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(Working Papers)

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I WILL SURVIVE.
PRICING STRATEGIES OF FINANCIALLY DISTRESSED FIRMS

by Ioana A. Duca°, José M. Montero^, Marianna Riggi* and Roberta Zizza*

Abstract

We consider a standard result of customer market theory: if firms have stable customer relations and face financial frictions, they may keep prices relatively high in times of low demand and vice versa. Indeed, during recessions, when firms have low cash flow and greater difficulty in raising external funds, they may set higher prices on their locked-in shoppers to maintain short-term profits at the expense of future market shares. We extend this theoretical framework so that the countercyclical behaviour of price margins is strengthened by the expected persistence of the downturn and the procyclicality of competitive pressures. We test these predictions for Italian firms participating in the 2014 Wage Dynamics Network Survey. All things being equal, financially constrained firms charge higher markups when faced with low demand; this behaviour is more evident when demand is perceived as being persistent. Our findings suggest that the severity of financial constraints in Italy was one of the causes of the sustained growth of prices in 2010-2013, notwithstanding the considerable slack in the economy.

JEL Classification: C25, C26, D22, L11.
Keywords: markups, financial frictions, customer market.

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I will survive. Pricing strategies of financially distressed firms

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February 28, 2017

Abstract

We consider a standard result of customer market theory: if firms have stable customer relations and face financial frictions, they may keep prices relatively high in times of low demand and vice versa. Indeed, during recessions, when firms have low cash flow and greater difficulty in raising external funds, they may set higher prices on their locked-in shoppers to maintain short-term profits at the expense of future market shares. We extend this theoretical framework so that the countercyclical behaviour of price margins is strengthened by the expected persistence of the downturn and the procyclicality of competitive pressures. We test these predictions for Italian firms participating in the 2014 Wage Dynamics Network Survey. All things being equal, financially constrained firms charge higher markups when faced with low demand; this behaviour is more evident when demand is perceived as being persistent. Our findings suggest that the severity of financial constraints in Italy was one of the causes of the sustained growth of prices in 2010-2013, notwithstanding the considerable slack in the economy.

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How markups move, in response to what, and why, is however nearly terra incognita for macro...[We] are a long way from having either a clear picture or convincing theories, and this is clearly an area where research is urgently needed.

Olivier J. Blanchard (2008, 18)

1 Introduction[1]

In recent decades a substantial amount of theoretical and empirical research has addressed the issues of how price and margins vary over the business cycle and what are the driving forces behind their movements.

The difficulty, shared by many empirical studies, of finding significant positive effects of demand on price margins[2] has urged economists to search for reasons why prices are kept relatively high in times of low demand and viceversa. This may occur because firms might be less able to collude in high-demand periods, generating "price wars" during booms (Rotemberg and Saloner, 1986); because prices are sticky (as in the textbook new Keynesian model); because of a procyclical entry of firms (Jaimovich and Floetotto, 2008) or, provided that consumers face high switching costs, because of a procyclical inflow of new customers that can be captured using aggressive pricing behavior (Klemperer, 1995).

Beside these explanations, the countercyclical behavior of price margins has been linked to the interaction between customer relations (in the spirit of Phelps and Winter, 1970) and financial constraints. The idea that markups might be countercyclical if firms are financially constrained and consumers face switching costs dates back to the works by Gottfries (1991) and Chevalier and Scharfstein (1996; CS thereafter): intuitively, firms are more likely to be liquidity-constrained in periods of low demand when they have low cash flow and greater difficulty in raising external funds. In this scenario, firms might prefer to set higher prices on their locked-in shoppers to boost short run profits, temporarily forgoing any effort to gain market shares. Clearly, crucial to this mechanism is the assumption that firms have a degree of market power over their repeat-purchasers; in this case, pricing decisions must be investment decisions in market shares, which need,

[1]Many thanks to two anonymous referees, Marco Grazzi, Philip Vermeulen and seminar participants at the ECB and at the SIE conference in Milan for useful suggestions and discussion. The views expressed in the article are those of the authors and do not involve the responsibility of the European Central Bank, the Banco de España and Banca d'Italia. We thank Elisabetta Manzoli for providing us with data for the Italian credit market at the province level.

[2]See, for instance, Bils and Chang (2000) and Lundin et al. (2009) and references therein.

in a sense, available financial resources.

Our work addresses the role of financial frictions for markups formation in Italy at the beginning of this decade. To this aim we use the third wave of the Wage Dynamics Network (WDN) survey, carried on in 2014 by the European System of Central Banks, covering manufacturing and service firms. The questionnaire, which consists almost exclusively of qualitative questions, is particularly well-suited for the purpose of this paper, as firms are asked directly how they changed their markups over the period 2010-2013 compared to the years between 2005 and 2008, generally considered as "normal" times, together with questions related to the evolution of demand for their products and to the difficulties in obtaining credit and external financing through the usual financial channels.

In order to discipline our understanding of the mechanisms underlying margins setting, we make use of the theoretical frame by CS and extend it in two simple ways with the goal of enriching their set of testable predictions. This allows to better exploit the WDN questionnaire.

First, our version of the CS model allows for some degree of demand persistence, in order to study how changes in the expected persistence of demand affect equilibrium prices and, hence, markups cyclicality. This feature strikes as relevant given the exceptional length of the recession in the Italian economy. On a priori ground, the expected persistence of the state of demand can be crucial when firms set their markups; according to the theoretical model that we develop in this paper, higher expected persistence tends to magnify the effects of financial frictions on markups cyclicality. The questionnaire contains questions that can serve as proxies for the perceived persistence of firms' own demand, which we use in our analysis.

Second, whereas CS model features constant demand elasticity, we allow for a procyclical nature (firms perceive stronger competition in expansions than during downturns) in order to study the effect of a change in competitive pressures on markups cyclicality; on the empirical side, we exploit survey questions on the change in competition experienced in the firms' main product market. This strikes as particularly relevant, as according to the theoretical model a change in the perceived competitive pressures amplifies the effects of financial frictions on markups cyclicality, by altering the degree of strategic complementarities in price setting. Some macroeconomic evidence on the plausibility of assuming a procyclical demand elasticity has been provided for Italy by Riggi and Santoro (2015), who find that whereas in the pre-1999 period the price elasticity of demand was almost constant, after 1999 it increased in the wake of a demand stimulus.

In sum, according to our model, we expect that when faced with a low demand environment, the probability of raising markups increases for firms with limited access to external finance. Moreover, a countercyclical behavior emerges also when firms perceive demand to be highly persistent and the competitive pressures to have gone down.

We present both simple probit regression estimates as well as those obtained adopting an instrumental variable strategy to tackle the endogeneity of firms' access to finance with respect to their profitability. The countercyclical behavior of markups for financially constrained firms emerges in the whole economy as well as in the industry and services macro-sectors. Besides, whereas we find no significant effect of the degree of competition on margins, we find that, in a low demand environment, high persistence of demand increases the probability of raising markups, consistently with the theoretical predictions.

The paper is organized as follows. Section 2 relates our work to the literature. Section 3 lays out the theoretical framework and the testable predictions. Section 4 presents the dataset and the empirical strategy. Section 5 discusses the results and Section 6 concludes.

2 Related literature

The empirical relevance of financial constraints for markup formation has been the subject of different studies, using a variety of techniques. CS provide evidence from the supermarket industry in the US suggesting that during regional and macroeconomic recessions, more financially constrained supermarket chains raise their prices relative to less financially constrained ones. More recently, Asplund et al. (2005) test the theory in the Swedish newspaper industry during the deep recession starting in 1990. Newspapers with weak financial standings showed the highest increases in prices in the subscription market, where switching costs are relevant, whereas financial standings could not explain prices for advertising space, a market where buyers are less attached to a particular newspaper. Kimura (2013) focuses on the post bubble Japan's economy of the 1990s, where, despite large fluctuations in the real economy, general prices were fairly stable and relates this outcome, for firms where the customer market theory can be applied, to the countercyclical impact of financial positions on firms' prices[3]. Secchi et al. (forthcoming) find that Italian exporters in the early 2000s tended to charge higher prices when facing financial constraints, with a wider price premium for products and sectors where switching costs are expected to be more relevant.

[3]Kimura (2013) shows that the countercyclicality in the pricing behaviour emerges only for large firms and explains this result on the ground of customer markets: financial constraints do not affect the cyclicality of pricing decisions of small firms, because their product brand is not well established in the market and, consequently, they cannot lock-in customers.

The debate on the role of financial frictions in corporate pricing policies gathered pace in the context of the global financial crisis, as the extraordinary turmoil that swept through financial markets during the Great Recession was accompanied by only a mild decrease in inflation in most advanced countries. Gilchrist et al. (forthcoming) use a micro-level data set, which contains good-level prices merged with the respondent firms' income and balance sheet data, to analyze how differences in firms' internal liquidity positions affect their price-setting behavior during the recent financial crisis. Whereas liquidity unconstrained firms slashed prices in 2008, those with limited internal liquidity significantly increased their prices during the same period. Furthermore, these differences in price setting were concentrated in nondurable goods manufacturing, a sector where the hallmark features of customer-markets theories - customer retention and acquisition consideration - are utmost relevant. The hypothesis that changes in financial conditions influence the cyclical dynamics of prices is also upheld by Gilchrist and Zakrajsek (2015). They show that prices in industries in which firms rely more heavily on external finance and thus facing a higher likelihood of financing constraints, decline noticeably less in response to economic downturns associated with a significant tightening of financial conditions. Moreover, a weak balance sheet position in 2006 strongly influenced the likelihood that a firm raised its prices above the industry average during the crisis. Using a panel of firm-level data, Montero and Urtasun (2014) find a significant increase in estimated Spanish firms' price-cost markups since 2007. This finding is explained through the high degree of financial pressure faced by Spanish firms, in terms of both high levels of corporate leverage and tight financing conditions, on the background of an increase in the pace of business destruction which has probably resulted in a strengthening of surviving firms' market power.

The idea that the price elasticity of demand might display some cyclical behavior has been long investigated in research that focuses on firms' price setting policies by using micro data with the aim of understanding key macroeconomic phenomena such as the countercyclicality of price markups and the inertial adjustment of prices to shocks. The Kimball-style preferences, where - in contrast to the Dixit–Stiglitz world of a constant elasticity - sellers face a price elasticity of demand that is increasing in their goods' relative price, have emerged as the most suitable microfoundation for general equilibrium macromodels to account for gradual and persistent real effects of nominal shocks. In the wake of an aggregate demand stimulus, a repricing firm will temper its price increase since this would result in a more elastic demand curve, so it takes longer for a demand shock to fully pass through to the average price level.

Several channels could lead to a procyclical demand elasticity. First, recessions are periods that typically entail a large increase in the pace of business destruction, together with a marked sluggishness in business formation. Sbordone (2009) shows that a decrease in the number of competitors (and hence in the number of traded goods) reduces the steady-state value of the firm's elasticity of demand, altering the response of prices to changes in the economic outlook. On this issue, Montero and Urtasun (2014) for Spain and Riggi and Venditti (2015) for the euro area relate some changes in the dynamics of markups, at the micro and macro level, respectively, to the cleansing effect of recessions. Another possible channel put forward by Warner and Barsky (1995) is instead related to consumers' behavior: retailers perceive their demand to be more elastic in the high demand states because in such periods consumers are more vigilant and better informed. "*Customers for whom it does not pay to search and travel very much when only one item is to be purchased will invest more in information and transportation to obtain the lowest possible price when purchasing a number of units of the same good or a number of different items for which search and travel costs can be at least partly shared*" (Warner and Barsky, 1995, p. 324). This would explain a well known micro puzzle: the tendency for markdowns to occur when shopping intensity is exogenously high, like in weekends or in the period prior to Christmas. To have in the model a procyclical demand elasticity we rely on this "increasing-return shopping technology".

3 Theoretical framework[4]

Our theoretical framework is based on the Klemperer (1987, 1995) model of competition with consumer switching costs extended to allow for liquidity constraints by CS. In this class of models, firms have a degree of market power over their repeat-purchasers, as consumers have switching costs between similar products of competing firms. This implies that firms' current market shares are valuable, as customers get locked-in, so that firms face a trade-off between short-run and long-run profits: they can invest in market share by setting a low price (and thus increasing future profits) or they can set a high price and extract rents on their current locked-in shoppers (thus enhancing short-run profits). In this customer-market framework, CS show that price markups behave in a countercyclical fashion if firms are financially constrained, as the likelihood of being liquidity-constrained is higher in recessions and liquidity-constrained firms place a greater weight on short-run profits than on future profits.

[4]More details on the theoretical model are available in Annex A.

To derive some testable predictions on the cyclical behavior of markups, we start with the two-period model of CS, in which consumers develop switching costs after their first-period purchases, and we extend it in two ways.

First, in CS expected demand is $\overline{\theta}_1$ in the first period, while being normalized to 1 in the second one. In our model, instead, firms attribute a certain probability to the event that the first-period state of demand will persist in the future. This allows to study how changes in the expected persistence of demand affect equilibrium prices and, hence, markups cyclicality.

Second, whereas the CS model assumes a constant elasticity of demand, we allow the elasticity to be pro-cyclical. This is done by appealing to the "increasing-return shopping technology", as in Warner and Barsky (1995): in our model the volume of shopping per household increases (decreases) in booms (recessions) and the intention to buy a greater (smaller) number of units during booms (recessions) leads households to bear higher (lower) search/travel costs. Hence, the elasticity of demand is higher in booms than in recessions and firms perceive stronger competition during expansions than in downturns. This allows to study the effect of a change in competitive pressures on markup cyclicality.

3.1 The model

There are two firms $k = A, B$ which compete for two periods $\tau = 1, 2$. There is a mass of consumers normalized to 1. They reside uniformly on the line segment $[0, 1]$, with firm A located at 0 and firm B located at 1. Each shopper has a reservation value of R for one unit of good produced by A and B, at constant marginal cost c. Only one type of good is bought and sold. In the first period consumers bear a transportation cost of t per unit of distance traveled along the line to the firm of their choice. These costs are zero in the second period, but consumers develop switching costs, s, as a result of their first-period purchases.

Each consumer exogenously purchases θ_H or $\theta_L < \theta_H$ units of the good per period; in each period each customer buys the same quantity of goods. Firms set first-period prices before they know the realization of demand, i.e. before customers arrive to the store. For each firm, first-period demand can be high ($\theta_1 = \theta_H$) with probability μ, or low ($\theta_1 = \theta_L$) with probability $(1-\mu)$. We allow the first-period state of demand to persist in the second period with probability $P(\theta_\tau = \theta_{\tau-1})= \alpha$. The values of α and μ are identical for both firms.

In the second period, the market is "mature", as consumers' switching costs have already been built up: a fraction σ_1^A of consumers has bought from firm A in $\tau = 1$ and so each bears a switching cost s of buying from B; the complementary fraction $\sigma_1^B = (1-\sigma_1^A)$ has previously purchased from B and developed a switching cost s of buying from A. In this context, Klemperer (1995) showed that each firm can safely charge the reservation price R in the second period. The intuition is that, provided that switching costs s are high enough, firm A cannot steal any of B's customers unless it lowers its price a discrete amount below B's price. As the same price must be charged to all customers, this price cut produces a shortfall in profits on locked-in customers that is not compensated for by the gains derived from attracting B's consumers. In this setting, the best strategy for A is to act as a monopolist against its own customer base. Hence, firms' joint-profit-maximizing outcome yields the unique non-cooperative (Nash) equilibrium (for either price or quantity competition).

As in CS, firms have to invest an amount I at the beginning of the first period in order to compete in this market.

Internally financed firms

Let's start by assuming that firms are financed with internally generated funds. We denote with p_τ^k the price charged by firm k in period τ.

The second-period profits for each firm k depend on their first-period market shares σ_1^k :

$$\pi_2^k\left(\sigma_1^k, p_2^k, \theta_2\right) = (R-c)\,\theta_2\sigma_1^k \tag{1}$$

To evaluate the market shares in period 1, one must take into account that, given our hypothesis and if $p_1^k\theta_1 + ty < R\theta_1$, the location y_i^* (with $i = H, L$) of the shopper who is indifferent between A and B is:

$$y_i^* = \frac{\left(p_1^B - p_1^A\right)\theta_i}{2t} + \frac{1}{2} \tag{2}$$

From (2), we get that market shares of firm A (σ_1^A) and B (σ_1^B), i.e. the fraction of consumers that buy from A and B, respectively, in period 1 are given by:

$$\sigma_1^A = \frac{\left(p_1^B - p_1^A\right)\theta_1}{2t} + \frac{1}{2} = 1 - \sigma_1^B \tag{3}$$

First-period profits for firm A can be written as:

$$\pi_1^A\left(p_1^A, p_1^B, \theta_1\right) = \left(p_1^A - c\right)\theta_1\sigma_1^A\left(\theta_1\right) \tag{4}$$

At the beginning of the first period, each firm simultaneously and non-cooperatively chooses prices, given its conjecture about its rival price, and before knowing the demand realization (i.e. before the customers arrive to the store), to maximize total discounted future profits:

$$V^A = \left(p_1^A - c\right)\overline{\theta}_1\sigma_1^A\left(\overline{\theta}_1\right) + (R-c)\,\overline{\theta}_2\sigma_1^A\left(\overline{\theta}_1\right)$$

where we have assumed that the discount factor is 1 and $\overline{\theta}_1$ and $\overline{\theta}_2$ are firm's expectations formulated at the beginning of time 1 for first and second period demand, respectively:

$$\overline{\theta}_1 = \mu\theta_H + (1-\mu)\theta_L \tag{5}$$

and

$$\overline{\theta}_2 = \left[\mu\alpha + (1-\mu)(1-\alpha)\right]\theta_H + \left[(1-\mu)\alpha + \mu(1-\alpha)\right]\theta_L \tag{6}$$

Maximizing with respect to first-period price, we obtain firm A's pricing reaction curve as a function of firm B's price:

$$p_1^A = \frac{p_1^B + c}{2} + \frac{t}{2\overline{\theta}_1} - \frac{\overline{\theta}_2}{2\overline{\theta}_1}(R-c) \tag{7}$$

implying that prices are strategic complements (i.e. firm A's optimal price is increasing in its rival's price). The symmetric equilibrium when both firms are internally financed is:

$$p_1^* = c + \frac{t}{\overline{\theta}_1} + \frac{\overline{\theta}_2}{\overline{\theta}_1}(R-c) \tag{8}$$

and the markup of price over marginal cost is:

$$m_1^* = \frac{t}{\overline{\theta}_1} - \frac{\overline{\theta}_2}{\overline{\theta}_1}(R-c) \tag{9}$$

The cyclicality of price margin can be measured by $\lambda \equiv \frac{\partial m_1^*}{\partial \mu}$,[5] which, after some algebra,

[5] As in CS we study the cyclicality of markups by differentiating them with respect to μ. Indeed, high values of μ can be interpreted as a boom while low values as a bust and the level of expected demand $\overline{\theta}_1$ is a monotonically increasing function of μ.

is:

$$\lambda \equiv \frac{\partial m_1^*}{\partial \mu} = \left\{ (R-c)(1-\alpha) \frac{(\theta_H + \theta_L)}{\overline{\theta}_1^2} - \frac{t}{\overline{\theta}_1^2} \right\} (\theta_H - \theta_L) \tag{10}$$

To gain some intuition, let us stress the difference between the equilibrium markup that emerges in our model (9) and the one in CS, which is $m_1^{*CS} = t - \frac{(R-c)}{\overline{\theta}_1}$.

First, in the CS framework, in a one-period setting, each firm would charge a markup t. In a one-period version of our model, instead, markup would be equal to $\frac{t}{\overline{\theta}_1}$. This difference comes from having assumed that consumers wish to buy a different number of units depending on being in a period of boom or bust. As a consequence, the travel cost they are willing to bear varies with the number of goods they wish to buy. This means that, when firms expect high demand, they perceive greater competition for their market area, i.e. a higher elasticity of demand affecting pricing behavior. Note that the demand elasticity is $\eta = -\frac{\overline{\theta}_1 p_1^A}{\left(p_1^B - p_1^A\right)\overline{\theta}_1 + t}$. If we measure the way it varies with the cycle as $\upsilon \equiv \frac{\partial |\eta|}{\partial \mu} = \frac{t p_1^A (\theta_H - \theta_L)}{\left[\left(p_1^B - p_1^A\right)\overline{\theta}_1 + t\right]^2}$, then the cyclicality of markups can be written as $\lambda \equiv \frac{\partial m_1^*}{\partial \mu} = \frac{t\upsilon}{\eta \overline{\theta}_1} + (1-\alpha)(R-c)\frac{\theta_H^2 - \theta_L^2}{\overline{\theta}_1^2}$.

Second, in a two-period setting price margins are lower by $\overline{\theta}_2 \frac{(R-c)}{\overline{\theta}_1}$ in our framework and by $\frac{(R-c)}{\overline{\theta}_1}$ in CS. This difference comes from having assumed a variable second-period demand, whose expected level matters for firms' incentive to compete for first-period market shares, on which they can later charge the monopoly price R.

Based on (9) and (10), we can draw the following testable predictions:

1. *Demand persistence and the level of price markups*

$$\frac{\partial m_1^*}{\partial \alpha} = -\left[2\mu - 1\right](\theta_H - \theta_L)\frac{(R-c)}{\overline{\theta}_1}$$

When the high demand state is more likely, higher demand persistence lowers price markups: if $\mu > \frac{1}{2}$, $\frac{\partial m_1^*}{\partial \alpha} < 0$; by contrast when the high demand state is less likely, higher demand persistence raises price markups: if $\mu < \frac{1}{2}$, $\frac{\partial m_1^*}{\partial \alpha} > 0$. The intuition is the following: when the state of demand is high (in booms), the more it is expected to persist in the future, the stronger the relative convenience of investing in market shares - by lowering current markups - to reap profits in the future. By contrast, when the state of demand is low (in recessions), the more it is expected to persist in the future, the lower the relative convenience of investing in market shares - by lowering current markups - to gain profits in the future.

2. *Markups cyclicality*

$$\lambda \equiv \frac{\partial m_1^*}{\partial \mu} = \frac{(\theta_H - \theta_L)}{\overline{\theta}_1^2} \left\{ (R - c) (\theta_H + \theta_L) (1 - \alpha) - t \right\}$$

Markups can be both procyclical ($\lambda > 0$) or countercyclical ($\lambda < 0$), depending on the parameters of the model.

Markups might be procyclical, i.e. fall in recessions, because, as in CS, the fall in current demand relative to future demand makes it more appealing to invest in market shares by cutting prices (and increase monopoly profits in the future when demand will be relatively high), relative to charging a high price when demand is relatively low. The opposite holds true during booms. However, the two additional channels that we have considered weaken the procyclical behavior of markups: the procyclicality might be weakened and markups might even become countercyclical if the expected persistence of the state of demand (α) is high, or if competitive pressures fall (increase) strongly in recessions (booms). Indeed:

2a. *Demand persistence and markups cyclicality*

$$\frac{\partial \lambda}{\partial \alpha} < 0$$

The higher the expected persistence of demand, the less procyclical (or the more countercyclical) are price margins. Intuitively, when the low (high) state of demand is expected to persist in the future, the relative convenience of lowering current markups to reap profits in the future, rather than in the present, is weaker (stronger).

2b. *Changes in competitive pressures and markups cyclicality*

$$\frac{\partial \lambda}{\partial \upsilon} < 0$$

The more procyclical is the elasticity of demand, the less procyclical (or the more countercyclical) are price margins. The intuition is the following: the more the elasticity of demand falls in downturns, the smaller becomes the loss (gain) in demand size incurred for a given price increase (decrease). This reduces the benefit from investing in market shares (by cutting prices) during recessions. Specularly, the more the elasticity of demand increases in booms, the larger becomes the loss (gain) in demand size incurred for a given price increase (decrease). This increases the benefit from investing in market shares (by cutting prices) during booms.

In sum, for non-financially constrained firms, the following testable implications emerge:

a. When the high-demand state is more likely, higher demand persistence lowers the level of price markups; by contrast when the high demand state is less likely, higher demand persistence raises the level of price markups.

b. The markup of non-financially constrained firms can be either procyclical or countercyclical;

c. It is less procyclical (or more countercyclical), the more the firm expects the current shock to demand to persist into the future;

d. It is less procyclical (or more countercyclical), the more the firm perceives that competitive pressures are falling during downturns.

Financially constrained firms

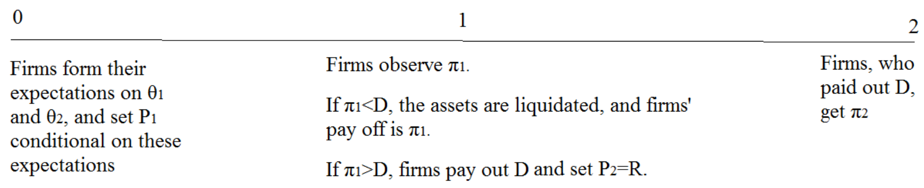
We now extend the model to the case in which firms need to raise I externally, allowing for capital market imperfections. We follow CS closely, who introduce financial frictions as in Bolton and Scharfstein (1990,1996) and Hart and Moore (1998). These authors develop an incomplete contracts model in which the basic assumption is that corporate cash flows, while being observable to the manager and to investors, cannot be verified by a third party (i.e. a judge). Hence, contracts are incomplete, as cannot be made contingent on performance. Furthermore, an additional friction is that the manager can costlessly divert all project returns to himself or herself, but cannot divert the firm's productive assets.

In line with Hart and Moore (1998), the allocation of foreclosure rights is crucial for the solution of this type of model. The only way to get managers to make payments to investors is to threaten with the liquidation of firm's assets. However, this option in inefficient in the sense that assets are transferred away from the entrepreneur who can extract the most value from them. In terms of the model, this means that firm's assets are worth a fraction $\xi < 1$ of the remaining cash flows if managed by external investors. As Hart and Moore (1998) and Bolton and Scharfstein (1996) show, the optimal contract resembles a real-world debt contract: it requires a fixed payment of D at date 1; and if no payment is made, then the investor has the right to seize and liquidate the project's assets.

The manager is restrained from diverting cash flow in period 1, and is forced to pay out D, by the prospect of diverting all of the period 2 cash flow to himself. Otherwise, the project's assets are liquidated and he loses this option. From these assumptions, we get the incentive compatibility constraint $D \leq \pi_2^k$.

In the case when the project does not generate enough returns $(D > \pi_1^k)$, then the manager would choose to pay nothing and the investor seizes and liquidates the project's assets. Therefore, the entrepreneur's total payoff would only be π_1^k. As in CS, and consistently with the conjecture that firms are more likely to be liquidity-constrained in recessions, we assume that $\pi_1^k(\theta_L) < D < \pi_1^k(\theta_H)$.

Figure



In what follows we define $\pi_{1L}^k \equiv \pi_1^k(\theta_L)$ as the first-period level of profit when demand is low, while $\pi_{1H}^k \equiv \pi_1^k(\theta_H)$ when demand is high. The expected second-period profits, conditional on having a high and a low level of demand in the first period, are $\pi_{2/1H}$ and $\pi_{2/1L}$, respectively.

The investor's participation constraint ensures that his expected payouts are nonnegative: $\mu D + (1-\mu)\xi\pi_{2/1L} - I \geq 0$. In a competitive setting, the previous condition is met with equality. The optimal contract is designed such that it is compatible with product market equilibrium in periods 1 and 2. Therefore, the value of D in equilibrium, $D^* = \frac{I-(1-\mu)\xi\pi_{2/1L}}{\mu}$, must be smaller than $\pi_{2/1H}$ for the contract to be both incentive compatible and feasible. We thus assume that $D^* \leq \pi_{2/1H}$ from now on, as in CS.

Firm A chooses p_1^A to maximize the expected payoff over the two periods $V^A = \mu[\pi_{1H}^A - D + \pi_{2/1H}^A] + (1-\mu)\pi_{1L}^A$, taking D and p_1^B as given.

$$\frac{\partial V^A}{\partial p_1^A} = \mu[\frac{\partial \pi_{1H}^A}{\partial p_1^A} + \frac{\partial \pi_{2/1H}^A}{\partial p_1^A}] + (1-\mu)\frac{\partial \pi_{1L}^A}{\partial p_1^A} \tag{11}$$

Defining expected demand in the second period conditional on having a high level of demand in the first period $\overline{\theta}_{2/1H} \equiv \alpha\theta_H + (1-\alpha)\theta_L$, from the first order condition we get that the symmetric equilibrium when both firms are externally financed is:

$$p_1^* = c + \frac{\overline{\theta}_1}{\Gamma}t - \frac{\mu\overline{\theta}_{2/1H}\theta_H}{\Gamma}(R-c) \tag{12}$$

$$m_1^* = \frac{\overline{\theta}_1}{\Gamma}t - \frac{\mu\overline{\theta}_{2/1H}\theta_H}{\Gamma}(R-c) \tag{13}$$

where $\Gamma \equiv \mu\theta_H^2 + (1-\mu)\theta_L^2$.

The cyclicality of price margin when firms are financially constrained is:

$$\lambda \equiv \frac{\partial m_1^*}{\partial \mu} = -\left[(R-c)\,\overline{\theta}_{2/1H}\theta_L + t\,(\theta_H - \theta_L)\right]\frac{\theta_L\theta_H}{\Gamma^2} \tag{14}$$

or equivalently:

$$\lambda \equiv \frac{\partial m_1^*}{\partial \mu} = -\left[(R-c)\,\overline{\theta}_{2/1H}\theta_L - t\frac{\upsilon}{\eta}\overline{\theta}_1\right]\frac{\theta_L\theta_H}{\Gamma^2} \tag{15}$$

We can draw the following testable predictions.

1. *Demand persistence and the level of price markups*

$$\frac{\partial m_1^*}{\partial \alpha} = -\frac{\mu\theta_H}{\Gamma}(R-c)(\theta_H - \theta_L) < 0$$

Higher demand persistence lowers price markups. The intuition is the following: when firms are financially constrained, demand persistence matters only if the first period state of demand is high (otherwise, the assets are liquidated and second-period profits go to the investors). As in the unconstrained case, when the state of demand is high, the more it is expected to persist in the future, the higher the relative convenience of investing in market shares - by lowering current markups - in order to reap profits in the future.

2. *Markups cyclicality*

$$\lambda = -\left[(R-c)\,\overline{\theta}_{2/1H}\theta_L + t\,(\theta_H - \theta_L)\right]\frac{\theta_L\theta_H}{\Gamma^2} < 0$$

The cyclicality of price margins when firms are financially constrained is always negative. Intuitively, during recessions, price margins go up because financially constrained firms care less about the future; the increased probability of liquidation makes them prefer extracting rents by setting a higher price rather than building market shares.

2a. *Demand persistence and markups cyclicality*

$$\frac{\partial\lambda}{\partial\alpha} < 0$$

The higher the expected persistence of demand, the more countercyclical are price margins. The intuition is the following: when the low (high) state of demand is expected to persist in the future, the relative convenience of lowering current markups to reap profits in the future, rather than in the present, is - all the more so - weaker (stronger).

2b. *Changes in competitive pressures and markups cyclicality*

$$\frac{\partial\lambda}{\partial\upsilon} < 0$$

The more procyclical is the elasticity of demand, the more countercyclical are price margins. The intuition is the following: the more the elasticity of demand falls in downturns, the smaller becomes the loss (gain) in demand size incurred for a given price increase (decrease). This reduces the benefit from investing in market shares (by cutting prices) during recessions. Specularly, the more the elasticity of demand increases in booms, the larger becomes the loss (gain) in demand size incurred for a given price increase (decrease). This increases the benefit from investing in market shares (by cutting prices) during booms.

In sum, for financially constrained firms, the following testable implications emerge:

a. Higher demand persistence lowers the level of price markups.

b. The markup of financially constrained firms is countercyclical;

c. It is more countercyclical the more the firm expects the current shock to demand to persist into the future;

d. It is more countercyclical, the more firms perceive that competitive pressures are falling during busts.

4 Data and empirical strategy

Our empirical analysis is based on a unique dataset on Italian firms' price- and wage-setting behavior collected by Banca d'Italia through an ad hoc survey launched in the context of the European System of Central Banks Wage Dynamics Network (WDN).[6] The sample consists of a cross-section of about 1,000 firms that replied to the survey. The firms operate in industrial (including construction), trade and business service sectors[7]. Questions mostly refer to the period between 2010 and 2013. The distribution of firms across sectors and size is given in Table 1.

Our theoretical model is based on the presumption that consumers develop switching costs after their initial purchases, which provides firms with a certain degree of market power over their customer base. Thus, in our empirical exercise we would like to restrict the sample to firms in industries which are more prone to develop this type of "brand loyalty". A priori, as argued by Motta (2004), one can realistically think that the existence of switching costs is a widespread phenomenon across many industries. There are many reasons why consumers might prefer to stick to products/services already bought in the past, other things equal. Switching to a product/service can entail transaction costs (for example, when one cancels a contract with a software provider and signs another one with a new provider), learning costs (cost of learning how to use an electronic device, after having learned how to operate with a different one), contractual costs (e.g. penalties for changing your telecom operator before a pre-agreed period), artificial costs (e.g. frequent flyer programs) or even psychological costs (as, for instance, those induced by addiction). In sum, these strategies are pervasive across industries, either in manufacturing or in services sectors, as further illustrated in Klemperer (1995).

[6] See D'Amuri et al. (2015) for additional details about the Italian WDN survey.

[7] The sectoral breakdown is based on NACE Rev.2. The business services category includes firms from transportation and storage; accommodation and food service activities; information and communication; real estate activities; professional, scientific and technical activities; and administrative and support service activities.

For this reason, we prefer to do a minimal cleaning and only drop firms belonging to regulated and non-market sectors, where arguably pricing decisions are not very much driven by competition and market forces, such as electricity, gas and water, financial intermediation, public sector services and arts. This results in dropping only 15 firms. In any case, our purpose is not to test a very specific model, but rather to use it as a guide to understanding how pricing decisions are affected by the presence of financial constraints. To the extent that there is some product differentiation and some degree of switching costs, our theoretical model can be understood –and applied– in more general terms.

The dependent variable in our estimation exercises is a dummy variable coded as unity if the firm raises markups, and zero elsewhere. To be more specific (see Annex B for the precise wording of the main questions we rely upon), it equals one when firms replied that prices (as compared to total costs) increase either moderately or strongly during 2010-2013.

As right hand side variables, we include information on our main variables of interest, i.e. the dynamics of demand, the evolution of the degree of competition, the volatility/uncertainty about the level of demand, and the extent of financial constraints. We account for the dynamics of demand (our cyclical variable) by introducing a dummy (*low_ dem*) which is equal to one if the firm reported a negative evolution (strong/moderate decrease) of the domestic or foreign demand for its main product/service during 2010-2013. Regarding the level of competition, we define a dummy (*low_ comp*) which equals one when firms report a (strong/moderate) decrease in competitive pressure on its main product/service (either on domestic or foreign markets), compared to the situation before 2008. Additionally, we proxy for the level of demand persistence through firms' perception about volatility/uncertainty of their demand. A higher volatility means that shocks are expected to be less persistent, as the likelihood that there will be a future reversal of demand is higher. Thus, the dummy for the volatility of demand for the firm's main product/service (*low_ volat*) is coded as one when the firm reports that volatility has not had a negative effect on its activity during 2010-2013, because high volatility is likely to be perceived as a negative factor.[8]

Further, we consider variables accounting for the impact of credit availability on firms'

[8] A large and growing literature (see Bloom (2014) for a survey) points out that volatility is highly countercyclical. In other words, recessions are periods of high volatility, and the latter may actually signal a pessimistic future assessment rather than a positive one. Notwithstanding, in the WDN survey about nine out of ten firms reporting that volatility/uncertainty had a strong negative effect on their activity considered this effect transitory or at worst partly persistent (see Annex B for the wording of the question). This supports our view that negative shocks that are volatile are more likely to be less persistent.

economic activity. In particular, the survey asks firms to relate the difficulties in obtaining credit to the main purpose for which finance was needed. Namely, they are asked to assign a ranking ("not relevant", "of little relevance", "relevant", "very relevant") to the events "Credit was not available" and "Credit was available but conditions were too onerous" for financing the following activities: (i) working capital, (ii) new investment, and (iii) refinance existing debt (rollover). Firms are defined as financially constrained (dummy *fc* equal to one) if they reply "relevant" or "very relevant" to any of the six questions.

Finally, we also account for a number of firm-level characteristics - all of them 0/1 dummies -, such as sectoral dummies (industry, trade and business services), firm size (three dummies: for less than 50, between 50 and 199 and at least 200 employees), nationality of the ownership (mainly domestic or mainly foreign), degree of autonomy (namely, whether the firm is a subsidiary/affiliate or not) and organizational structure (single- or multi-establishment firm).

Table 2 contains descriptive statistics of the variables used in our empirical analysis by credit constraint status. It can be seen that there exist some differences in the observable characteristics between both types of firms. Financially constrained firms are slightly more likely to be small and medium sized (1 percentage point on average) and younger (about two years on average) than non-constrained units. Moreover, the share of firms that are foreign-owned, a subsidiary or part of a multi-establishment firm is lower among constrained firms. Furthermore, these firms are more likely to report a fall in demand and a fall in the degree of competition, while they are less probable to have a lower volatility. Finally, apparently there is a higher (unconditional) likelihood of raising their price-cost margins (more on this below) for non-financially constrained businesses (10% vs 19%).

Given the categorical nature of our endogenous variable, we first model the determinants of price-cost margins increases by estimating a binary response probit model in the form:

$$\Pr(y_i = 1) = \Phi(X_i\beta + Z_i\gamma) \tag{16}$$

where i=1,. . . ,n denotes the firm and $\Phi(\bullet)$ denotes the cumulative distribution function of the Normal distribution. X_i is the vector representing the two potentially endogenous variables (*fc* and its interaction with our cyclical variable, *low_ dem*), and Z_i includes the set of exogenous firm-level characteristics as well as our additional variables of interest (*low_ dem, low_ comp, low_ volat*). As we are interested in the cyclical behavior of markups and how it changes with different firm's characteristics, the latter two variables are also interacted with *low_dem*, consistent with our theoretical model.

Arguably, one might be worried that the relevance of credit constraints is not independent of firms' pricing decisions (i.e. of firms' markups) to the extent that these decisions have an impact on firms' profitability: it might be the case that the direction of causality could thus run in the opposite direction. To address this potential endogeneity problem we use the two-step instrumental variables (2SIV) approach proposed by Rivers and Vuong (1988). In a nutshell, the estimation proceeds in two steps: i) each endogenous RHS variable is regressed on all the exogenous variables and on an instrument and then the residuals are calculated; ii) the probit model is enlarged including the residuals from the first stage to estimate the (normalized) coefficients.

Finding a good instrumental variable is not easy in our context, in which many firms' decisions can be related to some extent to a firm's financial health. We exploit two instruments: a proxy for credit constraints on the supply side (the share of non-performing loans in the province where the firm operates) and firm's age. Regarding the former, we construct the share of non-performing loans (NPL) over total loans in the province where the firm is located over the 2010-2013 period (*npl1013*) – as well as the interaction between *npl1013* and *low_dem* as an instrument for the interaction between financial constraints and *low_dem* – using data provided in banks' supervisory reports collected by Banca d'Italia. The rationale behind this choice is that the degree of burden imposed by deteriorated loans on local banks' balance sheets should negatively affect credit supply available to each firm (hence, the instrument should be relevant). At the same time we do not expect the profitability of each firm (as determined by its pricing policy) to have a first order effect on the share of non-performing loans in a whole province, due to the fragmentation of the Italian productive system into many small- and medium-sized firms.[9] In other words, our exclusion restriction is that the share of NPL mainly affects markups through its impact on financial constraints. Arguably, as we are dealing with an extended period of time, NPL may have a negative impact on economic activity through lower credit supply, thus affecting competition (more firms tend to exit, i.e. there is selection) and, therefore, pricing decisions (i.e. markups). However, it has to be noticed that we are already conditioning on the degree of competition, so that the impact through competition is already taken into account and we hopefully only retain the variation in *fc* generated

[9] In the same vein, Secchi et al. (forthcoming) exploit the exogenous shock to the geographical variation in credit supply caused by the progressive removal, during the 1990s, of local restrictions to banking services introduced in 1936 by Banca d'Italia.

by our instrument *npl1013*.

Second, we include firm's age (a relatively exogenous firm characteristic) as a further instrument, as in Gilchrist and Zakrajsek (2015), who in turn borrow from Hadlock and Pierce (2010). Hadlock and Pierce (2010) show that firm size and age are particularly useful predictors of financial constraint levels. They find that financial constraints fall sharply as young and small firms start to mature and grow.[10] Eventually, these relations appear to level off. Moreover, they argue that an appealing feature of these variables is that they are much less endogenous than most other usual proxies for financial constraints, such as a firm's leverage and cash flow. In sum, we expect a firm's age to influence its probability of being financially constrained, but not to affect the markup decision directly, only through its impact on financial constraints. Again, it can be argued that age is likely to affect markups through other channels, mainly those related to a firm's survival, i.e. those related to a firm's productivity. Therefore, we also try to account for the productivity channel by including some proxies of firms' productivity. In particular, we use a survey question about the share of high-skilled workers in the firm (*high_skill*), which can be held highly correlated with its productivity.[11] Consequently, *age*low_dem* will be included as instrument for *fc*low_dem*.

5 Results

Italy is an interesting case to study as the European financial crisis severely hit its economy, causing a collapse in demand, a sharp increase in uncertainty and difficulties in accessing external finance (D'Amuri et al., 2015). This landscape is consistent with the results based on the Italian part of the WDN survey. Indeed, almost 60% of surveyed companies indicate a lower level of demand in 2010-2013 (Table 2), while almost 70% report a negative role for the volatility/uncertainty of demand (i.e. $low\_volat = 0$). The tightening of credit conditions has been a prominent feature of the recent crisis in the euro area, and even more so in Italy, where bank credit to firms fell by 5% in 2013 and by 2.1% in 2012. This is again consistent with WDN data, as the share of financially constrained firms, as defined in Section 4, is slightly above 50%. Concerning price-cost margins, 70% of firms declared to have cut profit margins in the period 2010-2013 as

[10] The idea is that information asymmetries are likely to be especially large for young and newly-established firms, because creditors have not had enough time to monitor such firms and because such firms have not had enough time to build long-term relationships with suppliers of finance (see inter alia Coluzzi et al. (2015) and references therein).

[11] We have used other proxies for productivity, but results are robust –see below–.

compared to 2005-2008, while 14% have conversely increased them (15 and 13 per cent, respectively, in the manufacturing and in the services sectors).

Estimated coefficients for all right hand side variables are reported in Tables 3A-C, while Tables 4A-C show the corresponding marginal effects for the three main variables in our analysis (over the two different states of demand, according to *low_ dem*). We also split the whole sample into two broad sectors of economic activity, namely industry - including construction - and services, to check the potential sectoral heterogeneity of estimated effects. As already explained in Section 4, we further tackle the endogeneity of firms' financial constraints with respect to their pricing decisions and thus present a set of probit regression estimates obtained exploiting two instrumental variables (the relative size of nonperforming loans over total loans and firm's age).

Simple probit estimates for the probability of raising price-cost markups (Table 3A) indicate that while the coefficients for both *low_ dem* and *fc* are negative, the interaction of these two variables yields a positive and significant (at a 10% level) coefficient; and the aggregate effect is driven by the services sector (Table 3A, column 3). We also find a positive association between demand persistence (*low_ volat*) and the probability of raising markups in the industrial sector and in the economy as a whole (Table 3A, columns 1 and 2). As far as the degree of competition (*low_ comp*) is concerned, we have instead not been able to identify a significant relationship with the likelihood of increasing markups. According to the marginal effects (Table 4A, columns 1-3), which are calculated over the two different states of the firms' demand (lower and higher), financially constrained firms have a lower probability of raising markups in the case of high demand, while in the case of low demand it is non-significant. This implies a counter-cyclical behavior as predicted by our theoretical model. Moreover, it holds true for both industry and services firms, though with a non-statistically significant effect for the former case.

Tables 3B and 3C report the estimated coefficients when we address the endogeneity of financial constraints *fc*, while Table 3D reports the estimates for the first stages.[12] First of all, the quality of our instrumental variables is reasonably good. The extent of non-performing loans in the province and firm's age have the expected sign (respectively positive and negative) and are relevant instruments for the *fc* status and for its interaction with *low_ dem*, as the first-stage F statistics for their joint exclusion is well above the critical values for testing for weak instruments derived by Stock and Yogo (2005). Further, when we use both instruments together and perform an over-identification test, we fail to reject the null hypothesis of instrument validity at standard significance levels (Table

[12] First stages for manufacturing and services are available upon request.

3C).

Estimates from this instrumental variable exercise suggest that the coefficient for the variable *fc* is not significant any more, but the interaction between *low_dem* and *fc* turns out to be positive and significant, while we still find a negative and significant coefficient for *low_dem*. Our proxy for the persistence of demand has a positive and significant effect when interacted with a fall in demand, as envisaged by our theoretical model, although *low_volat* alone is significant in some specifications for the industrial sector (Tables 3B and 3C, columns 2 and 5). Marginal effects (Tables 4B and 4C) tend to corroborate the counter-cyclical behavior of the likelihood of increasing markups when firms are financially constrained, consistent with our model's predictions. Indeed, we find a positive and statistically significant marginal effect for *fc* when firms report negative demand conditions and a negative, though not significant, effect in case of favorable demand. This holds true in the whole economy and in both macro-sectors considered. Moreover, the economic effect is highly relevant, as the probability of raising markups in a low demand environment when firms are financially constrained is higher on average by 26-30 percentage points (pp) depending on the specification, which compares with an unconditional probability of 13-15%. Additionally, the impact of demand persistence is also economically meaningful; when the low level of demand is perceived as persistent, the likelihood of raising price-cost margins increases by 17-25 pp (Tables 4B and 4C, columns 1-3).

Finally, as anticipated in Section 4, we account for the productivity channel by including some proxies of firms' productivity, such as the share of high-skilled workers, of high-tenured workers, the labour share, the event of having increased the share of performance-related pay (e.g. bonuses) and the incidence of the latter over the total wage bill. Our main results are broadly confirmed (see Table 5 where we use the share of high-skilled workers; results for the remaining proxies are available upon request). As a further robustness check we replaced our *fc* variable with the first principal component obtained from the set of six original variables about financial constraints (see Section 4[13]), as well as introduced sampling weights. Results are broadly unaffected.

[13] Also in Bodnar et al. (2017), which also exploit the WDN survey, principal component analysis has been applied to the variables on financial constraints; besides, the same work provides a validation of the replies given by firms using external sources.

6 Conclusions

In this paper we have used the third wave of the WDN survey to investigate the role of financial frictions in markups formation in Italy over the period between 2010 and 2013.

In order to rationalize our results, we use the model by Chevalier and Scharfstein (1996), who first made the point that the interaction between customer markets and financial frictions might lead to a countercyclical behavior of price margins, and we extend it to allow for demand persistence and procyclical competitive pressures. According to the theoretical model, when faced with a low demand environment, the probability of raising markups increases for firms facing financial constraints. Moreover, this countercyclical behavior is strengthened if firms perceive demand to be highly persistent and the competitive pressures to have gone down.

We present both simple probit regression estimates as well as an instrumental variable strategy to tackle the endogeneity of firms' access to finance with respect to their profitability. Our empirical results show that in a low demand environment, other things being equal, firms with limited access to external finance tend to charge higher markups than unconstrained firms. In particular, the probability of raising markups increases by 26-30 pp for firms facing financial constraints, depending on sector and specification. Demand persistence amplifies the countercyclical behavior of markups, while we find no significant effect of the degree of competition on markups.

All in all, our findings suggest that, similar to the US and Spain during the Great Recession, in Italy the wide extent of financial constraints could have lied behind the sustained growth of prices in the 2010-2013 period, notwithstanding the slackness of economic activity.

Annex A

To evaluate the market shares in period 1, one must take into account that a shopper located at y, who is going to buy θ_i (with $i = H, L$) units of the good, is indifferent between store A and store B if

$$p_1^A \theta_i + ty = p_1^B \theta_i + (1-y)t \tag{1a.}$$

From (1a.) one gets that the location y_i^*, with $i = H, L$ of the shopper who is indifferent between A and B, is:

$$y_i^* = \frac{\left(p_1^B - p_1^A\right)\theta_i}{2t} + \frac{1}{2} \tag{2a.}$$

From (2a.), we get that market shares of firm A (σ_1^A) and B (σ_1^B), i.e. the fraction of consumers that buy from A and B, in period 1 are given by:

$$\sigma_1^A = \frac{\left(p_1^B - p_1^A\right)\theta_1}{2t} + \frac{1}{2} = 1 - \sigma_1^B \tag{3a.}$$

Internally financed firms

At the beginning of the first period, each firm simultaneously and non-cooperatively chooses prices, given its conjecture about its rival prices, before knowing the demand realization, to maximize total discounted future profits:

$$V^A = \left(p_1^A - c\right)\overline{\theta}_1 \sigma_1^A\left(\overline{\theta}_1\right) + (R-c)\,\overline{\theta}_2 \sigma_1^A\left(\overline{\theta}_1\right)$$

First order condition is the following:

$$\overline{\theta}_1 \overline{\sigma}_1^A\left(\overline{\theta}_1\right) + \left(p_1^A - c\right)\overline{\theta}_1 \frac{\partial \overline{\sigma}_1^A\left(\overline{\theta}_1\right)}{\partial p_1^A} + (R-c)\,\overline{\theta}_2 \frac{\partial \overline{\sigma}_1^A\left(\overline{\theta}_1\right)}{\partial p_1^A} = 0 \tag{4a.}$$

That is:

$$\overline{\theta}_1 \left[\frac{\left(p_1^B - p_1^A\right)\overline{\theta}_1}{2t} + \frac{1}{2}\right] - \frac{\left(p_1^A - c\right)\overline{\theta}_1^2}{2t} - (R-c)\,\frac{\overline{\theta}_2 \overline{\theta}_1}{2t} = 0 \tag{5a.}$$

After some algebra we get (7), (8) and (9) in the main text.

The cyclicality of price margin can be measured by $\lambda \equiv \frac{\partial m_1^*}{\partial \mu}$

$$\lambda \equiv \frac{\partial m_1^*}{\partial \mu} = -\frac{t}{\overline{\theta}_1^2}\frac{\partial \overline{\theta}_1}{\partial \mu} - \frac{(R-c)}{\overline{\theta}_1^2}\left[\frac{\partial \overline{\theta}_2}{\partial \mu}\overline{\theta}_1 - \overline{\theta}_2\frac{\partial \overline{\theta}_1}{\partial \mu}\right] \tag{6a.}$$

Taking into account $\overline{\theta}_1 = \mu\theta_H + (1-\mu)\theta_L$ and

$\overline{\theta}_2 = [\mu\alpha + (1-\mu)(1-\alpha)]\,\theta_H + [(1-\mu)\,\alpha + \mu\,(1-\alpha)]\,\theta_L$, one gets that:

$$\frac{\partial \overline{\theta}_1}{\partial \mu} = \theta_H - \theta_L \tag{7a.}$$

and

$$\frac{\partial \overline{\theta}_2}{\partial \mu} = (2\alpha - 1)(\theta_H - \theta_L) \tag{8a.}$$

Hence (6a.) can be written as:

$$\lambda = -\frac{(\theta_H - \theta_L)}{\overline{\theta}_1^2}\left\{t + (R-c)\left[(2\alpha-1)\,\overline{\theta}_1 - \overline{\theta}_2\right]\right\} \tag{9a.}$$

substituting $\overline{\theta}_1$ and $\overline{\theta}_2$ into (9a.) we obtain (10) in the main text.

From (3a.) one gets:

$$\begin{aligned}\eta = \frac{\partial\left[\frac{\left(p_1^B - p_1^A\right)\theta_1}{2t} + \frac{1}{2}\right]}{\partial p_1^A}\frac{p_1^A}{\frac{\left(p_1^B - p_1^A\right)\theta_1}{2t} + \frac{1}{2}} = \\ = -\frac{p_1^A\theta_1}{\left(p_1^B - p_1^A\right)\theta_1 + t}\end{aligned} \tag{10a.}$$

The cyclicality of demand elasticity is:

$$\begin{aligned}\upsilon \equiv \frac{\partial|\eta|}{\partial \mu} = \frac{p_1^A\frac{\partial \theta_1}{\partial \mu}\left[\left(p_1^B - p_1^A\right)\theta_1 + t\right] - p_1^A\theta_1\left(p_1^B - p_1^A\right)\frac{\partial \theta_1}{\partial \mu}}{\left[\left(p_1^B - p_1^A\right)\theta_1 + t\right]^2} \\ = \frac{p_1^A(\theta_H - \theta_L)\left[\left(p_1^B - p_1^A\right)\theta_1 + t\right] - p_1^A\theta_1\left(p_1^B - p_1^A\right)(\theta_H - \theta_L)}{\left[\left(p_1^B - p_1^A\right)\theta_1 + t\right]^2} = \\ = t\frac{p_1^A(\theta_H - \theta_L)}{\left[\left(p_1^B - p_1^A\right)\theta_1 + t\right]^2} > 0\end{aligned} \tag{11a.}$$

Using (10a.) and (11a.) into (6a.), markup cyclicality in a symmetric equilibrium can be rewritten as:

$$\lambda = \frac{t}{\overline{\theta}_1}\frac{\upsilon}{\eta} - \frac{(R-c)}{\overline{\theta}_1^2}\left[\frac{\partial \overline{\theta}_2}{\partial \mu}\overline{\theta}_1 - \overline{\theta}_2\frac{\partial \overline{\theta}_1}{\partial \mu}\right] \tag{12a.}$$

Firm A chooses p_1^A to maximize the expected payoff over the two periods

$$V^A = \mu[\pi_{1H}^A - D + \pi_{2/1H}^A] + (1-\mu)\pi_{1L}^A \tag{13a.}$$

taking D and p_1^B as given.

$$\frac{\partial V^A}{\partial p_1^A} = \mu[\frac{\partial \pi_{1H}^A}{\partial p_1^A} + \frac{\partial \pi_{2/1H}^A}{\partial p_1^A}] + (1-\mu)\frac{\partial \pi_{1L}^A}{\partial p_1^A} \tag{14a.}$$

Taking into account that:

$$\pi_{1H}^A\left(p_1^A, p_1^B, \theta_H\right) = \left(p_1^A - c\right)\theta_H \sigma_1^A\left(\theta_H\right) \tag{15a.}$$

$$\pi_{1L}^A\left(p_1^A, p_1^B, \theta_L\right) = \left(p_1^A - c\right)\theta_L \sigma_1^A\left(\theta_L\right) \tag{16a.}$$

$$\pi_{2/1H}^A = (R-c)\left(\alpha\theta_H + (1-\alpha)\theta_L\right)\sigma_1^A\left(\theta_H\right) \tag{17a.}$$

$$\sigma_1^A\left(\theta_H\right) = \frac{\left(p_1^B - p_1^A\right)\theta_H}{2t} + \frac{1}{2} \tag{18a.}$$

$$\sigma_1^A\left(\theta_L\right) = \frac{\left(p_1^B - p_1^A\right)\theta_L}{2t} + \frac{1}{2} \tag{19a.}$$

we get the following first-order condition:

$$\frac{\partial V^A}{\partial p_1^A} = \begin{array}{c} \mu[\theta_H \sigma_1^A\left(\theta_H\right) - \frac{\left(p_1^A - c\right)\theta_H^2}{2t} - \frac{(R-c)(\alpha\theta_H + (1-\alpha)\theta_L)\theta_H}{2t}] + \\ +(1-\mu)\left[\theta_L \sigma_1^A\left(\theta_L\right) - \left(p_1^A - c\right)\frac{\theta_L^2}{2t}\right] = 0 \end{array} \tag{20a.}$$

After some algebra, defining expected demand in the second period, and conditional on having a high level of demand in the first period $\overline{\theta}_{2/1H} \equiv \alpha\theta_H + (1-\alpha)\theta_L$,we get:

$$\begin{array}{c} \frac{\partial V^A}{\partial p_1^A} = \mu\theta_H[\frac{\left(p_1^B - p_1^A\right)\theta_H}{2t} + \frac{1}{2} - \frac{\left(p_1^A - c\right)\theta_H}{2t} - \frac{(R-c)\overline{\theta}_{2/1H}}{2t}] + \\ +(1-\mu)\theta_L\left[\frac{\left(p_1^B - p_1^A\right)\theta_L}{2t} + \frac{1}{2} - \left(p_1^A - c\right)\frac{\theta_L}{2t}\right] = 0 \end{array} \tag{21a.}$$

$$\left[\mu\frac{\theta_H^2}{t}+(1-\mu)\frac{\theta_L^2}{t}\right]p_1^A=$$
$$=\left[\mu\frac{\theta_H^2}{t}+(1-\mu)\frac{\theta_L^2}{t}\right]\frac{p_1^B}{2}+\frac{c}{2}\left[\mu\frac{\theta_H^2}{t}+(1-\mu)\frac{\theta_L^2}{t}\right]-\mu\theta_H\frac{(R-c)\overline{\theta}_{2/1H}}{2t}+\frac{1}{2}\left[\mu\theta_H+(1-\mu)\theta_L\right] \tag{22a.}$$

$$p_1^A=\frac{p_1^B}{2}+\frac{c}{2}-\frac{\mu\theta_H}{2}\frac{(R-c)\,\overline{\theta}_{2/1H}}{\left[\mu\theta_H^2+(1-\mu)\theta_L^2\right]}+\frac{t}{2}\frac{\overline{\theta}_1}{\left[\mu\theta_H^2+(1-\mu)\theta_L^2\right]} \tag{23a.}$$

From the previous equation, we get (12) and (13) in the main text.

Let define $\Gamma\equiv\left[\mu\theta_H^2+(1-\mu)\theta_L^2\right]$. Markup cyclicality is:

$$\begin{gathered}\lambda\equiv\frac{\partial m_1^*}{\partial\mu}=\frac{t\frac{\partial\overline{\theta}_1}{\partial\mu}\Gamma-t\overline{\theta}_1\left(\theta_H^2-\theta_L^2\right)}{\Gamma^2}-\frac{\theta_H(R-c)\overline{\theta}_{2/1H}\Gamma-\mu\theta_H(R-c)\overline{\theta}_{2/1H}\left(\theta_H^2-\theta_L^2\right)}{\Gamma^2}=\\=\frac{t\frac{\partial\overline{\theta}_1}{\partial\mu}\Gamma-t\overline{\theta}_1\left(\theta_H^2-\theta_L^2\right)}{\Gamma^2}-\theta_H\left(R-c\right)\frac{\overline{\theta}_{2/1H}\theta_L^2}{\Gamma^2}=\\t\frac{(\theta_H-\theta_L)\left[\mu\theta_H^2+(1-\mu)\theta_L^2\right]-\left[\mu\theta_H+(1-\mu)\theta_L\right]\left(\theta_H^2-\theta_L^2\right)}{\Gamma^2}-\theta_H\left(R-c\right)\frac{\overline{\theta}_{2/1H}\theta_L^2}{\Gamma^2}\end{gathered} \tag{24a.}$$

Rearranging terms we get (14) and (15) in the main text.

Annex B: questions posed in the WDN survey and used in the estimates

To derive **high_mup**:

How did the following factors evolve in your firm during 2010-2013? Please choose one option for each line

1=Strong decrease; 2=Moderate decrease; 3=Unchanged; 4=Moderate increase; 5=Strong increase

[...]

Prices (as compared to total costs)

[...]

To derive **fc**:

With regard to finance, please indicate for 2010-2013 how relevant were for your firm each one of the following events? Please choose one option for each line. Note: credit here refers to any kind of credit, not only bank credit

1=Not relevant; 2=Of little relevance; 3=Relevant; 4=Very relevant

Credit was not available to finance working capital

Credit was not available to finance new investment

Credit was not available to refinance debt

Credit was available to finance working capital, but conditions (interest rate and other contractual terms) were too onerous

Credit was available to finance new investment, but conditions (interest rate and other contractual terms) were too onerous

Credit was available to refinance debt, but conditions (interest rate and other contractual terms) were too onerous

To derive **low_dem**:

How did [. . .] demand for your main product evolve during 2010-2013? Please choose one option for each line

1=Strong decrease; 2=Moderate decrease; 3=Unchanged; 4=Moderate increase; 5=Strong increase

[. . .]

Domestic demand for your main product/service

Foreign demand for your main product/service

To derive **low_volat**:

How did the following factors affect you firm's activity during 2010-2013? Please choose one option for each line

1=Strong decrease; 2=Moderate decrease; 3=Unchanged; 4=Moderate increase; 5=Strong increase

[...]

Volatility/uncertainty of demand for your products/services

[...]

For those factors which affected your firm strongly, were the effects transitory, partly persistent or long-lasting for 2010-2013?

[...]

Volatility/uncertainty of demand for your products/services

Where:

1 = Transitory

2 = Only partly persistent

3 = Long-lasting

[...]

To derive **low_comp**:

Compared to the situation before 2008, how has the competitive pressure on your main product domestic and foreign markets changed in the period 2010-2013? Please choose one option for each line

1=Strong decrease; 2=Moderate decrease; 3=Unchanged; 4=Moderate increase; 5=Strong increase

Domestic market

Foreign market

Table 1. Sectoral breakdown and size distribution

	Size			
Sectoral breakdown	5-49	50-199	200+	Total
Industry including construction	325	170	56	551
Trade	129	45	13	187
Business services	121	83	47	251
Total	575	298	116	989

Notes: unweighted statistics.

Table 2. Descriptive statistics

	Financially constrained firms (50.2%)	Non-financially constrained firms (49.8%)
	Means (*std.dev.*)	Means (*std.dev.*)
Increase in markups = 1	0.097 (0.296)	0.194 (0.396)
Sector (Industry = 1)	0.523 (0.500)	0.524 (0.500)
Size (5-49 = 1)	0.887 (0.316)	0.875 (0.331)
Age	30.15 (21.00)	32.77 (21.70)
Ownership (Foreign = 1)	0.376 (0.485)	0.387 (0.488)
Subsidiary = 1	0.195 (0.397)	0.330 (0.471)
Structure (Multi-establ.=1)	0.079 (0.270)	0.159 (0.366)
Fall in demand = 1	0.635 (0.482)	0.544 (0.499)
Fall in competition = 1	0.129 (0.335)	0.081 (0.274)
Fall in volatility = 1	0.243 (0.429)	0.390 (0.488)
Share of high-skilled white-collar workers (in %)	10.88 (19.30)	13.31 (21.16)

Notes: unweighted statistics.

Table 3A. Italy: determinants of markups. Probit regression. (coefficients)

	Probit regression		
	Whole economy	Industry	Services
low_dem	-0.816^{***} [0.193]	-0.591^{**} [0.259]	-1.170^{***} [0.321]
low_comp	0.157 [0.284]	-0.164 [0.463]	0.365 [0.370]
low_dem*low_comp	0.133 [0.352]	0.420 [0.532]	-0.052 [0.513]
low_volat	0.529^{***} [0.152]	0.713^{***} [0.220]	0.327 [0.219]
low_dem*low_volat	0.307 [0.231]	0.101 [0.303]	0.568 [0.395]
fc	-0.427^{***} [0.154]	-0.341 [0.222]	-0.511^{***} [0.219]
fc*low_dem	$0.376*$ [0.221]	0.146 [0.296]	0.748^{**} [0.361]
constant	-0.867^{***} [0.162]	-1.003^{***} [0.225]	-0.967^{***} [0.238]
Observations	989	551	438

Notes: regressions include also the following controls: sector, size, nationality of the ownership, level of autonomy, organizational structure. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 3B. Italy: determinants of markups. Probit regression with IV

(coefficients)

	Probit regression with IV (IV probit)			Probit regression with IV (Two step + Wooldridge[14])		
	Whole economy	Industry	Services	Whole economy	Industry	Services
	Instruments: non performing loans over total loans in the province					
low_dem	−2.498*** [0.924]	−1.083 [1.175]	−4.222** [1.718]	−2.550*** [0.656]	−1.728* [0.923]	−3.051*** [1.049]
low_comp	0.222 [0.341]	−0.0961 [0.523]	0.647 [0.602]	0.227 [0.344]	−0.114 [0.539]	0.472 [0.490]
low_dem*low_comp	−0.108 [0.420]	0.227 [0.604]	−0.545 [0.755]	−0.153 [0.423]	0.193 [0.622]	−0.38 [0.635]
low_volat	0.315 [0.359]	0.970* [0.569]	−0.0745 [0.493]	0.348 [0.295]	0.754 [0.512]	0.208 [0.359]
low_dem*low_volat	0.804* [0.413]	0.132 [0.626]	1.198* [0.653]	0.808** [0.348]	0.407 [0.545]	0.927* [0.518]
fc	−1.465 [1.556]	0.533 [1.793]	−3.831 [3.165]	−1.346 [1.178]	−0.236 [1.568]	−1.563 [1.989]
fc*low_dem	3.374** [1.630]	1.083 [1.970]	6.364** [3.182]	3.456*** [1.122]	2.169 [1.516]	4.123** [1.843]
constant	−0.318 [0.925]	−1.612 [1.136]	0.863 [1.749]	−0.37 [0.721]	−1.129 [1.012]	−0.365 [1.121]
Wald test of exogeneity (p-value)	8.60 (0.01)	4.09 (0.13)	6.87 (0.03)	13.90 (0.00)	6.63 (0.04)	6.08 (0.05)
Observation	989	551	438	989	551	438

Notes: regressions include also the following controls: sector, size, nationality of the ownership, level of autonomy, organizational structure. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

[14] Procedure as recommended in Wooldridge (2002) in case of a binary endogenous variable; the fitted probabilities from a first-stage probit model for the endogenous variable are used as instruments in a standard IV regression.

Table 3C. Italy: determinants of markups. Probit regression with IV. (coefficients)

	Probit regression with IV (IV probit)			Probit regression with IV (Two step + Wooldridge[15])		
	Whole economy	Industry	Services	Whole economy	Industry	Services
	Instruments: non performing loans over total loans in the province and firm age					
low_dem	−2.322** [0.958]	−0.463 [1.244]	−4.286*** [1.589]	−2.221*** [0.658]	−0.95 [0.845]	−3.009*** [1.010]
low_comp	0.26 [0.357]	0.0254 [0.572]	0.678 [0.604]	0.237 [0.357]	0.0222 [0.580]	0.466 [0.488]
low_dem*low_comp	−0.222 [0.439]	0.00499 [0.661]	−0.609 [0.764]	−0.231 [0.438]	−0.0245 [0.668]	−0.384 [0.633]
low_volat	0.445 [0.370]	1.363** [0.575]	−0.0967 [0.476]	0.527* [0.297]	1.200*** [0.452]	0.213 [0.352]
low_dem*low_volat	0.713* [0.424]	−0.197 [0.652]	1.175* [0.639]	0.664* [0.351]	0.00892 [0.512]	0.912* [0.514]
fc	−0.939 [1.600]	1.713 [1.754]	−4.069 [2.976]	−0.547 [1.174]	1.161 [1.248]	−1.502 [1.924]
fc*low_dem	3.078* [1.694]	0.0678 [2.097]	6.529** [2.934]	2.873** [1.125]	0.892 [1.380]	4.066** [1.768]
constant	−0.652 [0.949]	−2.389** [1.111]	0.983 [1.648]	−0.865 [0.718]	−2.046** [0.824]	−0.408 [1.087]
Wald test of exogeneity (p-value)	10.50 (0.00)	7.05 (0.03)	8.10 (0.02)	13.78 (0.00)	7.04 (0.03)	6.45 (0.04)
Amemiya-Lee-Newey min χ^2statistics (p-value)	3.278 (0.07)	1.053 (0.30)	0.050 (0.082)	2.955 (0.09)	1.298 (0.25)	0.234 (0.63)
Observations	977	544	433	977	544	433

[15] Procedure as recommended in Wooldridge (2002) in case of a binary endogenous variable; the fitted probabilities from a first-stage probit model for the endogenous variable are used as instruments in a standard IV regression.

Table 3D. Italy: first-stage regressions (coefficients)

	Whole economy		Whole economy	
	fc	fc*low_dem	fc	fc*low_dem
npl1013	0.009** [0.004]	−0.001 [0.001]	0.009** [0.004]	−0.001 [0.001]
npl1013*low_dem	0.006 [0.005]	0.016*** [0.003]	0.006 [0.005]	0.016*** [0.003]
age			−0.000 [0.001]	−0.001 [0.001]
age*low_dem			−0.003* [0.002]	−0.002** [0.001]
low_dem	−0.078* [0.084]	−0.328*** [0.050]	−0.001 [0.107]	0.401*** [0.068]
low_comp	−0.059 [0.100]	−0.008 [0.012]	−0.059 [0.103]	−0.008 [0.012]
low_dem*low_comp	0.023 [0.114]	0.102* [0.055]	0.020 [0.118]	0.097* [0.058]
low_volat	−0.194*** [0.049]	0.001 [0.007]	−0.199*** [0.050]	0.002** [0.007]
low_dem*low_volat	0.043 [0.073]	−0.154*** [0.054]	0.045 [0.075]	−0.155*** [0.056]
constant	0.483*** [0.073]	0.034* [0.021]	0.487*** [0.088]	0.041* (0.03)
F–test of excluded instrument (p-value)	14.01 (0.00)	14.76 (0.00)	8.22 (0.00)	8.850 (0.00)

Notes: regressions include also the following controls: country, sector, size, nationality of the ownership, level of autonomy, organizational structure. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 4A. Italy: determinants of markups. Probit regression.

(marginal effects)

	Probit regression		
	Whole economy	Industry	Services
fc			
high_dem	−0.123***	−0.100	−0.139**
	[0.043]	[0.064]	[0.058]
low_dem	−0.007	−0.030	0.024
	[0.022]	[0.030]	[0.029]
low_volat			
high_dem	0.153***	0.210***	0.088
	[0.043]	[0.060]	[0.058]
low_dem	0.158***	0.125***	0.146**
	[0.042]	[0.032]	[0.073]
low_comp			
high_dem	0.047	−0.048	0.110
	[0.088]	[0.136]	[0.121]
low_dem	0.044	0.039	0.038
	[0.036]	[0.040]	[0.049]

Notes: regressions include also the following controls: sector, size, nationality of the ownership, level of autonomy, organizational structure. Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4B. Italy: determinants of markups. Probit regression with IV.
(marginal effects)

	Probit regression		
	Whole economy	Industry	Services
	Instrument: non performing loans over total loans in the province		
fc			
high_dem	-0.344 [0.283]	-0.087 [0.374]	-0.274 [0.547]
low_dem	0.278^{***} [0.100]	0.295^{**} [0.144]	0.294^{*} [0.155]
low_volat			
high_dem	0.105 [0.070]	0.213^{*} [0.113]	0.074 [0.079]
low_dem	0.241^{***} [0.057]	0.169^{***} [0.038]	0.214^{**} [0.097]
low_comp			
high_dem	0.060 [0.092]	-0.036 [0.144]	0.118 [0.134]
low_dem	0.010 [0.030]	0.007 [0.040]	-0.001 [0.039]

Notes: regressions include also the following controls: sector, size, nationality of the ownership, level of autonomy, organizational structure. Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4C. Italy: determinants of markups. Probit regression with IV.
(marginal effects)

	Probit regression		
	Whole economy	Industry	Services
	Instrument: non performing loans over total loans in the province and firm age		
fc			
high_dem	−0.124 [0.269]	0.317 [0.327]	−0.354 [0.518]
low_dem	0.297*** [0.092]	0.273** [0.124]	0.265* [0.139]
low_volat			
high_dem	0.156** [0.067]	0.334*** [0.101]	0.065 [0.077]
low_dem	0.249*** [0.057]	0.169*** [0.037]	0.204** [0.093]
low_comp			
high_dem	0.065 [0.094]	−0.019 [0.149]	0.124 [0.134]
low_dem	0.001 [0.030]	−0.001 [0.039]	0.003 [0.040]

Notes: regressions include also the following controls: sector, size, nationality of the ownership, level of autonomy, organizational structure. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Italy: determinants of markups. Probit regression including a proxy for productivity.
(coefficients)

	Probit	IV Probit with NPL	IV Probit with NPL and firm age
low_dem	-0.831^{***} [0.194]	-2.460^{***} [0.934]	-2.259^{**} [0.971]
low_comp	0.156 [0.282]	0.210 [0.341]	0.238 [0.359]
low_dem*low_comp	0.128 [0.351]	-0.109 [0.419]	-0.216 [0.440]
low_volat	0.520^{***} [0.152]	0.335 [0.364]	0.472 [0.376]
low_dem*low_volat	0.334 [0.232]	0.809^{*} [0.414]	0.711^{*} [0.426]
fc	-0.414^{***} [0.154]	-1.302 [1.606]	-0.729 [1.653]
fc*low_dem	0.376^{*} [0.222]	3.279^{**} [1.649]	2.937^{*} [1.720]
high_skill	0.00364 [0.00252]	0.00432 [0.00325]	0.00510 [0.00334]
constant	-0.901^{***} [0.164]	-0.448 [0.967]	-0.816 [0.993]
Observations	989	989	977

Notes: regressions include also the following controls: sector, size, nationality of the ownership, level of autonomy, organizational structure. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

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