European Economic Review ▮ (▮▮▮▮) ▮▮▮–▮▮▮

Contents lists available at ScienceDirect

European Economic Review

journal homepage: www.elsevier.com/locate/eer

Average-cost pricing: Some evidence and implications

Carlo Altomonte [a,b], Alessandro Barattieri [c,d,*], Susanto Basu [e,f]

[a] Department of Institutional Analysis and Public Management, Bocconi University, via Roentgen 2, 20136 Milan, Italy
[b] Bruegel, Belgium
[c] ESG UQAM, Case Postale 8888, succursale Centre-ville Montreal, Quebec, Canada H3C 3P8
[d] Collegio Carlo Alberto, Italy
[e] Boston College, Department of Economics, 140 Commonwealth Avenue, Chestnut Hill, MA 02467-3806, USA
[f] NBER, USA

ARTICLE INFO

Article history:
Received 22 July 2014
Accepted 6 August 2015

JEL classification:
E32
L11
B22

Keywords:
Marginalist controversy
Full cost pricing
Amplification mechanisms

ABSTRACT

We present new survey evidence on pricing behavior for more than 14,000 European firms, and study its macroeconomic implications. Among firms that are price setters, roughly 75% respond that their prices are set as a markup on *total costs*, a business practice termed "full cost pricing". Only 25% set prices as markups over variable or marginal costs. Moreover, using industry data for the U.S., we find that the correlation between changes in output prices and changes in variable input prices is significantly lower when fixed costs are likely to be more important.

Since our results are similar to the findings in the classic and controversial paper of Hall and Hitch (1939) and subsequent survey evidence, we believe it worth studying the implications of full cost pricing for macroeconomics. We first propose a problem for the firm where full cost pricing can arise as optimizing behavior. We embed this problem, featuring an occasionally binding constraint, into a simple general equilibrium model. We show that when the model is hit by a shock that makes the constraint binding, the response of endogenous variables is amplified significantly more than it would be under the unconstrained regime.

1. Introduction

"When I teach I start from supply and demand, the theory of comparative advantage, how firms maximize profits. We really know that stuff. We are pretty sure that firms maximize profits by setting marginal revenue equal to marginal costs. I'm absolutely confident that one hundred years from now we are not going to say that we got that wrong." (N.G. Mankiw, The Challenges Facing Monetary and Fiscal Policy, Speech at Princeton University, October 20th 2011)

From the advent of modern economic theory in the second half of the 19th century, a key precept of economics has been that rational agents "think at the margin" when making economic decisions. One eminent economist has asserted that all problems in price theory can be reduced to "marginal this equals marginal that."[1] In simple models of smooth optimization, it is clear that a marginal condition is a necessary condition for maximization. Marginal thinking is, therefore, prescriptive—it tells economic agents what they should do. But do they in fact follow these precepts? It is worth at least considering the hypothesis that they might not, and looking for evidence that points one way or the other. If the evidence indicates that a substantial number of market participants do not behave in marginal terms, then it is worth taking the next step and asking how their deviation from the usual economic assumptions would change the answers to standard micro- and macro-economic questions. Finally, while it is

* Corresponding author.
E-mail addresses: carlo.altomonte@unibocconi.it (C. Altomonte), barattieri.alessandro@uqam.ca (A. Barattieri), susanto.basu@bc.edu (S. Basu).

[1] "Thinking at the margin" is described as one of the key features characterizing economic thinking by major textbooks on economic principles.

http://dx.doi.org/10.1016/j.euroecorev.2015.08.003
0014-2921/

clear in simple environments that agents can maximize payoffs only by obeying a marginal condition, there is a rich history of economic thought that rationalizes seemingly irrational behavior as optimal reactions to more complicated environments: the study of addiction, herd behavior, and tit-for-tat strategies in games, to name just three examples. Is it possible that deviations from marginal-cost pricing also fall into this category? These are the questions that we address in this paper. Since they are large questions, we restrict ourselves to examining pricing behavior, and its implications for simple macroeconomic models.

We proceed in three steps. First, we briefly review the academic debate later termed the "Marginalist Controversy." In a seminal paper, Hall and Hitch (1939) reported the results of some surveys conducted among business managers. One of their main findings was that businessmen tended to set prices according to the rule of "full cost pricing," basically applying a margin over a measure of unit total cost, including both unit variable and unit fixed costs. Hall and Hitch concluded that it was questionable that firms maximize profits. Unsurprisingly, this controversial statement prompted a large academic debate, which did not end until the early 1950s, but since then has basically disappeared from economic discussion.

Second, we present original survey evidence on pricing behavior from a representative sample of roughly 14,000 European firms. We asked these firms whether their prices are fixed by the market, set as a margin over a measure of total (including fixed) cost, or fixed as a margin over a measure of variable cost. 35% of the firms declare themselves to be price-takers. Of the 60% of firms that claim to have some power to set their own prices, roughly 75% say they set prices as a markup over a measure of *total costs* and only 25% set prices relative to a measure of *variable costs*. We investigate the determinants of "full cost pricing" and we find that geography matters the most (the fractions of firms pricing at full cost in Spain, Italy and France are statistically higher than the fractions in Germany and the UK). The firms also declare that demand responsiveness to price change is among the most important determinants of the size of the markup. We also present evidence from industry level data for the U.S. Using the CES-NBER productivity database, which contains information for 473 manufacturing industries from 1952 to 2009, we show that the correlation between the changes in output prices and the changes in variable inputs prices is significantly lower when fixed costs are likely to be more important.

Third, we investigate the implication of "full cost pricing" for macroeconomics. First, building on previous literature, we show that full cost pricing might be actually the result of a rational maximization problem, in which firms maximize profits subject to a constraint of keeping the probability of bankruptcy below a certain threshold. Second, we embed the problem with the occasionally binding constraint into a very simple general equilibrium model characterized by two regimes. As usual firms maximize profits, but now potentially subject to the constraint. When the constraint is not binding, firms set prices as markups over marginal costs (MCP). When the constraint binds, however, firms price at average cost (ACP). We solve the model with a piece-wise linear perturbation method approach proposed by Guerrieri and Iacoviello (2015). Following a positive technology shock, which does not affect the constraint, the linear solution and the piecewise linear solution coincide, and the responses of the real variables follow standard RBC dynamics. Following a negative technology shock, which makes the constraint binding, in the piecewise linear solution the dynamic responses of real variables such as output and consumption are amplified by 33% relative to the linear solution that ignores the occasionally binding constraint. We finally show how the constraint is more likely to be binding the higher the persistence and the higher the volatility of the technology shock.

The paper is linked to several strands of the literature. Lee (1984) and Mongin (1992), and a more recent monograph by Nubbemeyer (2011) provide excellent analysis of the marginal controversy as part of the history of economy thought. Of course, the paper is also related to the vast literature on evidence on pricing behavior at firm level. Nubbemeyer (2011) contains an extended set of references to studies over the last 50 years suggesting that "full cost pricing" is a widespread business practice. Two of the most recent examples of this literature are Govindarajan and Anthony (1983) and Shim and Sudit (1995). These studies, however, were based on small samples of large firms, while we present evidence for a large and representative sample of more than 14,000 firms coming from seven European countries.

This paper is also linked to the macroeconomic literature on the amplification mechanisms that are needed to explain large economic fluctuations as result of relatively small shocks. Classic contributions in this area include King et al. (1999), Rotemberg et al. (1995), and many others. To the best of our knowledge, however, we are the first to propose average cost pricing as a new, plausible and powerful amplification mechanism in macroeconomics.

Finally, this paper is connected to a recent contribution by Ito (2014). Using price variation at spatial discontinuities in electricity service areas, Ito (2014) shows evidence indicating that consumers respond to average prices, rather than marginal prices, when pricing is non-linear.

The paper is organized as follows. Section 2 briefly reviews the "Marginalist Controversy". Section 3 reports our empirical results from the survey on European firms and the NBER manufacturing database. Section 4 introduces a way to rationalize the emergence of full cost pricing as an optimizing strategy. Section 5 explores the macroeconomic implications of full cost pricing. Section 6 concludes, and suggests directions for future research.

2. The marginalist controversy

An exhaustive review of the marginalist controversy is well beyond the scope of the present paper. What follows is a brief summary of the main events, findings and arguments that characterized this interesting academic debate, which developed in the 1940s and early 1950s, mostly in the U.S. and in the UK.[2]

[2] For more complete summaries and interpretation of the marginalist controversy see Lee (1984), Mongin (1992), and Nubbemeyer (2011).

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

In 1936 a group of economists at the University of Oxford founded a research group that in later times became known as the "Oxford Economics Research Group" (OERG). The research that the group pursued consisted mainly of designing questionnaires that were sent in advance to businessmen, who were then invited to Oxford to discuss with the group their way of doing business and answer questions posed by the economists.

In 1939, one of the first publications containing the results of these discussion was the paper "Price Theory and Consumer Behavior", by Hall and Hitch, published in the *Oxford Economics Papers* (Hall and Hitch, 1939). Based on the interviews with 38 businessmen, one of the most striking result contained in the paper was that businessmen did not appear to follow the "marginalist principles" deriving from profit maximization in fixing their prices, but instead applied a "rule of thumb," choosing a price obtained by applying a markup to full average cost. Hall and Hitch concluded that this evidence called into question the assumption of profit maximization as a principle of *positive* economics.

After the second world war, R.A. Lester, a professor at Princeton, published a paper in the *American Economic Review* titled "Shortcomings of Marginal Analysis for Wage–Employment Problems". This time the "marginalist principles" were challenged on the labor market side. Lester (1946) reported evidence coming from 58 interviews with Southern entrepreneurs regarding (among other things) the factors that mostly determined their employment decisions. While present and prospective sales did appear to play a key role, variation in the level of wage or profit was not reported as important in the employment decisions of the entrepreneurs interviewed.

A few months after the publication of Lester's article, a harsh critique to his findings came from Machlup (1939), who attacked the studies of Hall and Hitch (1939) and Lester (1946) on multiple grounds. First, Machlup criticized the method, by pointing to the possible confusion coming from the use of different "languages" between economists and businessmen, the inadequacy of empirical research conducted through questionnaires, and so on. Second, Machlup underlined that the papers questioning "marginalism" did not really shed light on the core of the theory, which he argued had to do with *changes* rather than levels (which can be determined by historical antecedents). In this way Machlup questioned the relevance of the findings by Hall and Hitch (1939) and Lester (1946). Finally, using the example of a car driver who needs to overtake a truck and routinely performs the complex physics problem required in his head, he pointed out humans often are not able to report all the complexity of the thought process that actually takes place within their minds.

The following year, the *American Economic Review* hosted comments by Lester (1947), Machlup (1939) and Stigler (1947),[3] where the three keep disagreeing deeply on the relevance of the findings of Lester (1946) and Hall and Hitch (1939). The debate became more intense, as more people added contributions to the controversy.[4]

According to Lee (1984), the end of the marginalist controversy in the U.S. can be dated around June 1952, when Richard Heflebower presented a paper at an NBER conference titled "Conference on Business Concentration and Price Policy" where he successfully convinced the economics profession that "full cost pricing" could indeed be reconciled with marginalist principles, due to a sufficient dependency of the markup on the elasticity of demand.[5] This is important, because in the perception of the profession the hypothesis of full-cost pricing was not rejected altogether, but simply absorbed as "marginalism told in a different language".

It may be important to note that in the same year Friedman (1953) wrote his influential essay on "The Methodology of Positive Economics" (which was published the following year). This essay may have played an important role in ending the marginalist controversy, by indicating that one should not question a theory on the basis of the lack of realism of its assumptions.

Interestingly, Govindarajan and Anthony (1983) published a paper in which they surveyed 500 companies from the Fortune 1000 list asking about their pricing behavior.[6] Their findings were broadly similar to those of Hall and Hitch (1939), with a majority of firms declaring they followed a "full cost" pricing policy. This paper, however, failed to generate any discussion.[7]

3. "Full cost pricing": some evidence

In this section we provide evidence on the relevance of average-cost pricing. We first provide some survey results, and then move on to regression results using industry-level data.

3.1. Results from a survey of European firms

We first report the results obtained from a survey of more than 14,000 European firms, a representative sample of the population of firms in the countries surveyed (Austria, France, Germany, Hungary, Italy, UK and Spain). The survey is part of the project *"European Firms in a Global Economy: internal policies for external competitiveness"* (EFIGE).[8]

[3] Stigler (1947) had published an economic analysis of the minimum wage legislation firmly grounded on marginalist principles. That analysis was criticized by Lester (1947).

[4] For instance Oliver (1947) and Gordon (1948).

[5] "Heflebower concluded that the mark-up was sufficiently demand-influenced so as to make it amenable to marginal analysis." (Lee, 1984, p. 1119).

[6] We report in the Appendix their questionnaire and their results.

[7] Similarly, no discussion in the economic profession was spurred by similar findings presented by Shim and Sudit (1995).

[8] The project EFIGE was supported by the Directorate General Research of the European Commission through its 7th Research Framework. See the data appendix for details. The EFIGE questionnaire and the relevant data can be accessed at http://www.bruegel.org/datasets/efigedataset/

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

While the questionnaire is very rich,[9] we are interested in two particular questions on pricing policy that were inserted into this large survey. The first question that was put to the firms was the following:

Question # 1: "How do you mainly set your prices in your domestic market? (One answer)"

1. *Prices are set as a margin over total costs*
2. *Prices are set as a margin over variable costs*
3. *Prices are fixed by the market*
4. *Prices are regulated*
5. *Other*

Table 1 reports the results obtained.[10] 35% of firms declared themselves to be price takers (option 3). However, out of the roughly 60% of firms that claimed to have some sort of pricing power, almost 75% responded that they set prices as a margin over total costs, while only 25% answered that they set prices as a margin over variable costs.[11]

Table 1
Pricing policies for the main product.

Pricing policies	Freq	Percent
Average cost pricing (ACP)	5928	41.52
Marginal cost pricing (MCP)	2144	15.02
Price takers	5270	36.91
Regulated prices	439	3.07
Other	498	3.49
Total	**14,279**	**100**

Table 2
Average cost pricing, by industry.

NACE2	ACP (%)
Tobacco products	100.0
Other transport equipment	82.9
Office machinery and computers	80.0
Food products and beverages	77.6
Wood and of products of wood and cork	77.1
Dressing of leather; manufacture of luggage, handbags, saddlery, harness	77.0
Other non-metallic mineral products	76.1
Machinery and equipment n.e.c.	75.6
Wearing apparel; dressing and dyeing of fur	75.3
Recycling	75.0
Chemicals and chemical products	74.7
Medical, precision and optical instruments, watches and clocks	74.1
Textile	73.6
Basic metals	73.4
Fabricated metal products, except machinery and equipment	73.1
Furniture; manufacturing n.e.c.	72.2
Electrical machinery and apparatus n.e.c.	71.7
Rubber and plastic products	71.5
Coke, refined petroleum products and nuclear fuel	71.4
Motor vehicles, trailers and semi-trailers	66.7
Radio, television and communication equipment and apparatus	66.3
Pulp, paper and paper products	66.3
Publishing, printing and reproduction of recorded media	64.5
Total	**73.4**

[9] The questionnaire contains both qualitative and quantitative data on firms' characteristics and activities, for a total of around 150 different variables split into six different sections: proprietary structure of the firm; structure of the workforce; investment, technological innovation and R&D; internationalization; finance; market and pricing.

[10] We are aware that the simplicity of the question asked makes the results somewhat vulnerable to some of the criticisms originally leveled at Hall and Hitch (1939). However, precisely this simplicity allows us to at least partly deal with the language critique, namely that businessmen do not talk the language of economists. See the Appendix for a brief discussion of the design of the survey and of this specific question.

[11] In the Appendix, we report additional evidence provided by Govindarajan and Anthony (1983) on the prevalence of this pricing rule coming from a survey of 500 large U.S. firms. Govindarajan and Anthony were able to ask to firms a question based on a concrete example including numbers, and found that 83% of firms were following some sort of full-cost pricing, while 17% of them used variable-cost pricing.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Table 3
Average cost pricing: by country.

Country	ACP (%)
SPA	84.0
ITA	76.3
FRA	72.9
GER	68.1
HUN	67.9
AUT	66.2
UK	61.6
Total	**73.4**

Table 4
Average cost pricing, by size.

Employees	ACP (%)
10–19	72.2
20–49	74.6
50–249	72.8
≥ 250	74.3
Total	**73.4**

We call the share of "average cost pricing" the number of firms that picked answer 1 over the number of firms that picked answers 1 or 2. Table 2 illustrates how this share varies across industries. While we find a certain degree of heterogeneity across industries, there does not seem to be a clear pattern, say relating this answer to the likely importance of fixed costs in the production process of the different industries.

We find a more intriguing result when we turn to consider geographical differences in the answers (Table 3). Here we clearly notice a pattern, with countries like Spain and Italy reporting a much higher proportion of average-cost pricing then countries like the UK or Austria. Finally, we investigated whether firm size is correlated with the probability of using average-cost pricing, and we find that it is not (Table 4).

We conclude that this large survey of European firms provides *prima facie* evidence of a widespread pricing policy that resembles the one found by Hall and Hitch (1939) in their much smaller survey of UK respondents. Moreover, we find that the only attribute that seems to have a first-order impact on the share of respondents declaring that they price based on average costs is the country of origin. In Section 4 we argue that our rationalization of average-cost pricing can potentially explain this pattern.

In order to investigate the hypothesis advanced by the marginalists during the controversy, we then asked a second question to the firms who picked either answers 1 or 2 in question #1:

Question # 2: Among the following which is the most important factor in determining the size of the margin over your costs? (only one answer)

1. *Responsiveness of demand for the product to variation in prices*
2. *Average margin in the industry*
3. *Macroeconomic factors (GDP, exchange rate, inflation, etc.)*

While Question #1 had been asked before in other surveys, to the best of our knowledge this is the first time that a survey includes a question on the main determinants of the markup to be applied to a measure of cost to get the selling price. Table 5 reports the answers that we received. 55% of the total sample declares that the most important factor in shaping their margin is the responsiveness of demand to variation in prices. The percentage is slightly higher when considering the subsample of firms who claim to price products using markups over total costs. On the other hand, only 13% of firms declare that macroeconomic factors play the most important role.

Thus a mixed outcome emerges from the survey. On one hand, we do find some evidence of a pricing policy close to the "full cost price" discussed in the 1940s. Taken at face value, this might question the standard assumption that firms act to maximize profits. On the other hand, the size of the margin seems for many firms to depend on the elasticity of demand. This fact can be considered evidence that firms indeed try to maximize their profits. In Section 4 we propose a theoretical reconciliation of these apparently inconsistent results.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Table 5
Determinants of margin over costs.

Sample	All	All	ACP	ACP	MCP	MCP
Responsiveness of demand	4482	55.91	3319	56.94	1,130	53.58
Average margin in the industry	2512	31.34	1793	30.76	690	32.72
Macroeconomic Factors	1022	12.75	717	12.3	289	13.7
Total	8016	100	5829	100	2109	100

3.2. Results from U.S. industry data

One of the criticisms of Hall and Hitch (1939) and Lester (1946) was the objection that business people might say they were doing one thing but actually do something else. While unfortunately we do not have access to firm-level pricing data from the sample of firms in the survey, we can try to adduce some evidence on the importance of average-cost pricing using industry-level data.

If firms price using average rather than marginal costs, then we should observe a weaker relation between movements in output prices and movements in variable input prices when fixed costs are likely to be more important. We present here some evidence using data from the CES-NBER productivity database consistent with this claim.

The CES-NBER productivity database provides detailed information for 473 industries from 1952 to 2009. The database includes information on employment, sales, total payrolls, salaries of production and non-production workers, cost of material, cost of energy, capital expenditure, as well as some information about deflators (for shipments, energy, investments and material).

We build a proxy for the variation of the variable costs as a weighted average of the change in the price for production workers (their wages), the material costs and the cost of fuel and energy

$$\Delta \hat{MC}_{it} = \omega_{it}^{L} \Delta W_{it}^{Prodw} + \omega_{it}^{M} \Delta P_{it}^{Mat} + \omega_{it}^{E} \Delta P_{it}^{Ener} \tag{1}$$

The weights, ω_{it}^{j}, are the share of the production worker wage bill, the material costs and the cost of energy in the total of the three. We use time-varying weights. We then check whether the correlation between movements in output prices and movement in input prices is affected by the relevance of fixed costs. We use the following specification:

$$\Delta P_{y,it} = \alpha_0 + \alpha_1 \Delta \hat{MC}_{it} + \alpha_2 \Delta \hat{MC}_{it} * \frac{\hat{F_k}}{Y}_{it} + \alpha_3 \frac{\hat{F_k}}{Y}_{it} + \alpha_4 Z_{it} + \delta_i + \phi_t + \nu_{it} \tag{2}$$

where δ_i are industry fixed effects, aimed at capturing industry-specific pricing characteristics, such as the elasticity of demand or other industry-specific differences in firm pricing behavior (for example, whether firms compete in quantities or prices). ϕ_t are time fixed effects, aimed at capturing common cyclical shocks to prices. Z_{it} are time-varying industry controls (we will use the size measured in terms of employment and total factor productivity growth).

Clearly, we face the major challenge of providing proxies for the fixed costs $\left(\frac{\hat{F_k}}{Y}_{it}\right)$. We use two possible proxies ($k \in [1,2]$). As for the non-capital fixed costs, following Domowitz et al. (1988), we use the wage bill of non-production workers (in both our proxies). As for the capital fixed costs, in the absence of a clear guidance from the literature, we experiment with two different proxies. In our first proxy we use the investment expenditure.[12] Formally

$$\frac{\hat{F_1}}{Y}_{it} = \frac{\left(W_{it}^{Tot} - W_{it}^{Prodw}\right) + INV_{it}}{Y_{it}} \tag{3}$$

In our second proxy, we use instead a fraction of the real capital stock[13]:

$$\frac{\hat{F_2}}{Y}_{it} = \frac{\left(W_{it}^{Tot} - W_{it}^{Prodw}\right) + 0.1K_{it}}{Y_{it}} \tag{4}$$

We expect the coefficient attached to our proxy for change in marginal costs, α_1, to be positive. Moreover, we expect the interaction term between the proxy for the change in marginal costs and the ratio of fixed costs over sales, α_2, to be negative, thus indicating that a higher ratio of fixed costs to sales reduces the effect of a change in marginal cost on the output price.

Table 6 reports some basic descriptive statistics for the variables used. The mean sales value is around 5 billion dollars for the average industry. A notable feature is the importance of intermediate inputs as a fraction of total variable input: the

[12] While the capital stock and investment must scale with firm size to some extent, companies can vary their flows of production quite significantly with the same fixed capital stock, as documented for example by Bresnahan and Ramey (1994). Our intuition suggests that the stock of plant and equipment imposes a maximum capacity on production, but the usual level of production is below this capacity. Thus, for local fluctuations around the usual production level, capital might be better treated as a fixed rather than variable input.

[13] Implicitly assuming a depreciation rate of 10% per year.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Table 6
CES-NBER productivity database: descriptive statistics.

Variable	Units	Mean	St. deviation	Obs
Employment	Thousands	34.81	45.05	24,167
Y	USD millions	4799.50	13,196.31	24,167
W^{Tot}	USD millions	735.90	1252.87	24,167
W^{Prodw}	USD millions	443.80	736.83	24,167
Mat	USD millions	2620.97	9721.22	24,167
Energy	USD millions	97.69	360.53	24,167
$\Delta P_{y,it}$	% Change	0.031	0.067	23,694
ΔP_{it}^{Ener}	% Change	0.041	0.084	23,694
ΔP_{it}^{Mat}	% Change	0.032	0.063	23,694
ΔW_{it}^{Prodw}	% Change	0.039	0.119	23,694
ω_{it}^{E}	Share	0.031	0.037	24,167
ω_{it}^{L}	Share	0.208	0.101	24,167
ω_{it}^{M}	Share	0.762	0.105	24,167
$\frac{\hat{F}_1}{Y}_{it}$	Share	0.11	0.05	24,167
$\frac{\hat{F}_2}{Y}_{it}$	Share	0.16	0.09	24,167

average share ω_{it}^{M} is above 0.7. The average for the ratio of fixed costs over sales is 0.1 for our first proxy, and 0.16 for our second proxy.

Table 7 reports the result we obtained from the regression analysis, where we use robust standard errors, clustered at the industry level. The correlation between the changes in our estimates of marginal costs and the changes in output price is as expected positive and statistically significant (0.587). Once we introduce the interaction terms with our proxies for the importance of fixed costs, their coefficients are negative and strongly statistically significant. These results are verified using both of our proxies for the importance of fixed costs in each industry (columns 2 and 3) and are robust to the inclusion of a control for size, measured as the log of the number of employees, and for total factor productivity growth (columns 4 and 5). Not surprisingly, the coefficients on the growth of total factor productivity are negative and highly statistically significant. In the last column, we separate the non-capital fixed costs from the capital fixed costs to investigate which accounts for the attenuation of the effect of changes in marginal cost on output price. We find that only the non-production worker costs have a significant impact on the relation between changes in input and output prices.

An alternative way to visualize the results presented in Table 7 is represented in Fig. 1, where we plot the average correlation between the changes in output prices and the change in our estimate of marginal costs against the average of our first proxy for the importance of fixed costs over the period 1952–2009. As the figure shows, there is a clear negative relationship between the two variables.

While we certainly do not claim that the results presented in this section are conclusive evidence for the importance of average cost pricing, we think that these results are consistent with models where fixed costs play some role in the pricing decisions of the firms.[14]

4. Rationalizing "full cost pricing"

In this section, building on previous literature, we propose a problem for the firm where full-cost pricing can arise as optimizing behavior.

Let us consider a standard monopolistically competitive model with CES preferences over a continuum of varieties. We introduce an element of uncertainty by adding an idiosyncratic demand shock. Firms set their prices before observing the realization of the shock and they are risk neutral; thus, they simply maximize expected profits. The representative firm's problem is to

$$\text{Max } E_t(\pi_t) = E_t\left[p_t(\omega)y_t(\omega) - w_t l_t(\omega)\right]$$

$$\text{s.t. } y_t(\omega) = \epsilon_t(\omega)\left(\frac{p_t(\omega)}{P_t}\right)^{-\theta} Y_t \quad \text{and} \quad y_t(\omega) = A_t(l_t(\omega)) - F$$

where $\epsilon_t(\omega)$ is a normally distributed i.i.d. random variable with mean one and variance σ_ϵ^2.[15] The maximization of profits is subject to a technological constraint (the production function) and the demand function for the single variety (ω).

[14] Naturally, we cannot say that models where fixed costs play a role in pricing decisions are the only models consistent with the empirical results we obtain in Table 7.

[15] This can be interpreted as a demand shifter coming from the utility function of the consumers, which we are not modeling here.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Table 7
Price equations.

Dep. variable: ΔP_{it}	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\hat{MC}_{it}$	0.587***	0.867***	0.790***	0.892***	0.834***	0.836***
	(0.059)	(0.086)	(0.087)	(0.069)	(0.068)	(0.065)
$\Delta\hat{MC}_{it}*\frac{\hat{F}_1}{Y_{it}}$		−3.251***		−2.412***		
		(0.464)		(0.367)		
$\frac{\hat{F}_1}{Y_{it}}$		0.008		−0.170***		
		(0.028)		(0.031)		
$\Delta\hat{MC}_{it}*\frac{\hat{F}_2}{Y_{it}}$			−1.494***		−1.112***	
			(0.305)		(0.235)	
$\frac{\hat{F}_2}{Y_{it}}$			0.008		−0.046***	
			(0.015)		(0.013)	
$\Delta\hat{MC}_{it}*\frac{INV_{it}}{Y_{it}}$						−0.034
						(0.717)
$\frac{INV_{it}}{Y_{it}}$						−0.329***
						(0.048)
$\Delta\hat{MC}_{it}*\frac{W_{it}^{Tot}-W_{it}^{Prod}}{Y_{it}}$						−3.290***
						(0.467)
$\frac{W_{it}^{Tot}-W_{it}^{Prod}}{Y_{it}}$						−0.068*
						(0.040)
$\Delta\hat{MC}_{it}*\frac{0.1*K_{it}}{Y_{it}}$						0.290
						(0.280)
$\frac{0.1*K_{it}}{Y_{it}}$						−0.045***
						(0.014)
Tfp growth				−0.455***	-0.455***	−0.447***
				(0.023)	(0.023)	(0.023)
Size				−0.003***	−0.003***	−0.003***
				(0.001)	(0.001)	(0.001)
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.458	0.488	0.472	0.668	0.655	0.674
N	23,694	23,685	23,686	23,685	23,686	23,682

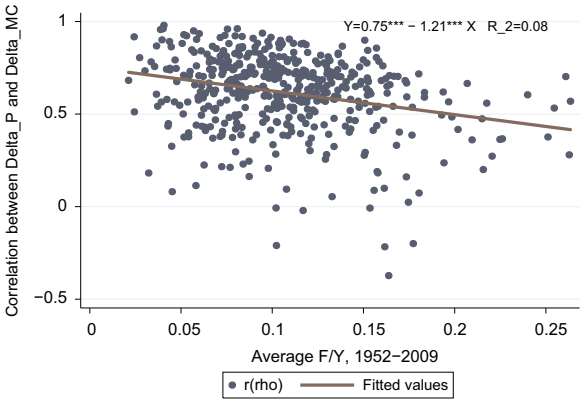

Fig. 1. Average $\frac{F_1}{Y}$ and correlation between ΔP and ΔMC.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

This problem, is well known, implies a standard marginal cost pricing solution[16]

$$p_t(\omega) = \frac{\theta}{\theta - 1}\frac{w_t}{A_t} \tag{5}$$

Day et al. (1971) suggest that the firms operating under uncertainty might in fact be subject also to another constraint. Elaborating on a criterion originally proposed by Shackle (1949) and Telser (1955), Day et al. explore the possibility that firms might be in fact willing to maximize profits, but under a maximum acceptable probability of making losses. According to what they call a *"strictly safety first principle"*, entrepreneurs first see that the acceptable safety margin is obtained and then proceed to maximize profits.

Day et al. (1971) show how this problem can be expressed by adding another constraint on firms *expected average profits* being larger than a certain parameter ν, which depends on the perceived uncertainty of the economic environment (the variance of the shock, in our case) and the maximum acceptable probability of making losses. The modified profit maximization problem hence becomes

$$\begin{aligned} &\text{Max } E_t\left[p_t(\omega)y_t(\omega) - w_t l_t(\omega)\right] \\ &\text{s.t. } y_t(\omega) = \epsilon_t(\omega)\left(\frac{p_t(\omega)}{P_t}\right)^{-\theta} Y_t, \quad y_t(\omega) = A_t(l_t(\omega)) - F \\ &\text{and} \quad E_t\left\{p_t(\omega) - \frac{w_t l_t(\omega)}{y_t(\omega)}\right\} \geq \nu \end{aligned}$$

There are several reasons why limiting the probability of making losses might be a plausible constraint on firm pricing and production decisions. First, firms might face difficulty in finding sources of external finance if they are unable to meet costs out of current revenues.[17] Second, bankruptcy costs might be substantial.[18]

The Lagrangian for the problem just proposed is

$$L = E_t\left\{p_t(\omega)y_t(\omega) - \frac{w_t}{A_t}y_t(\omega) - \frac{w_t}{A_t}F - \mu_t\left[\frac{p_t(\omega)y_t(\omega) - \frac{w_t}{A_t}y_t(\omega) - \frac{w_t}{A_t}F}{y_t(\omega)} - \nu\right]\right\} \tag{6}$$

where μ_t is the multiplier attached to the constraint on average profits. The F.O.C. for this problem are

$$E_t\left\{y_t(\omega) + p_t(\omega)\frac{\partial y_t(\omega)}{\partial p_t(\omega)} - \frac{w_t}{A_t}\frac{\partial y_t(\omega)}{\partial p_t(\omega)} - \mu_t\left[1 + \frac{\frac{\partial y_t(\omega)}{\partial p_t(\omega)}\frac{w_t}{A_t}F}{y_t(\omega)^2}\right]\right\} = 0 \tag{7}$$

$$\mu_t \geq 0 \tag{8}$$

$$\mu_t E_t\left\{\left[\frac{p_t(\omega)y_t(\omega) - \frac{w_t}{A_t}y_t(\omega) - \frac{w_t}{A_t}F}{y_t(\omega)} - \nu\right]\right\} = 0 \tag{9}$$

Manipulating (7) we can get the following expression for the optimal price:

$$p_t(\omega) = \frac{\theta}{E_t\{[(\theta - 1)y_t(\omega) + \mu_t]\}}E_t\left\{\left[y_t(\omega)\frac{w_t}{A_t} + \mu_t\frac{\frac{w_t}{A_t}F}{y_t(\omega)}\right]\right\} \tag{10}$$

From Eq. (10) is clear that if the constraint is not binding, then $\mu_t = 0$ and the optimal price is the standard one. On the other hand, if the constraint is binding, then we have

$$p_t(\omega) = E_t\left(\frac{w_t l_t(\omega)}{y_t(\omega)}\right) + \nu \tag{11}$$

Eq. (11) represents a pricing rule very close to "full cost pricing," where the markup applied to the average cost is additive rather than multiplicative.

[16] The fact that uncertainty of demand does not affect the optimal price in this example depends crucially on our assumption of constant marginal costs. See Kimball (1989) for a more general treatment where uncertainty of demand does affect optimal pricing.

[17] In a recent survey run by Eurostat on the limit to business growth for the period 2011–2013, Spain and Italy are the European countries where the largest shares of firms were found citing "lack of access to finance" as a source of worry. Interestingly, these are the two countries where our survey found the largest share of firms declaring that they use "full cost pricing".

[18] As a purely anecdotal evidence, until recently in Italy a bankrupt entrepreneur temporarily lost his or her voting rights!

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Note that the model analyzed in this section predicts that average cost pricing should be observed more frequently either in situations where agents are more risk averse (and thus desire a lower maximum probability of default) or when volatility of demand is higher.

We present some indirect evidence on these mechanisms using our disaggregated industry data for the U.S. We compute the standard deviation of the growth rate of sales for the 473 4-digit manufacturing industries in the U.S. In Fig. 2 we show a scatter plot of the standard deviation of sales against the correlation between the growth of the price of output and the growth of our proxy for the marginal costs. The relation between the two variables is clearly negative and it is statistically significant.[19] While this evidence is indirect, it is consistent with the notion that average cost pricing is more likely to be used if demand is volatile.

A second way of exploring these channels empirically is by using the results of our survey. In Table 3 we reported a clear ranking by country in terms of the incidence of ACP. We explore now how this can be linked to agents' attitude towards failure. We downloaded an index of "Fear of Failure" from the Global Entrepreneurship Monitor.[20] The Index represents the share of population between 18 and 64 perceiving good opportunities to start a business but indicating that the fear of failure prevents them from doing so. In Fig. 3 we report a scatter plot of an average value of the "Fear of Failure" index for the period 2004–2014 against the percentage of firms in our survey that price at average cost. The relationship is positive and statistically significant: in countries with low scores of the index (Austria, UK, Hungary) the incidence of ACP is more limited than in countries where the "fear of failure" appears to be high (Italy, France, Spain). While this evidence is also indirect, it is nevertheless consistent with the mechanism presented in this section (and with intuition).

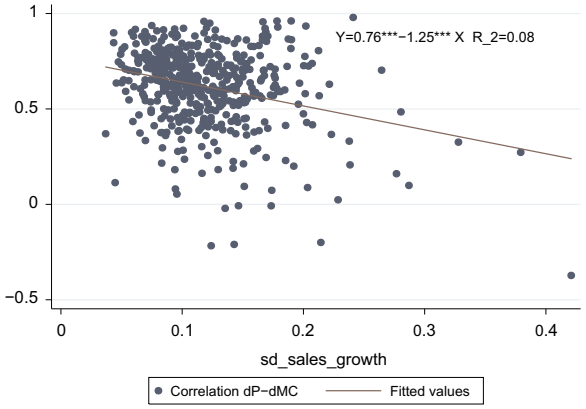

Fig. 2. Volatility of sales and the correlation between ΔP and ΔMC.

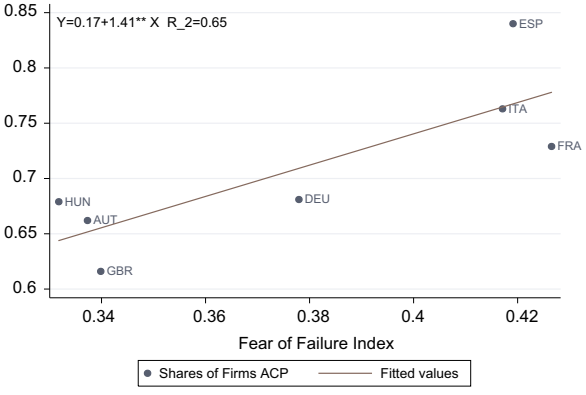

Fig. 3. Fear of failure and ACP.

[19] We checked that the relationship remains statistically significant after omitting the few obvious outliers.
[20] The world's largest survey on entrepreneurship.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

5. The macroeconomic effects of "full cost pricing"

In order to explore the aggregate implications of full cost pricing, we embed the insights from the previous section into a stylized macroeconomic model. The economy is closed, and is inhabited by a representative household that maximizes the present value of utility subject to an intertemporal budget constraint

$$\text{Max} \sum_{t=0}^{\infty} \beta^t (\ln C_t - \kappa L_t)$$
$$\text{s.t. } P_t C_t + B_t = (1+r_t)B_{t-1} + w_t L_t + \Pi \tag{12}$$

β is the discount factor, C_t is a C.E.S. aggregate of individual product varieties with elasticity of substitution θ. P_t is the associated C.E.S. price index. L_t is the number of hours worked and w_t the wage rate. B_t is a riskless bond whose return is r_t.

From the maximization problem of the household, we can derive an inter-temporal Euler equation for consumption and an intratemporal leisure-labor choice condition

$$\frac{1}{P_t C_t} = \beta(1+r_{t+1})\frac{1}{P_{t+1}C_{t+1}} \tag{13}$$

$$\frac{w_t}{P_t} = \kappa C_t \tag{14}$$

Production of any positive quantity requires firms to pay a per-period fixed cost, so the technology available to the firm is

$$Y_t = A_t L_t - F \tag{15}$$

where A_t represents productivity, which evolves according to the following process:

$$A_t = \eta_a A_{t-1} + (1-\eta_a)\overline{A} + \epsilon_t^a \tag{16}$$

with ϵ_t^a drawn from a normal distribution with mean zero and variance σ_a^2. Labor is the only input to production, and we abstract from capital accumulation.

Firms maximize profits and are monopolistic competitors, using markup pricing to cover their fixed costs of operation. Firms are also subject to a non-negativity constraint on profit, implying that the price must be larger than the average cost of production, which we will call P_t^*

$$P_t \geq P_t^* = \frac{w_t L_t}{Y_t} \tag{17}$$

This is a simplified version of the problem presented in the previous section.[21] As before, the optimal pricing rule now depends on whether the constraint (17) binds

$$P_t = \frac{\theta}{[(\theta-1)Y_t + \mu_t]}\left[Y_t \frac{w_t}{A_t} + \mu_t \frac{\frac{w_t}{A_t}F}{Y_t}\right] \tag{18}$$

If the constraint does not bind, μ_t is zero, and (18) reduces to the standard formula for marginal cost pricing with a constant markup (MCP). If the constraint binds, then price equals average cost, and (18) implicitly defines the value of μ_t.

In order to close the model, market clearing for goods and bonds requires

$$Y_t = C_t \tag{19}$$

$$B_t = 0. \tag{20}$$

We set the nominal wage to be the numeraire (hence $w_t = 1$).

Our model thus switches between two regimes. If the constraint is not binding, so $P_t \geq P_t^*$, then firms price at marginal costs (MCP). When the constraint becomes binding, firms switch to the alternative regime, where they price at average costs (ACP) until the constraint is again relaxed. This type of model can be solved with the piecewise linear perturbation method proposed by Guerrieri and Iacoviello (2015), which is coded in the Matlab package OccBin. Guerrieri and Iacoviello (2015) show that for this class of problems their method delivers solutions that are virtually indistinguishable from the solutions obtained using more general global methods.

5.1. Dynamic effects of a productivity shocks

We use fairly standard parameter values to illustrate some of the quantitative properties of the model. The parameter values are listed in Table 8.

[21] The non-negativity constraint on profits can be seen as an extreme form of the *strictly safety first principle* discussed in the previous section.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Table 8
Baseline calibration.

Parameter	Meaning	Value
β	Discount factor	0.99
κ	Disutility from labor effort	1
θ	Elasticity of substitution	3.7
μ	Mark-up	1
F	Fixed costs	0.27
$\overline{A}$	Steady state productivity	1
η_a	Persistence productivity shock	0.979

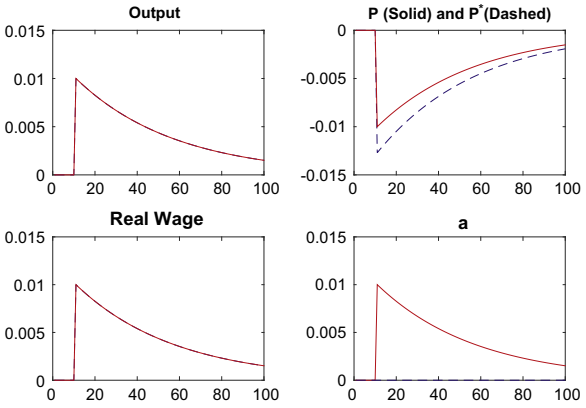

Fig. 4. Impulse response to a positive technology shock.

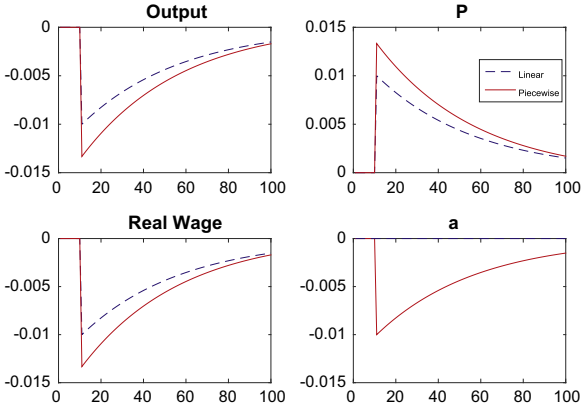

Fig. 5. Impulse response to a negative technology shock.

We set $\beta = 0.99$ and $\kappa = 1$. The quarterly persistence of the productivity shock is set to 0.979, following King et al. (1999). We fix θ to 3.7, in order to get a markup of 1.37, as found for the European Economies by Christopoulou and Vermeulen (2008, Table 1). This leaves us with a numerical value for $F = 0.27$, in order to equate to zero the steady state level of profits.

Fig. 4 reports the responses of the system to a 1% positive shock to productivity. In this case, the constraint (17) is never binding, as shown by the fact that the decrease in P_t is lower than that of P_t^*. The solution that ignores the occasionally binding constraint and the piecewise linear solution coincide, and the endogenous variables follow standard dynamics in response to a productivity improvement.

Fig. 5 reports the responses of the system to a negative productivity shock. Here, the constraint becomes binding, and the piecewise linear solution shows a much higher amplification of the shock (around 33% larger) than the solution that ignores the occasionally binding constraint.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

In order to understand the mechanisms at work, it is instructive to inspect some of the log-linearized equations of the model. Under the unconstrained regime (MCP), the log-linear version of the pricing rule is simply

$$\hat{p}_t = \hat{w}_t - \hat{a}_t \tag{21}$$

whereas under the alternative regime, we get

$$\hat{p}_t = \hat{w}_t + \hat{l}_t - \hat{y}_t \tag{22}$$

The log-linearized production function is

$$\hat{y}_t = \frac{Y+F}{Y}\hat{a}_t + \frac{Y+F}{Y}\hat{l}_t \tag{23}$$

Substituting (23) into (22), we get

$$\hat{p}_t = \hat{w}_t - \left(1+\frac{F}{Y}\right)\hat{a}_t - \frac{F}{Y}\hat{l}_t. \tag{24}$$

Comparing Eqs. (21) and (24) helps one to understand the amplification obtained in the impulse responses. In this simple model, under both regimes, the wage is constant. Hence, a decrease in $\hat{a}_t$ generates an increase in the price level. Moreover, from (14), consumption and output fall one-for-one with the rise in prices under the MCP regime.

Under ACP, instead, on impact a productivity decline increases prices by more than under MCP $\left(1+\frac{F}{Y}>1\right)$ and so consumption and output decrease by more. The discussion makes clear that the extent of the amplification obtained under ACP depends positively on the size of F.[22] This is unsurprising, since ACP and MCP coincide if $F=0$.

As a final exercise, in Table 9 we investigate how frequently the constraint (17) binds by simulating the unconstrained model for 1000 periods, and repeating the exercise for different levels of the volatility of the technology shock (σ_a) and its persistence (η_a). Consistent with intuition, for a given persistence of the shock, the constraint is more likely to bind as the volatility increases. For a given volatility, the constraint is more likely to be binding as the persistence increases.

While this model is too simple to draw definitive conclusions about the quantitative importance of average cost pricing, we claim that average cost pricing is a new, plausible and potentially powerful mechanism that amplifies negative shocks and generates asymmetric responses to symmetric disturbances.

Table 9
Frequency of binding constraints as function of the persistence and volatility of the productivity shock.

σ_a / η_a	**0.95**	**0.979**	**0.99**
0.01	0.587	0.677	0.735
0.03	0.598	0.681	0.742
0.05	0.607	0.717	0.788

6. Conclusions

In this paper we reviewed a once-vibrant academic debate on the nature of the objectives of the firms, the "Marginalist Controversy". We present new survey evidence on pricing behavior for more than 14,000 European firms, showing the prevalence of a business practice called "full cost pricing", and we study its macroeconomic implications.

We propose a problem for the firm where full cost pricing can arise as optimizing behavior. We then embed this problem into a simple general equilibrium model, with the novel feature being an occasionally binding constraint that does not permit firms to make negative profits. We find that full cost pricing raises the amplification and propagation of shocks, even in models without nominal rigidities.

Our results, both empirical and theoretical, suggest that further research in this area is warranted.

A first promising venue for future research would be to explore the empirical evidence on average cost pricing using firm-level price information.

A second important venue for future research would be to explore the implications of full cost pricing for more sophisticated macroeconomic models. An immediate direction that comes to mind is the extension of the simple model presented to include sticky prices, in order to explore the implications of full cost pricing for monetary policy.

Finally, the problem of the firm presented in Section 4 has similarities with what Manzini and Mariotti (2007) define as "Sequentially Rationalizable Choice." A greater exploration of the similarities between the problem we propose and this concept might also be useful.

We plan to explore these issues further in future research. We hope that our work inspires others to do so as well.

[22] And specifically on the ratio $\frac{F}{Y}$.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Acknowledgments

We would like to thank Paul Beaudry, Kenneth Carlaw, Richard Lipsey, Julien Martin, Charles Seguin, Pierre Yves Yanni, and seminar participants at ESG UQAM, the CEA Annual Meeting, the Mid-West Macro Meeting, the World Bank and Collegio Carlo Alberto for useful comments and suggestions. A special thanks to Robert Solow for encouraging us to pursue this project, and to Matteo Iacoviello for assisting us with the implementation of OccBin. The usual disclaimers apply.

Appendix A. Appendix

A.1. Survey EFIGE

The survey has been designed in order to obtain representative samples of manufacturing firms across European countries. In particular the dataset includes around 3000 firms for Germany, France, Italy and Spain, more than 2200 firms for the UK, and some 500 firms for Austria and Hungary. Firms with less than 10 employees have been excluded from the survey.

Table 10
Sample by industry.

NACE	Description	Freq	Percent
15	Food products and beverages	1497	10.36
16	Tobacco products	7	0.05
17	Textile	504	3.49
18	Wearing apparel; dressing and dyeing of fur	295	2.04
19	Dressing of leather; manufacture of luggage, handbags, saddlery, harness	221	1.53
20	Wood and of products of wood and cork	623	4.31
21	Pulp, paper and paper products	316	2.19
22	Publishing, printing and reproduction of recorded media	837	5.8
23	Coke, refined petroleum products and nuclear fuel	21	0.15
24	Chemicals and chemical products	555	3.84
25	Rubber and plastic products	919	6.36
26	Other non-metallic mineral products	681	4.72
27	Basic metals	344	2.38
28	Fabricated metal products, except machinery and equipment	3012	20.85
29	Machinery and equipment n.e.c.	1762	12.2
30	Office machinery and computers	67	0.46
31	Electrical machinery and apparatus n.e.c.	569	3.94
32	Radio, television and communication equipment and apparatus	339	2.35
33	Medical, precision and optical instruments, watches and clocks	447	3.09
34	Motor vehicles, trailers and semi-trailers	275	1.9
35	Other transport equipment	137	0.95
36	Furniture; manufacturing n.e.c.	938	6.49
37	Recycling	77	0.53
	Total	**14,443**	**100**

Table 11
Sample: by country.

Country	Freq	Percent
AUT	343	2.37
FRA	2759	19.1
GER	2935	20.32
HUN	486	3.36
ITA	3021	20.92
SPA	2832	19.61
UK	2067	14.31
Total	**14,443**	**100**

Table 12
Sample by size.

Employees	Freq	Percent
10–19	4587	31.76
20–49	5968	41.32
50–249	2901	20.09
$\geq$ 250	987	6.83
Total	**14,443**	**100**

Table 10 reports the breakdown of the number of firms by industry. Fabricated Metal Product (20%), Machinery and Equipment (12%), and Food (10%) are the most represented industries in the sample. Table 11 offers a breakdown of the sample by country, where it is evident how the larger country are equally represented, while only few hundreds firms are available for Austria and Hungary. Table 12 reports the descriptive statistics by size, where it is possible to appreciate how our sample includes both small and large firms, with the exclusion of firms with less than 10 employees.

The variables of interest have been collected for each firm through a survey questionnaire. Questions mainly concern the year 2008, with some questions asking information for 2009 and for earlier years in order to have a picture of the effects of the crisis as well as the dynamic evolution of firms' activities.

The survey was conduced by GFK, a leading firm in the survey administration industry. The interviews were made by telephone. The questionnaire underwent a complex fine tuning process. After a first draft was submitted, GFK conducted focus groups with about 50 firms, in order to check whether the questions were properly understood, and to assess the time needed to complete the survey. The questionnaire was then modified according to the issues emerged during these focus groups. A second version of the questionnaire was administered to about 100 firms in the different countries, and subsequently further modified to get to the final version, which was used for the full representative sample of firms.

In the case of the pricing questions, the first question had to be modified after the first focus groups. In an attempt to craft a question that would address as much as possible the critiques moved to Hall and Hitch by the marginalists, the text of the original question was the following:

Question: "Suppose your variable unit costs permanently increase by 20% while your fixed costs do not change. Do you generally increase your price:

1. by 20%
2. by less than 20%, because your total unit costs increased by less than 20%, but you keep unchanged your margin over your variable unit costs
3. by less than 20%, because demand would fall too much, and you accept a reduction in your margin
4. by another amount (explain)_____

However, the focus groups made clear how the entrepreneurs had difficulties in understanding this question, and at least 3 min were needed to explain it to them. Clearly, this was too much time, given the total number of questions to be asked (more than 150), and the total budget available (both in terms of time and costs). GFK suggested to find a simpler formulation for this specific question, and we proposed the one contained in Section 3.1, which turned out to be much more easily understood by the entrepreneurs and managers that were interviewed.

A.2. Govindarajan and Anthony (1983)

We report here the question and the results obtained by Govindarajan and Anthony (1983) on a sample of roughly 500 large American firms.

Question: "Companies arrive at selling prices for their products based on several factors – costs, market conditions and the like. We are interested in the way you use cost data in arriving at the normal or target selling price for one of your typical products – a product for which you use cost data in arriving at the selling price and for which you probably publish catalog or other price lists.

To avoid confusion about the meaning of terms, we give below hypothetical numbers for the unit cost of a product, and various methods of arriving at the selling price. For the assumed set of cost data, all the pricing method give a selling price of $100. Please choose the method that comes closest to the one you usually use in arriving at the normal selling price for your typical product (check one box)":

Component	Unit cost	Pricing method	Answers
Material, labor		1. % of variable production costs	54
and other variable costs	$40	($40*250%=$100)	
Fixed prod costs	$20		
Total production costs	$60	2. % of total production costs	168
		($60*167%=$100)	
Variable selling, general			
and admin costs	$10		
Total	$70	3. % of production and other variable costs	41
		($70*143%=$100)	
Fixed selling, general and			
administrative costs	$20	4. % of total costs	208
Total costs	$90	($90*111%=$100)	
Profit	$10		
Normal selling price	$100		
		5. % of total variable costs	30
		([$40+$10]*200%=$100)	

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003

Govindarajan and Anthony (1983) stress how pricing methods 1 and 5 are akin to variable cost pricing, and they represent only 17% of the answers, while pricing methods 2, 3 and 4, closer to full-cost pricing, represent 87% of the total responses.

Appendix B. Supplementary data

Supplementary data associated with this paper can be found in the online version at http://dx.doi.org/10.1016/j.euroecorev.2015.08.003.

References

Bresnahan, T.F., Ramey, V.A., 1994. Output fluctuations at the plant level. Q. J. Econ. 109 (3), 593–624.
Christopoulou, R., Vermeulen, P., 2008. Markups in the Euro Area and the US over the Period 1981–2004: A Comparison of 50 Sectors. ECP Working Paper 856.
Day, H., Aigner, D.J., Smith, K., 1971. Safety margins and profit maximization in the theory of the firm. J. Polit. Econ. 79 (6), 1293–1301.
Domowitz, I., Hubbard, R.G., Petersen, B., 1988. Market structure and cyclical fluctuations in U.S. manufacturing. Rev. Econ. Stat. 70 (1), 55–66.
Friedman, M., 1953. The methodology of positive economics. In: Essays in Positive Economics, vol. 2. Universit of Chicago Press, Chicago, pp. 311–356.
Gordon, R.A., 1948. Short-period price determination in theory and practice. Am. Econ. Rev. 38 (June), 265–288.
Govindarajan, V., Anthony, R., 1983. How firms use cost data in price decisions. Manag. Account. (July) 30–36.
Guerrieri, L., Iacoviello, M., 2015. Occbin: a toolkit for solving dynamic models with occasionally binding constraints easily. J. Monet. Econ. 70, 22–38.
Hall, R., Hitch, C.J., 1939. Price theory and business behaviour. Oxford Econ. Pap. 2 (May), 1–11.
Ito, K., 2014. Do consumers respond to marginal or average price? Evidence from nonlinear electricity pricing. Am. Econ. Rev. 104 (2), 537–563.
Kimball, M.S., 1989. The effect of demand uncertainty on a precommitted monopoly price. Econ. Lett. 30, 1–5.
King, R.G., Rebelo, S.T., 1999. Resuscitating real business cycles. In: Taylor, J.B., Woodford, M. (Eds.), Handbook of Macroeconomics, North-Holland Elsevier, Amsterdam, New York.
Lee, F., 1984. The marginalism controversy and the demise of full cost pricing. J. Econ. Iss. 18 (December), 1107–1132.
Lester, R.A., 1946. Shortcomings of marginal analysis for wage–employment problems. Am. Econ. Rev. 36 (March), 63–82.
Lester, R.A., 1947. Marginalism, minimum wage, and labor markets. Am. Econ. Rev. 37 (March), 135–148.
Machlup, F., 1939. Evaluation of the practical significance of the theory of monopolistic competition. Am. Econ. Rev. 29 (June), 227–236.
Machlup, F., 1939. Rejoinder to an atimarginalist. Am. Econ. Rev. 37 (March), 148–154.
Manzini, P., Mariotti, M., 2007. Sequentially rationalizable choice. Am. Econ. Rev. 97 (5), 1824–1839.
Mongin, P., 1992. The full-cost controversy of the 1940s and 1950s: a methodological assessment. Hist. Polit. Econ. 24.
Nubbemeyer, E., 2011. A Reconsideration of Full-Cost Pricing. Sudwestdeutscher Verlag fur Hochschulschriften.
Oliver, H.M., 1947. Marginal theory and business behavior. Am. Econ. Rev. 37 (June), 375–383.
Rotemberg, J.J., Woodford, M., 1995. Dynamic general equilibrium in models with imperfectly competitive product markets. In: Cooley, T.F. (Ed.) Frontiers of Business Cycle Research, Princeton University Press, New Jersey.
Shackle, G.L.S., 1949. Expectation in Economics. Cambridge University Press, Cambridge.
Shim, E., Sudit, E., 1995. How manufacturers price products. Manag. Account. 76, 37–39.
Stigler, G., 1947. Professor lester and the marginalists. Am. Econ. Rev. 37 (March), 148–157.
Telser, L., 1955. Safety first and hedging. Rev. Econ. Stud. 22, 1–16.

Please cite this article as: Altomonte, C., et al., Average-cost pricing: Some evidence and implications. European Economic Review (2015), http://dx.doi.org/10.1016/j.euroecorev.2015.08.003