I will survive. Pricing strategies of financially distressed firms.*

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Abstract

We consider a standard result of customer market theory: if firms have customer relations and face financial frictions, it may be the case that they keep prices relatively high in times of low demand and viceversa. Indeed, during recessions, when firms have low cash flow and greater difficulty raising external funds, they may prefer to set higher prices on their locked-in shoppers to maintain short-run 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 by the procyclicality of competitive pressures. We test these theoretical predictions for Italian firms participating in 2014 to the Wage Dynamic Network survey. Ceteris paribus, firms with limited access to external finance charge higher markups when faced with a low demand environment. Evidence on the role of demand persistence is also consistent with the theoretical predictions. Our evidence suggests that the severity of financial constraints in Italy was one of the causes behind the sustained growth of prices in the 2010-2013 period, notwithstanding the ample slack in the economic activity.

JEL classification:

Keywords: markups, financial frictions, customer market

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

Blanchard (2009)

1 Introduction

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[1] 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, rather than to invest in 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, in a sense, available financial resources.

Our work addresses the role of financial frictions for markups formation in Italy over the period between 2010 and 2013. To this aim we use the third wave of the Wage Dy-

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

namic 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 evolutions 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 exploit the WDN harmonized questionnaire better.

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 lenght 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 on the perceived persistence of firms' own demand, which are particularly useful to test this prediction.

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 alters the degree of strategic complementarities in price setting. More specifically a fall in the perceived competitive pressures amplifies the effects of financial frictions on markups cyclicality.

In sum, according to our model, we expect that when faced with a low demand environment, the probability of raising mark-ups increases for firms with limited access to external finance. Moreover, a countercyclical behaviour 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 behaviour of markups for financially constrained firms emerges in the whole economy as well as in both 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 frame 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[2]. 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.

The debate on the role that financial frictions play in shaping firms' prices has gained renewed attention in the context of the global financial crisis, as the extraordinary turmoil that swept through financial markets during the Great Recession has been accompanied by only a mild decrease in inflation in most advanced countries. Gilchrist et al. (2015) use a micro-level data set, which contains good-level prices merged with the respondent firms'

[2]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.

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; moreover 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, 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, together with an increase in market power, on the background of a large increase in the pace of business destructions during the crisis.

3 Theoretical frame

Our theoretical frame is based on the Klemperer (1995) model of competition with consumer switching costs, extended to allow for liquidity constraints, as in 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 they determine firms' future profits, and that firms face a trade-off, in any period, between investing in market share by setting a low price and extracting rents by setting a high price on their locked-in shoppers. In this customer-markets framework, CS show that price markups behave in a countercyclical fashion if firms are financially constrained, as firms are more likely to be liquidity-constrained in recessions and liquidity constrained firms place a greater weight on short-run profits than on future profits.

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 α 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 affects equilibrium prices and, hence, markups cyclicality.

Second, whereas CS's model features constant demand elasticity, we allow for a pro-cyclical nature. 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 costs. Hence the elasticity of demand is higher in booms than it is 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 markups cyclicality.

3.1 The model

There are two firms $k = A, B$, who compete for two periods $\tau = 1, 2$. The mass of consumers is 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 price R for one unit of a 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. For each firm, first-period demand of each consumer can be high ($\theta_1 = \theta_H$) with probability μ, or low ($\theta_1 = \theta_L$) with probability $(1 - \mu)$. Each customer of a firm buys the same quantity of goods; the value of μ is the same for both firms, but the actual realization of demand, θ_H or θ_L, is firm-specific.

The expected persistence of the first-period state of demand is α. In other words, α is the probability that the first-period state of demand will persist in the second period: $P(\theta_\tau = \theta_{\tau-1}) = \alpha$.

Firms set first-period prices before they know the demand realization. In the second period, provided that switching costs are high enough, each firm can charge the consumer's reservation price R without fear of being undercut by its rival because the rival would

have to cut the price a discrete amount to $R - s - \varepsilon$. While the rival may sell more units at this lower price, it earns considerably less on its locked-in first-period customers.

Finally we assume that in order to compete in this market firms must invest an amount I at the beginning of the first period.

Internally financed firms

Let's start by assuming that firms are financed with internally generated funds.

We first solve for firms' optimal second-period behavior, for any given first-period market shares. 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 price plus transportation costs are less than R, 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 fractions of consumers that buy from A and B, in period 1 are given by:

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

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

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

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

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

where we have assumed that the discount factor is 1 and $\overline{\theta}_1$ and $\overline{\theta}_2$ are the expectations formulated at the beginning of time 1 for demand in the first and second period, respectively: $\overline{\theta}_1 = \mu\theta_H + (1-\mu)\theta_L$ and $\overline{\theta}_2 = [\mu\alpha + (1-\mu)(1-\alpha)]\,\theta_H + [(1-\mu)\,\alpha + \mu\,(1-\alpha)]\,\theta_L$

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

$$p_1^A = \frac{p_1^B}{2} + \frac{c}{2}\frac{\overline{\theta}_1 + \overline{\theta}_2}{\overline{\theta}_1} + \frac{t}{2\overline{\theta}_1} - \frac{1}{2}\frac{\overline{\theta}_2 R}{\overline{\theta}_1} \tag{3}$$

that shows 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:

$$p_1^* = \frac{t}{\overline{\theta}_1} + \frac{\overline{\theta}_1 + \overline{\theta}_2}{\overline{\theta}_1} c - \frac{\overline{\theta}_2 R}{\overline{\theta}_1} \tag{4}$$

and the markup of price over marginal cost:

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

To gain some intuition, from (2) we note that the demand elasticity is $\eta = -\frac{\overline{\theta}_1 p_1^A}{\left(p_1^B - p_1^A\right)\overline{\theta}_1 + t}$ and we can measure the procyclicality of demand elasticity as $\upsilon \equiv \frac{\partial|\eta|}{\partial\mu} = \frac{t p_1^A (\theta_H - \theta_L)}{\left[\left(p_1^B - p_1^A\right)\overline{\theta}_1 + t\right]^2}$. In a symmetric equilibrium, we have $\eta^* = -\frac{\overline{\theta}_1 p_1^*}{t}$ and $\upsilon^* = \frac{p_1^*(\theta_H - \theta_L)}{t}$ and we can write the equilibrium markup when firms are internally financed as:

$$m_1^* = -\frac{\upsilon^*}{\eta^*}\frac{t}{\theta_H - \theta_L} - \frac{\overline{\theta}_2}{\overline{\theta}_1}(R - c)$$

The cyclicality of price margin can be measured by $\lambda \equiv \frac{\partial m_1^*}{\partial\mu}$,[3] which, after some algebra, is

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

or, equivalently:

$$\lambda \equiv \frac{\partial m_1^*}{\partial\mu} = \frac{t\upsilon^*}{\eta^*\overline{\theta}_1} + (1 - \alpha)(R - c)\frac{\theta_H^2 - \theta_L^2}{\overline{\theta}_1^2} \tag{5}$$

Based on (5), price markups can be procyclical ($\lambda > 0$) or countercyclical ($\lambda < 0$), depending on the parameters of the model. We can conclude that:

[3] As in CS (1996) 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.

- When demand elasticity is nearly constant, then markups are procyclical: as in the CS's model, markups fall in recession because 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 procyclicality might be weakened and markups might even become countercyclical if:

- the expected persistence of the state of demand is high. When the low state of demand is expected to persist in the future, the relative convenience of reaping profits in the future, rather than in the present, is weaker. ($\frac{\partial \lambda}{\partial \alpha} = -(R-c)\frac{\theta_H^2 - \theta_L^2}{\overline{\theta}_1^2}$)
- competitive pressures fall strongly in recessions (i.e. the procyclicality of demand elasticity is very high). Indeed, this would imply a large decrease in the elasticity of demand during downturns; the smaller the gain in demand size incurred for a price decrease, the smaller the benefit from investing in market shares.

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

1. The markup of non-financially constrained firms can be either procyclical or countercyclical
2. It is less procyclical (or more countercyclical), the more the firm expects the current shock to demand to persist into the future.
3. 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. As in CS, the latter are introduced following Bolton and Scharfstein (1990,1996) and Hart and Moore (1989): corporate cash flow, while being observable to the manager and investors, cannot be observed by outside parties, i.e. it is

not verifiable, and hence, contracts cannot be contingent on its realization. Furthermore the manager can costlessly divert all of the cash flow to himself.

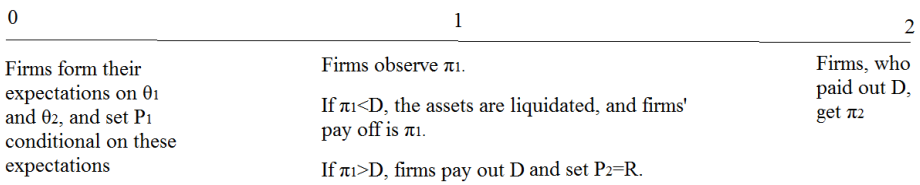
As in CS the only way to get managers to pay out cash flow is to threaten to liquidate the firm's assets if they do not; liquidation is inefficient as firm's assets are worth a fraction $\lambda < 1$ of the remaining cash flow if owned and managed by investors. As Hart and Moore (1989) and Bolton and Scharfstein (1996) show, the optimal contract calls for a repayment of D at date 1; if no payment is made, the investor has the right to seize the project's assets.

The manager has an incentive to pay out D if he/she has the cash to do so, because if he/she fails to pay, the asset will be liquidated and he/she loses the ability to divert cash to himself/herself at date 2. If the assets have not been seized at date 1, then the manager will divert all of the period 2 cash flow to himself. From this assumptions, we get that incentive compatibility requires $D \leq \pi_2^k$.

If the manager does not have enough cash ($\pi_1^k < D$), then he would choose to pay nothing and have the asset liquidated. His first-period payoff would be π_1^k.

As in CS, we assume that $\pi_1^k(\theta_L) < D < \pi_1^k(\theta_H)$, consistently with the conjecture that firms are more likely to be liquidity-constrained in recessions.

Figure 1



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; $\pi_{1H}^k \equiv \pi_1^k(\theta_H)$ as the first-period level of profit when demand is high and $\pi_{2/1H}$ and $\pi_{2/1L}$ the expected second-period profit, conditional on having a high and a low level of demand in the first period, respectively.

The investor will be willing to lend provided his expected payoffs are nonnegative: $\mu D + (1-\mu)\lambda\pi_{2/1L} - I \geq 0$. Competition among investors ensures that the previous condition is met with equality. Note that D is chosen taking into account product market equilibrium that follows in periods 1 and 2. However, if this value of D, $D^* = \frac{I-(1-\mu)\lambda\pi_{2/1L}}{\mu}$ is greater than $\pi_{2/1H}$, then the contract would not be incentive compatible and there would be no feasible contract. We assume for the remainder that $D^* \leq \pi_{2/1H}$, that is, incentive compatible contracts are feasible.

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

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

After some algebra, 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:

$$p_1^* = \frac{\overline{\theta}_1}{\mu\theta_H^2 + (1-\mu)\theta_L^2} t + c\frac{\left[\mu\theta_H^2 + (1-\mu)\theta_L^2 + \mu\overline{\theta}_{2/1H}\theta_H\right]}{\mu\theta_H^2 + (1-\mu)\theta_L^2} - \mu t\overline{\theta}_{2/1H}\frac{R\frac{\theta_H}{t}}{\mu\theta_H^2 + (1-\mu)\theta_L^2}$$

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

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

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

or equivalently:

$$\lambda \equiv \frac{\partial m_1^*}{\partial \mu} = -\left[(R-c)\,\overline{\theta}_{2/1H}\theta_L - t\frac{\upsilon^*}{\eta^*}\theta_1\right]\frac{\theta_L}{D^2}\theta_H$$

where $D \equiv \mu\theta_H^2 + (1-\mu)\theta_L^2$. Note that the cyclicality of price margins when firms are financially constrained is always negative. The intuition is the following. 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 high price rather than building market shares.

Besides, the countercyclicality of price margins is amplified the more competitive pressures are procyclical (the larger is υ^*) and the larger is the expected persistence $\frac{\partial|\lambda|}{\partial\alpha} = (R-c)\,(\theta_H - \theta_L)\,\theta_L^2\frac{\theta_H}{D^2}$. On the one hand, when competitive pressures fall strongly in recessions, the loss in demand for a given price increase becomes smaller, making the desired increase in prices larger. On the other hand, when the low state of demand is expected to persist in the future, the relative convenience of setting a lower price to reap profits in the future, rather than in the present, is - all the more so- weaker.

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

1. The markup of financially constrained firms is countercyclical.

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

3. 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 behaviour collected by Banca d'Italia through an ad hoc survey of firms launched in the context of the European System of Central Banks Wage Dynamics Network (WDN; see the Annex for the wording of the questions we relied upon). Interviewed firms operate in the manufacturing, trade and business service sectors and replies are mostly referred to the period between 2010 and 2013.

We estimate probit regressions for markups, where the dependent variable takes value one if the firm has raised markups and zero elsewhere. The probability of raising markups is modeled as a function of a number of covariates. First of all, firms' characteristics: sectoral dummies (manufacturing, 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), level of autonomy (namely, whether the firm is a subsidiary/affiliate or not) and organizational structure (single or multi-establishment firm). Secondly, we include information on the dynamics of demand, of competition and on volatility/uncertainty about the level of demand. We account for the dynamics of demand by introducing a dummy *low_ demand* which is equal to one if the firm reports a negative evolution of the domestic or foreign demand for its main product/service during 2010-2013. Competition is defined as lower (dummy *low_ comp* equal to 1) when, compared to the situation before 2008, the competitive pressure on its main product/service domestic and foreign markets decreased. Volatility of demand for the firm's main product/service is defined as low (dummy *low_ volat* equal to 1) if 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. We interpret the perception of low volatility as a proxy for a high level of demand persistence. Finally, and more importantly, we consider variables accounting for the impact of credit availability on firms' economic activity. In particular, firms were asked to relate the difficulties in obtaining credit to the main purpose for which finance was needed. Namely, they were 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 too onerous" for financing: (i) working capital, (ii) new investment, (iii) existing debt (rollover). Firms were defined as financially constrained (dummy *fc* equal to one) if they had replied 'Relevant' or 'Very relevant' to any of these six questions.

Arguably the relevance of credit constraints is not independent of firm profitability: it might be the case that the direction of causality could thus run in the opposite direction.

To address this possible endogeneity issue we introduce an instrumental variable approach. We first exploit as an instrument for *fc* the average share of non-performing loans over total loans in the province where the firm is located over the 2010-2013 period (*npl1013*), as well as the interaction between *npll013* and *low_demand* as an instrument for the interaction between *fc* and *low_demand*. Data on non-performing and total loans by province are those provided in banks' supervisory reports collected by Banca d'Italia. The rationale behind this choice is that the degree of burden in terms of deteriorated loans suffered by local banks should be a good predictor for credit supply to each firm (hence, the instrument should be relevant) while at the same time profitability of each firm is not held able to affect the share of non-performing loans in a whole province (due to the fragmentation of Italian productive system into several small and medium firms; thus the instrument should be valid).[4] Secondly, as in Gilchrist and Zakrajsek (2015), in turn borrowing from Hadlock and Pierce (2010) - who identified firm age and size as proxies for the likelihood of financing constraints in the US - we include firm age (a relatively exogenous firm characteristic) as a further instrument. The idea is that young firms usually face greater external financing obstacles than older ones because of their opaqueness (Coluzzi et al. 2015), thus we expect a negative loading as in the analysis by Hadlock and Pierce (2010).

Table 1 reports the main descriptive statistics on the breakdown of surveyed firms by financial constraint and demand status, as well as on the probability of raising markups across the groups of firms that descend from the same breakdown.

5 Results

Italy is an interesting case to study as the sovereign debt crisis severely hit its economy, causing a collapse in demand, increased uncertainty and difficulties in accessing external finance (D'Amuri et al., 2015). Almost 60 per cent of surveyed companies (which amount to slightly less than one thousand) indicated a lower level of demand in 2010-2013 (Table 1), almost 70 per cent reported a negative role for the volatility/uncertainty of the demand. The weakness of credit conditions has been a prominent feature of the recent macroeconomic landscape in the euro area, and even more so in Italy, where bank credit to firms fell by 5 per cent in 2013 and by 2.1 per cent in 2012. Financially constrained

[4] 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 the Bank of Italy.

firms as defined in Section 4 are slightly more than half. Concerning markups, 70 per cent of firms affirmed to have cut profit margins in the period 2010-2013 as compared to 2005-2008, 14 per cent has conversely increased them (15 and 13 per cent respectively in the manufacturing and in the services sectors).

As already hinted to in Section 4, we tackle the endogeneity of firms' financial constraints with respect to their profitability and thus present both simple probit regression estimates as well as those obtained exploiting the two instruments: the relative size of non-performing loans over total loans and firm age, which is held a relatively exogenous firm characteristic. Estimates are reported in Tables 2A-C and 3A-C, including respectively coefficients for all variables in the RHS and marginal effects for the three main variables in our analysis (over the two different states of demand, according to *low_demand*). We also split the whole sample into two broad sectors of economic activity, namely manufacturing and services.

Simple probit estimates for the probability of raising mark-ups (Table 2A) indicate that while the coefficients for both *low_demand* and *fc* are negative, the interaction of these two variables yields a positive and significant (at 10% level) coefficient; the effect is driven by the services sector (Table 2A, column 3). We also detect in the manufacturing sector and in the economy as a whole (Table 2A, columns 1 and 2) a positive association between demand persistence (*low_volat*) and probability of raising markups. As far as the degree of competition (*low_comp*) is concerned, we have instead not been able to identify a significant relationship with markup setting. Looking at the whole marginal effect of being financially constrained, calculated over the two different states of the firms' demand (lower and higher) for their product/service, it emerges that financially constrained firms in case of high demand have a lower probability of raising mark-ups, implying a counter-cyclical behaviour as predicted by the model. This holds true for both manufacturing and services, though with a non-statistically significant effect for the manufacturing sector (Table 3A, columns 1-3).

Then we address the endogeneity of *fc* (Tables 2B and 2C, columns 1 and 4). First of all, the extent of non-performing loans in the province and firm age have the expected sign (positive and negative, respectively) and are both relevant instruments for the *fc* status, as the first-stage F statistics for their joint exclusion is well above the critical values for testing for weak instruments as derived by Stock and Yogo (2005). Estimates from this instrumental variable exercise suggest that the coefficient for the *fc* variable is not any more significant, while we still find negative and significant coefficients for *low_demand* and a positive and significant one for the interaction between *low_demand* and *fc*. Persistence

of demand has a positive effect not per se, but only in case of adverse demand, as envisaged by our model; only for the manufacturing sector *low_volat* has in some specifications a significant coefficient if taken by itself; Tables 2B and 2C, columns 2 and 5). Marginal effects corroborate the counter-cyclical behaviour of financially constrained firms, which feature a higher probability of increasing mark-ups when hit by negative demand conditions and a lower (though not significant) probability of raising them in case of favourable demand. This holds true in the whole economy and in both macrosectors. The probability of raising markups in a low demand environment for financially constrained firms is higher by 26-30 percentage points depending on the specification and on the sector, which compares with an unconditional probability by 13-15%. Moreover when the low level of demand is perceived as persistent the likelihood of boosting price-cost margins raises by 17-25 percentage points depending on the specification and on the sector (Tables 3B and 3C, columns 1-3).

As a further robustness check we replaced our *fc* variable with the first principal component obtained from the set of six original variables on financial constraints (see Section 3), as well as introduced sampling weights. Results are broadly unaffected.

6 Conclusions

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

In order to rationalize our results, we have used 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 behaviour of price margins, and we have extended 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 behaviour is strengthened if firms perceive demand to be highly persistent and the competitive pressures to have gone down.

We have presented 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. 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 mark-ups increases by 26-30 percentage points for firms facing financial constraints,

depending on the sector and on the specification. It emerges also a role for demand persistence in amplyfying the countercyclical behaviour of margins; besides we have found no significant effect of the degree of competition on margins.

Our results suggest that the wide extent of financial constraints in Italy could have lied behind the sustained growth of prices in the 2010-2013 period notwithstanding the slackness of economic activity.

Annex: 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

[...]

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. Descriptive statistics

	Frequency of firms			Probability of raising markups		
Italy	fc=0	fc=1	Total	fc=0	fc=1	Total
High demand	22.6	18.0	40.6	0.32	0.15	0.24
Low demand	26.3	33.2	59.4	0.09	0.07	0.08
Total	48.9	51.1	100.0	0.19	0.10	0.14

Notes: weighted statistics.

Table 2A. Italy: determinants of markups. Probit regression.
(coefficients)

	Probit regression		
	Whole economy	Manufacturing	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]
Observation	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 2B. Italy: determinants of markups. Probit regression with IV

(coefficients)

	Probit regression with IV (IV probit)			Probit regression with IV (Two step + Wooldridge[5])		
	Total	Manufacturing	Services	Total	Manufacturing	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]
F-test (first stage) (p-value)	24.34 (0.00)	16.76 (0.00)	6.06 (0.05)	24.34 (0.00)	16.76 (0.00)	6.06 (0.05)
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

[5]Procedure as recommended in Wooldridge (2002) in case of a binary endogenous variable; the first-stage fitted probabilities are used as an instrumental variable and not as a regressor in the second-stage.

Table 2C. Italy: determinants of markups. Probit regression with IV

(coefficients)

	Probit regression with IV (IV probit)			Probit regression with IV (Two step + Wooldridge[6])		
	Total	Manufacturing	Services	Total	Manufacturing	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]
F-test (first stage) (p-value)	27.72 (0.00)	22.95 (0.00)	7.75 (0.05)	27.72 (0.00)	22.95 (0.00)	7.75 (0.05)
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)
Observation	977	544	433	977	544	433

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

[6]Procedure as recommended in Wooldridge (2002) in case of a binary endogenous variable; the first-stage fitted probabilities are used as an instrumental variable and not as a regressor in the second-stage.

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

	Probit regression		
	Whole economy	Manufacturing	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 3B. Italy: determinants of markups. Probit regression with IV.
(marginal effects)

	Probit regression		
	Whole economy	Manufacturing	Services
	Instrument: non performing loans over total loans in the province		
fc			
high_dem	−0.344	−0.087	−0.274
	[0.283]	[0.374]	[0.547]
low_dem	0.278***	0.295**	0.294*
	[0.100]	[0.144]	[0.155]
low_volat			
high_dem	0.105	0.213*	0.074
	[0.070]	[0.113]	[0.079]
low_dem	0.241***	0.169***	0.214**
	[0.057]	[0.038]	[0.097]
low_comp			
high_dem	0.060	−0.036	0.118
	[0.092]	[0.144]	[0.134]
low_dem	0.010	0.007	−0.001
	[0.030]	[0.040]	[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 3C. Italy: determinants of markups. Probit regression with IV.
(marginal effects)

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

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