relatively high serial correlation of real growth, that is, where generating cash today is critical for survival.

The long purse view of predation (Telser, 1966; Bolton and Scharfstein, 1990) can also account for procyclical markups. We find some evidence to support this view. First, liquidity-constrained industries operating in a very competitive environment are the most procyclical industries. Second, among country-industry pairs that have at least one listed firm—arguably not liquidity constrained—the markup procyclicality of liquidity-constrained industries is higher, especially when the share of sales of listed firms is relatively lower. This is exactly what we would expect if the incentives of these firms to prey on their constrained rivals are increasing in the rivals' market share. Although we do not consider these results as definitive evidence of the long purse theory because our setting is not optimal for exploring it, these results should encourage further research at a more micro level.

All of these results do not imply that competition and financing are the only determinants of markup cyclicality. Factor markets may be important as well, although on this front the theory is not clear-cut and rigidities in factor markets can be positively or negatively associated with cyclicality. Our results show that the difficulty in adjusting labor and capital inputs makes markups more procyclical. These findings are consistent with theories where rigidities attenuate fluctuations in factor prices—such as labor unions that try to stabilize wages or the wage bill—and with rigidities that result in capacity constraints in collusive agreement models.

Finally, we do not find strong evidence for mechanisms based on cyclical movements in the elasticities of demand. These cyclical movements can arise, for instance, from differences in the price sensitivities of consumers that enter during booms and exit during busts. We show that industries with higher exposure to international markets, which are supposedly less dependent on local demand conditions, are not significantly more procyclical than those that rely more on internal markets.

VII. Conclusion

We show that firms in industries with more liquidity constraints and more competition tend to have more procyclical markups—that is, prices fall more during recessions (relative to marginal costs) in these industries compared to industries with fewer financial problems and less competition. There is also some evidence that suggests these two elements complement each other: firms facing higher competition and higher liquidity constraints are even more procyclical than can be explained by liquidity constraints and competition alone. The procyclicality of markups increases where listed firms with comparatively smaller market shares exist.

This finding has important empirical and theoretical implications. As shown above, concluding that markups are countercyclical (on average) in the United States might be viewed as the result of combining liquidity constraints and competition for US industries. In this sense, financial development and market composition (e.g., number of firms, product differentiation, and regulation) play important roles in shaping the way firms interact with each other, and how production and pricing decisions vary during the cycle.

On the theoretical side, it has been common practice in general equilibrium models to assume constant markups, or constant cyclicality. As we have seen, this is a strong assumption when firms face heterogeneous levels of competition and liquidity constraints. A more realistic model should endogenize these elements.

Appendix

Table A1. Basic Statistics of the Sample

Number of observations	46,399
Number of countries	57
Number of industries	28
Number of years	40
Number of country-year pairs	1,894
Number of country-industry pairs	1,425
Number of industry-year pairs	1,119
Median observations by country	886
Median observations by industry	1,741
Median observations by year	1,232

Table A2. Country Characteristics

Country	GDP Growth	PCM	Lshare	Private Credit to GDP
Australia	0.035	0.233	0.474	0.372
Austria	0.032	0.190	0.531	0.648
Bangladesh	0.027	0.281	0.317	0.216
Belgium	0.032	0.153	0.505	0.249
Bolivia	0.024	0.284	0.322	0.322
Cameroon	0.044	0.230	0.426	0.183
Canada	0.035	0.233	0.468	0.551
Chile	0.042	0.404	0.244	0.390
Colombia	0.041	0.352	0.231	0.249
Costa Rica	0.046	0.224	0.402	0.204
Cote d'Ivoire	0.058	0.238	0.376	0.267
Cyprus	0.060	0.222	0.457	0.929
Denmark	0.026	0.202	0.579	0.302
Ecuador	0.038	0.255	0.336	0.194
Egypt, Arab Republic	0.051	0.169	0.497	0.210
El Salvador	0.026	0.327	0.331	0.241
Fiji	0.035	0.148	0.539	0.211
Finland	0.032	0.222	0.475	0.524
France	0.025	0.142	0.625	0.749
Greece	0.036	0.225	0.407	0.270
Honduras	0.034	0.191	0.479	0.252
Hong Kong SAR, China	0.062	0.171	0.505	1.471
Hungary	0.029	0.232	0.342	0.293
Iceland	0.035	0.151	0.631	0.331
India	0.050	0.130	0.434	0.190
Indonesia	0.060	0.268	0.264	0.299

(Continued)

Table A2. Country Characteristics (*Continued*)

Country	GDP Growth	PCM	Lshare	Private Credit to GDP
Iran, Islamic Republic	0.045	0.292	0.374	0.203
Ireland	0.048	0.265	0.445	0.451
Israel	0.055	0.239	0.488	0.503
Italy	0.030	0.207	0.450	0.597
Japan	0.045	0.265	0.334	1.324
Jordan	0.056	0.265	0.337	0.561
Kenya	0.046	0.148	0.455	0.189
Korea, Republic	0.079	0.292	0.285	0.444
Kuwait	0.020	0.291	0.394	0.454
Malawi	0.040	0.207	0.380	0.097
Malaysia	0.069	0.229	0.318	0.673
Malta	0.062	0.219	0.504	0.506
Mauritius	0.046	0.217	0.436	0.302
Mexico	0.040	0.327	0.250	0.200
Netherlands	0.035	0.167	0.558	0.555
New Zealand	0.024	0.153	0.572	0.229
Nigeria	0.029	0.337	0.304	0.089
Norway	0.036	0.173	0.575	0.434
Panama	0.044	0.279	0.384	0.445
Philippines	0.038	0.269	0.300	0.227
Portugal	0.046	0.228	0.430	0.706
Singapore	0.078	0.210	0.416	0.693
South Africa	0.027	0.200	0.495	0.468
Spain	0.038	0.195	0.463	0.739
Sweden	0.026	0.250	0.442	0.408
Trinidad and Tobago	0.019	0.212	0.514	0.256
Tunisia	0.056	0.175	0.450	0.515
Turkey	0.045	0.299	0.295	0.147
United Kingdom	0.024	0.226	0.468	0.607
Uruguay	0.021	0.317	0.354	0.299
Venezuela, RB	0.025	0.321	0.325	0.193
Min	0.019	0.130	0.231	0.089
Mean	0.040	0.234	0.421	0.415
Max	0.079	0.404	0.631	1.471
SD	0.014	0.059	0.098	0.267

Table A3. Industry Characteristics

ISIC stands for International Standard Industrial Classification, CCC stands for cash conversion cycle, and PCM stands for price-cost margin.

Industry (ISIC Code)	CCC	PCM	Lshare
Beverages (313)	0.334	0.363	0.271
Fabricated metal products (381)	1.006	0.217	0.453
Food products (311)	0.444	0.166	0.373
Footwear, except rubber or plastic (324)	1.177	0.199	0.52
Furniture, except metal (332)	1.038	0.211	0.52
Glass and products (362)	0.617	0.285	0.44
Industrial chemicals (351)	0.651	0.256	0.32
Iron and steel (371)	0.673	0.199	0.406
Leather products (323)	1.066	0.177	0.463
Machinery, electric (383)	1.412	0.233	0.416
Machinery, except electrical (382)	1.449	0.227	0.472
Misc. petroleum and coal products (354)	0.738	0.217	0.335
Nonferrous metals (372)	0.827	0.194	0.374
Other chemicals (352)	1.361	0.273	0.341
Other manufactured products (390)	1.335	0.237	0.439
Other nonmetallic mineral products (369)	0.738	0.289	0.368
Paper and products (341)	0.578	0.215	0.388
Petroleum refineries (353)	0.163	0.196	0.216
Plastic products (356)	0.667	0.233	0.404
Pottery, china, earthenware (361)	0.987	0.294	0.489
Printing and publishing (342)	0.76	0.249	0.497
Professional & scientific equipment (385)	1.839	0.258	0.459
Rubber products (355)	0.756	0.233	0.435
Textiles (321)	0.97	0.206	0.468
Tobacco (314)	1.724	0.392	0.242
Transport equipment (384)	0.873	0.192	0.498
Wearing apparel, except footwear (322)	1.224	0.196	0.518
Wood products, except furniture (331)	0.556	0.208	0.474
Min	0.163	0.166	0.216
Mean	0.927	0.236	0.414
Max	1.839	0.392	0.520
SD	0.404	0.052	0.083

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