1. INTRODUCTION

Intense research in industrial organization has led to the design of more and more refined methods to assess price-setting behavior of firms in various environments (see Bresnahan, 1989 and Schmalensee, 1989 for surveys). However, the approach has generally remained restrictive, in the sense that it has ignored the possibility that inputs, and particularly labor, are not priced competitively. The fact that unions bargain over wages and hence over a share of the firm's non-competitive rents, necessitates the integration of labor market variables when investigating profit margins. Labor economists on the other hand have devoted effort to test for imperfect competition in the labor market. Most papers deal with the determination of wages and employment in the presence of trade unions. The broad body of papers examines the effect of industry or firm performance on wages within a collective bargaining framework[1] and strongly supports the rent-sharing hypothesis. But a similar criticism applies to these studies, i.e. they solely focus on imperfections in the labor market, assuming perfect competition in the product market.[2] Only a few studies (Bughin, 1996; Crépon et al., 2002; Neven et al., 2002; Schroeter, 1988) have considered the possibility of imperfections in both product and factor markets, thereby taking into account that wages are no longer exogenous in econometric tests of product market power. A recent theoretical contribution is Blanchard and Giavazzi (2003).

In this paper, we investigate the relationship between the degree of labor market imperfections and the price-cost margin[3] of firms in the Belgian manufacturing industry over the period 1988-1995. We analyze how the *distribution* of the surplus available for sharing between the workers and the firm as well as the *size* of that surplus are related to union bargaining power.

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[1] See e.g. Blanchflower et al. (1996), Dobbelaere (2004), Goos and Konings (2001), Hildreth and Oswald (1997) and Teulings and Hartog (1998).

[2] The necessary conditions for a union to be able to appropriate any rents in a perfectly competitive product market without driving the firm out of existence are (1) that the union acts as a monopolist in the supply of labor and (2) that there is a fixed number of firms in the perfectly competitive industry (Booth, 1995).

[3] Throughout the paper, the price-cost margin refers to the 'hypothetical' price-cost margin, i.e. the price-cost margin evaluated at perfect competition in the labor market (for technical details, see Appendix).

Methodologically, we follow Crépon et al. (2002). Their methodology is a natural extension of Hall's (1988) approach, which in turn originated from Solow's (1957) well-known article on estimating total factor productivity as a measure of technical change. Besides deviating from perfect competition in the product market, we allow for the possibility that wages are bargained off the labor demand curve, according to an Efficient Bargaining model. Relaxing the condition that labor is priced competitively has important implications for the derivation of the Solow Residual. More precisely, it can be shown that the Solow residual can be decomposed into four components: (1) a mark-up of price over marginal cost component, (2) a scale factor, (3) a factor reflecting union bargaining power and (4) the rate of technical change. This extended approach has the advantage that no measurement of the user cost of capital is needed to estimate the firms' price-cost mark-up. Neither is a measurement of the alternative wage required to estimate the bargaining power of the union. In addition to testing simultaneously for imperfections in the product and the labor market, this approach provides an alternative test, based on the labor share, of the Right-To-Manage versus the Efficient Bargaining model.

We take advantage of a rich firm-level dataset covering the entire Belgian manufacturing industry over the period 1988-1995. Our analysis allows us to make various contributions to the literature. First, whereas the analysis of Crépon et al. (2002) is limited to the manufacturing industry as a whole, our large sample enables us to examine the important issue of heterogeneity in both price-cost mark-up and union bargaining power parameters. More specifically, we (1) study the heterogeneity among sectors and (2) investigate the relationship between union bargaining power and price-cost mark-ups. To our knowledge, the interaction between product market and labor market imperfections at the sectoral level has not been investigated before. Second, in contrast to most of the literature following Hall (1988), we estimate market power using a firm-level dataset. In addition to increasing the reliability and the efficiency of the estimates and to taking into account firm-heterogeneity within sectors, the use of firm-level data allows us to construct good instruments. We apply the Arellano and Bond (1991) Generalized Method of Moments (GMM) technique. Our main findings are the following. First, our results confirm the conclusion of Crépon et al. (2002) that ignoring imperfect competition in the labor market leads to an underestimation of the price-cost margin at the manufacturing industry level. Our sectoral analysis shows that this conclusion also holds at the sectoral level. Second, focusing on the cross-section dimension enables us to reach conclusions in terms of interdependencies between the estimated price-cost margins and the estimated union bargaining power. We find that sectors with higher union bargaining power typically show higher price-cost margins. The positive correlation between the two estimated parameters can be interpreted in two ways. One interpretation is that labor market imperfections affect product market imperfections in the long run. Strong unions may reduce the share of the rents left to the firm, thereby driving firms out of the market and reducing the degree of product market competition. According to this interpretation, more powerful unions do not only increase the fraction of product rents going to labor but also the size of total rents available for sharing between the workers and the firm. Another interpretation runs from product market to labor market characteristics, capturing a standard effect in the trade union literature. According to this interpretation, unions are most likely to be created in firms where rents can be extracted. This is most likely to happen if there is imperfect competition in the product market.

In the remainder, we first briefly describe our theoretical framework (section 2). In section 3, we outline our empirical model. Section 4 presents the dataset and some summary statistics. Section 5 discusses the estimation method and confronts the theoretical hypotheses with Belgian firm-level data. Section 6 summarizes and interprets the results.

2. Theoretical Framework

Theoretically, we rely on a model developed by Crépon et al. (2002). We concentrate in this section on the main elements. Technical details can be found in Appendix.

We start from a standard production function $Q_{it} = \Theta_{it} F(N_{it}, M_{it}, K_{it})$ where i is a firm index, t a time index, N is labor, M is material input, K is capital and Θ is an index of total factor productivity. Θ is allowed to vary across firms and over time. This shift variable is modelled as the sum of a deterministic component and a random component, i.e. $\Theta_{it} = Ae^{a_i + a_t + u_{it}}$, where a_i is a firm-specific time-invariant component, a_t represents productivity shocks common to all firms in a given year and u_{it} is a random component with mean zero capturing transitory and idiosyncratic differences in productivity.

Under imperfect competition in the product market and perfect competition in the input market, the Solow Residual can be expressed as:

$$\begin{aligned}
&\Delta q_{it} - \alpha_{Nit}\Delta n_{it} - \alpha_{Mit}\Delta m_{it} - (1-\alpha_{Nit} - \alpha_{Mit})\Delta k_{it} \\
&= (\mu_{it} - 1)\left[\alpha_{Nit}\left(\Delta n_{it} - \Delta k_{it}\right) + \alpha_{Mit}\left(\Delta m_{it} - \Delta k_{it}\right)\right] + \gamma_{it}\Delta k_{it} + \Delta\theta_{it} \\
&= \beta_{it}\left(\Delta q_{it} - \Delta k_{it}\right) + \frac{\gamma_{it}}{\mu_{it}}\Delta k_{it} + (1-\beta_{it})\Delta\theta_{it}
\end{aligned} \tag{1}$$

with $q_{it}, n_{it}, m_{it}, k_{it}$ and θ_{it} the logarithms of $Q_{it}, N_{it}, M_{it}, K_{it}$ and Θ_{it}. $\alpha_{Jit} = \frac{P_{Jit}J_{it}}{P_{it}Q_{it}}$ $(J = N, M)$ is the share of inputs in total revenue. $\beta_{it} = \frac{P_{it} - C_{Q,it}}{P_{it}} = \frac{\mu_{it} - 1}{\mu_{it}}$ refers to the price-cost margin with $\mu_{it} = \frac{P_{it}}{C_{Q,it}}$ the mark-up of price over marginal cost. Finally, $(1+\gamma_{it})$ represents the local scale elasticity measure.

Eq. (1) shows that the Solow Residual can be decomposed into (1) a price-cost mark-up component, (2) a scale factor and (3) a technological term or true total factor productivity growth ($\Delta\theta_{it} = \Delta a_t + \Delta u_{it}$).

When an Efficient Bargaining Model, capturing labor market imperfections, is embedded into the model, an extra term can be added to Eq. (1):

$$\begin{aligned}
&\Delta q_{it} - \alpha_{Nit}\Delta n_{it} - \alpha_{Mit}\Delta m_{it} - (1-\alpha_{Nit} - \alpha_{Mit})\Delta k_{it} \\
&= (\mu_{it} - 1)\left[\alpha_{Nit}\left(\Delta n_{it} - \Delta k_{it}\right) + \alpha_{Mit}\left(\Delta m_{it} - \Delta k_{it}\right)\right] + \\
&\quad \gamma_{it}\Delta k_{it} + \mu_{it}\frac{\phi_{it}}{1-\phi_{it}}\left(\alpha_{Nit} - 1\right)\left(\Delta n_{it} - \Delta k_{it}\right) + \Delta\theta_{it} \\
&= \beta_{it}\left(\Delta q_{it} - \Delta k_{it}\right) + \frac{\gamma_{it}}{\mu_{it}}\Delta k_{it} + \frac{\phi_{it}}{1-\phi_{it}}\left(\alpha_{Nit} - 1\right)\left(\Delta n_{it} - \Delta k_{it}\right) + (1-\beta_{it})\Delta\theta_{it}
\end{aligned} \tag{2}$$

where $\phi_{it} \in [0,1]$ represents union bargaining power.

From Eq. (2), it follows that the Solow residual can now be decomposed into four components: (1) a mark-up of price over marginal cost component, (2) a scale factor, (3) a factor reflecting union bargaining power and (4) the rate of technical change. Note that since in the Efficient Bargaining model, marginal revenue $\left(R_Q\right)$ equals marginal cost $\left(C_Q\right)$ evaluated at the competitive levels of output and wages, the mark-up has to be interpreted as a mark-up of prices over marginal costs evaluated at the competitive wage level, i.e. $\mu = \frac{P}{C_Q(\overline{Q}, w_a)}$ with w_a the competitive wage and $\overline{Q}$ the competitive output level (see Appendix).

3. EMPIRICAL MODEL

Rewriting the Solow Residual: $\Delta q_{it} - \alpha_{Nit}\Delta n_{it} - \alpha_{Mit}\Delta m_{it} - (1 - \alpha_{Nit} - \alpha_{Mit})\Delta k_{it}$

as SR_{it} and imposing that $\beta_{it} = \beta = 1 - \frac{1}{\mu}$, $\mu_{it} = \mu$, $\gamma_{it} = \gamma$ and $\phi_{it} = \phi$, we are able to estimate four different specifications.

Model 1 : constant returns to scale and no bargaining ($\gamma = 0$, $\phi = 0$)

$$SR_{it} = \beta\left(\Delta q_{it} - \Delta k_{it}\right) + (1-\beta)\Delta\theta_{it} \tag{3}$$

Model 2 : increasing or decreasing returns to scale and no bargaining ($\phi = 0$)

$$SR_{it} = \beta\left(\Delta q_{it} - \Delta k_{it}\right) + \left(\frac{\gamma}{\mu}\right)\Delta k_{it} + (1-\beta)\Delta\theta_{it} \tag{4}$$

Model 3 : constant returns to scale and bargaining ($\gamma = 0$)

$$SR_{it} = \beta\left(\Delta q_{it} - \Delta k_{it}\right) + \frac{\phi}{1-\phi}(\alpha_{Nit} - 1)(\Delta n_{it} - \Delta k_{it}) + (1-\beta)\Delta\theta_{it} \tag{5}$$

Model 4 : increasing or decreasing returns to scale and bargaining

$$SR_{it} = \beta\left(\Delta q_{it} - \Delta k_{it}\right) + \left(\frac{\gamma}{\mu}\right)\Delta k_{it} + \frac{\phi}{1-\phi}(\alpha_{Nit} - 1)(\Delta n_{it} - \Delta k_{it}) + (1-\beta)\Delta\theta_{it} \tag{6}$$

where $\Delta\theta_{it} = \Delta a_t + \Delta u_{it}$. In the estimations, Δa_t is captured by year dummies and Δu_{it} represents the stochastic element of productivity growth.

4. DATA

We use an unbalanced panel of the entire population of Belgian firms in the manufacturing industry over the period 1988-1995. All variables are taken from annual company accounts which are collected by the National Bank of Belgium (NBB). We use real gross sales as a proxy for production (Q). Labor (N) refers to the average number of employees in each firm for each year and material input (M) refers to the quantity of materials employed. The capital stock (K) is proxied by tangible fixed assets at historic cost minus depreciation. Nominal variables are deflated by the three-digit producer price index which we have drawn from the National Statistical Office (NIS).

In the initial dataset, the number of firms is approximately 19 000 per year. For the estimates, we only include firms for which we have at least three consecutive observations for all variables, ending up with 7 086 firms. Table 1 reports the means, standard deviations and first and third quartiles of the included data for our main variables. The average growth rate of real firm output for the overall sample is 2.9% per year over the period 1988-1995 whereas the corresponding average manufacturing industry real output growth rate amounts to 4.2%. Capital has decreased at an average annual growth rate of 2.4%, materials have increased at an average annual growth rate of 3% and labor is stable over the period. The Solow residual or the conventional measure of total factor productivity has increased at an average annual growth rate of 1.2%. As expected for firm-level data, the dispersion of all these variables is considerably large. For example, TFP growth is smaller than -2.9% for the first quartile of firms and higher than 5.3% for the fourth quartile.

<Insert Table 1 about here>

5. ESTIMATION METHOD AND RESULTS

5.1. Estimation Technique

Since transitory productivity shocks (u_{it}) might affect the level of factor inputs to the extent that the shock becomes part of the firm's information set before input choices are determined, Ordinary Least Squares (OLS) estimates would be inconsistent and biased. Moreover, the production price is endogenous to our models since the product market is imperfectly competitive and the production price depends on strategic quantity choices made by firms. Hence, we treat all current dated firm-specific variables as potentially endogenous.

To take into account the endogeneity problems, we estimate the models using the Generalized Method of Moments (GMM) technique for panel data as advocated by Arellano and Bond (1991). This estimation method is a more robust and efficient extension of the first difference instrumental variable method suggested for dynamic fixed effects models by Anderson and Hsiao (1982). The reason is that it utilizes the moment conditions around the error term to provide additional instruments. Under the assumption that current random shocks are uncorrelated with past values of firm-level regressors, we use lagged values of $\Delta n, \Delta m$ and Δk from (t-2) and before as instruments.[4,5] Crépon et al. (2002) and Klette and Griliches (1996) have adopted a similar approach. The validity of the use of 2-period lagged instruments depends critically on the errors in the level equation being serially uncorrelated. Absence of second-order serial correlation in the first difference error term is hence needed. We therefore present tests of this null hypothesis using a statistic developed in Arellano and Bond (1991) which has a standard normal distribution. The exogeneity of the instruments with respect to the error term is further tested by the Sargan test statistic which is distributed as chi-squared. The GMM estimator is also robust to heteroskedasticity.[6] In addition to using IV estimation techniques, we also include time dummies to capture possible unobservable

[4] Since all variables are expressed as growth rates, permanent shocks are not considered.

[5] Assuming that the idiosyncratic component of the productivity shock (u_{it}) is white noise, taking first (logarithmic) differences introduces errors that have a moving average structure of order one. For this reason, legitimate instruments are dated (t-2) or earlier.

[6] In this paper, we report the second step (optimal) GMM estimates. Our first-step estimates affect the precision of the estimates but confirm our main conclusions about the signs and the significance of the parameters.

aggregate shocks and productivity shocks common to all firms in a given year (a_t). By taking the first (logarithmic) difference of the production function, we control for individual firm effects (a_i). As a consequence, our parameter estimates are consistent even if a_i were correlated with regressors.

Estimation is carried out using the Dynamic Panel Data program developed by Arellano and Bond (1988), which works with the GAUSS programming language.

5.2. General Results

First, we ignore potential heterogeneity in the price-cost mark-up and the bargaining power parameters among sectors and estimate equations (3)-(6) for the manufacturing industry as a whole over the period 1988-1995. The two-step estimates are reported in Table 2. The first part of Table 2 gives the estimated values of the coefficients for the regressors entering the models. Part 2 presents the structural parameters computed from the reduced form parameters and the third part provides specification tests.

The specification tests do not show evidence against our estimates. Absence of second-order serial correlation cannot be rejected, which justifies our use of twice lagged instruments. The Sargan test does not reject their joint validity. As to the estimated coefficients, our main findings can be summarized as follows. Focusing on the degree of market power, all estimated models show that the price to marginal cost ratio is significantly larger than one, hence supporting the hypothesis of imperfect competition in the output market. This result confirms the findings of Bughin (1996) and Konings et al. (2001) who provide evidence of non-competitive pricing strategies in the Belgian manufacturing industry. Our estimates of the price-cost mark-up range from 20 to 49 percent. The results of Model 1 are in line with those of Martins et al. (1996) who find that the average mark-up for Belgian manufacturing over the period 1980-1992 is about 18 percent.[7] They also accord with the estimates of Konings et al. (2001) who point to a mark-up ratio of 1.27 for large firms in the Belgian manufacturing industry over the period 1994-1996.

[7] These authors apply Roeger's (1995) method, however, which uses the 'nominal' Solow residual to estimate price-cost mark-ups.

As far as the nature of returns to scale is concerned, Model 2 and Model 4 support the hypothesis of increasing returns to scale: the coefficient on Δk is significantly larger than zero in both models (point estimates of 0.165 and 0.099 respectively). The estimated scale elasticity is 1.228 (Model 2) and 1.147 (Model 4).[8]

We now turn to discussing the potential relationship between labor market imperfections and product market imperfections, as implied by the estimates of Model 3 and Model 4. First of all, we notice that the new variable which accounts for union bargaining power, is strongly significant when entering the models. The estimates of Model 3 point to a significant union bargaining power of 0.285 on a scale going from 0 to 1. In Model 4 the estimated bargaining power parameter is 0.244. These results reject the hypothesis that workers have no influence over employment, which is consistent with the idea that wages are bargained off the conventional labor demand curve. Hence, our findings accord with stylized facts about Belgian industrial relations[9] and confirm those of Bughin (1993) who rejects the Right-To-Manage model in favor of the Efficient Bargaining model for Belgium. Our estimates are somewhat higher than the value of union power (0.1) obtained by Goos and Konings (2001) for Belgium during the period 1987-1994. However, their empirical analysis boils down to estimating a Right-To-Manage model in which the elasticity of wages with respect to profits per employee measures the bargaining strength of the workers. In contrast, our analysis rejects the fact that union power does not affect the labor share.

The price-cost mark-up parameter is significantly higher than the estimates obtained from Model 1 and Model 2. Model 3 implies a significant price to marginal cost ratio of 1.350 compared to an estimate of 1.196 when labor market imperfections are ignored. In Model 4, the price-cost ratio increases to 1.488 compared with 1.381 when ignoring union bargaining power. Our findings are hence qualitatively consistent with those of Crépon et al. (2002). Using a panel of 1 026 French manufacturing firms over the period 1986-1992, price-cost mark-ups are found to be about 40 percent

[8] Note that the finding of increasing returns to scale is not driven by the inclusion of many small firms in our sample. Restricting the analysis to firms with more than 50 employees or firms with more than 100 employees still supports the hypothesis of increasing returns to scale.

[9] Belgian collective agreements do not only deal with wages but also with employment issues like hours of work and part-time labor policies (Bughin, 1996).

and union bargaining power is estimated at about 0.60. Ignoring imperfect competition in the labor market brings the price-cost mark-up estimate down to 10 percent.

<Insert Table 2 about here>

In the specifications mentioned above, firm-level data are deflated by a common industry price index at the three-digit level of sectoral disaggregation. Output price differences between firms are hence not taken into account, they show up in the error term. This may give rise to downwardly biased and inconsistent estimates of price-cost mark-up and scale coefficients if output price differences between firms within an industry are endogenous and correlated with the explanatory variables in the model (changes in factor inputs and factor shares).[10] This problem might arise when firms compete in an environment with differentiated products. To address this issue, we have adopted the solution suggested by Klette and Griliches (1996) which amounts to adding the growth in industry output as an additional regressor. Theoretically, this solution relies on the assumption that the market power of firms originates from product differentiation. Intuitively, in the case of product differentiation, the demand for an individual firm's products is a function of its relative price within the industry. Relative price differences can then be expressed in terms of relative output growth differences in the industry. In contrast to Klette and Griliches (1996) and Crépon et al. (2002), we find that the growth of industry output is not statistically significant in the empirical specifications.[11] Moreover, its inclusion has no effect on the estimated values of the other coefficients. Our results hence suggest that the main source of the market power of Belgian manufacturing firms is not in product differentiation but rather corresponds to other forms of imperfect competition.

[10] However, we argue that this downward bias is less severe in our estimations since we use a price index defined at the three-digit level of sectoral disaggregation as deflator (instead of an industry-wide deflator). In other words, we allow for a relatively high degree of price variability within the manufacturing industry as a whole as well as within the manufacturing sectors defined at the two-digit level of sectoral disaggregation.

[11] These results are not reported but available upon request.

5.3. Sectoral Analysis

To take into account heterogeneity among sectors, we disaggregate the Belgian manufacturing industry into 20 two-digit sectors and estimate the four models for each sector. Due to data limitations and econometric problems, we had to restrict the analysis to 18 sectors. For all reported results, the test statistics cannot reject absence of second-order serial correlation in the differenced error term. Moreover, on the basis of the Sargan test we can never reject the null hypothesis that our instruments are valid. Table 3 and Table 4 report the results for Model 1 and Model 2 respectively. With the exception of the milk and dairy products sector (sector 11), the ratio of price over marginal cost is significantly larger than one at the 1% level for all sectors. The estimated mark-up ratio of Model 1 ranges from 0.992 to 1.471. This range seems plausible and is also in line with the findings of Martins et al. (1996) and Konings et al. (2001).

We can group sectors according to the magnitude of the estimated price-cost mark-ups. Relatively high mark-ups (22-47 percent) appear in sectors such as ferrous and non-ferrous ores and metals, non-metallic mineral products, agricultural and industrial machinery, office and data processing machines, precision and optical instruments, other transport equipment, beverages and rubber and plastic products. On the other hand, the estimated mark-up ratio is relatively low (0.992-1.156) in the sectors producing metal products except machinery and transport equipment, meat preparations and preserves, milk and dairy products, textiles and clothing, and other manufacturing products.

When taking into account the influence of returns to scale, the mark-up ratio ranges from 0.991 to 1.808. The scale elasticity varies from 1 to 1.734, pointing to constant and increasing returns to scale. The higher the scale elasticity, the larger the increase in and the level of the price over marginal cost ratio compared to Model 1. The ranking of sectors according to the estimated price over marginal cost ratio remains largely the same.

Although high price-cost mark-ups may be indicative of a lack of competition in the sector, they cannot be considered as persistent rents resulting from market power. In innovative sectors, for example, high mark-ups may be the result of temporary innovation rents. Sunk costs may also necessitate mark-up pricing.

<Insert Table 3 and Table 4 about here>

Focusing on the relationship between labor market imperfections and product market imperfections leads to following insights (see Table 5 and Table 6). In Model 3, the estimated mark-up ratio ranges from 1.017 to 2.088 and the bargaining power parameter varies from 0.042 to 0.394. Our estimates of union bargaining power accord with those of Vandenbussche et al. (2001), who estimate bargaining power coefficients for NACE-three digit sectors over de period 1987-1994. Model 4 points to a range of 1-2.268 for the estimated mark-up ratio and 0.051-0.400 for union bargaining power.

For each sector, we find evidence of price-cost mark-ups being underestimated when imperfection in the labor market is ignored, hence, validating the findings of Bughin (1996). The higher the bargaining power of the workers in a sector, the higher the level of and the increase in the estimated price over marginal cost ratio. This allows us again to split up sectors according to the magnitude of both the mark-up ratio and union bargaining power. Concentrating on Model 3, the correlation between the estimated mark-up ratio and the union bargaining power parameter is 0.872. Sectors such as metal products except machinery and transport equipment, office and data processing machines, precision and optical instruments, electrical goods, other transport equipment and rubber and plastic products are characterized by a relatively high mark-up ratio (range of 1.502-2.088) and relatively high union bargaining power (range of 0.260-0.394). The sector office and data processing machines, precision and optical instruments can be labelled as the sector with both the highest price-cost mark-up and the highest union bargaining power parameter. Sectors such as non-metallic mineral products, chemical products, motor vehicles, other food products, beverages, paper and printing products and other manufacturing products can be classified as sectors with moderate price-cost mark-ups (range of 1.282-1.493) and moderate union bargaining power (range of 0.094-0.237). Sectors producing meat preparations and preserves and milk and dairy products display a relatively low price over marginal cost ratio (range of 1.017-1.125) and relatively low union bargaining power (range of 0.042-0.050). The lowest mark-up ratio as well as the lowest union bargaining power parameter is found in the milk and dairy products sector. Model 4 produces similar results. The correlation between the estimated mark-up ratio and the union bargaining power parameter is 0.714.

<Insert Table 5 and Table 6 about here>

6. CONCLUSIONS AND INTERPRETATION

This paper analyzes price-setting behavior in both the product and the labor market of Belgian manufacturing firms over the period 1988-1995. By embedding an Efficient Bargaining model into Hall's (1988) framework, we are able to estimate price-cost mark-up and union bargaining power parameters simultaneously. Applying the Generalized Method of Moments (GMM) technique for panel data, our results strongly reject perfect competition in both the output and the labor market. Assuming constant returns to scale, price-cost mark-ups are estimated at 35 percent and the union bargaining power parameter is found to be about 0.29. Ignoring labor market imperfections brings the estimated price-cost mark-up down to 20 percent. In this respect, our results qualitatively accord with the findings of Crépon et al. (2002).

To examine the important issue of heterogeneity in the price-cost mark-up and in union bargaining power, we have split up the sample into 18 sectors. For each sector separately, we find that neglecting imperfection in the labor market causes a significant underestimation in the price-cost mark-up. By focusing on the cross-sectional dimension, we are able to draw conclusions about the interdependencies between the two parameters. A new result in this paper concerns the remarkable positive relationship that we observe among sectors between estimated union bargaining power and estimated price-cost margins, evaluated at perfect competition in the labor market. In other words, labor market and product market imperfections are likely to go hand in hand. This observed positive correlation can be interpreted in two ways. We see it as a topic for further research to assess the relevance of each interpretation.

One interpretation runs from labor market to product market imperfections. The intuition is that strong unions imply higher wage rents and a smaller proportion of rents left to the firms. This change in factor income distribution leads to an exit of firms, which decreases the degree of product market competition and generates more unemployment. The workers' reservation wage will fall, price-cost mark-ups will rise. In some sense, our findings can be considered as an indirect empirical validation of the long-run implications of the model of Blanchard and Giavazzi (2003). The more powerful the union, the larger the size of the surplus that can be shared and the larger the part of the surplus going to the workers. Our framework does not allow us, however, to evaluate the effect of strong unions on the size of the surplus accruing to the firm. Theoretically, our findings are hence consistent with the hypothesis that unions may depress profits as well as with the hypothesis that unions do not affect profitability or even increase profitability.[12,13]

The results can also be interpreted in terms of product market imperfections affecting labor market imperfections. The idea is that workers are less likely to join unions unless they are able to extract some surplus from the firms and this is most likely to happen if there is imperfect competition in the product market. This is a standard interpretation in the trade union literature. Another explanation going from product market imperfections to labor market imperfections is that firms with higher price-cost margins may employ high-skilled workers who are harder to replace than low-skilled workers and therefore more powerful. In that case, monopoly power in the product market would also be associated with higher union bargaining power.

We are grateful to Jacques Mairesse (INSEE-CREST, NBER), Frederic Warzynski (Universidad Carlos III), Joep Konings (LICOS, K.U.Leuven), Freddy Heylen (SHERPPA, Ghent University) and participants at the EARIE Conference (Madrid, 2002), IIOC Conference (Boston, 2003) and HEWPEM Workshop (Patras, 2003) for helpful comments and suggestions. We also benefited from valuable comments of the editor Lars-Hendrik Röller and two anonymous referees. All remaining

[12] In the working paper version of this paper (Dobbelaere, 2003), we survey the existing theoretical and empirical literature on the effect of unions on economic performance, i.e. on productivity, firm profitability and investment.

[13] Estimating a structural model with endogenous wages for the European airline industry over the period 1976-1994, Neven et al. (2002) find that unions exert a small but positive effect on prices and on the true price-cost mark-up. The small impact is due to the quantitatively small effect of rent sharing on margin al costs, suggesting that rent sharing is mostly about redistribution.

errors are ours. Many thanks to LICOS for providing the data. Financial support from the Fund for Scientific Research - Flanders (Belgium) is gratefully acknowledged. Additional support has been provided by the Belgian Program on Interuniversity Poles of Attraction, contract UAP n° P5/21.

APPENDIX

A.1. Imperfection in the Output Market, Perfect Competition in the Labor Market

Starting from $Q_{it} = \Theta_{it} F(N_{it}, M_{it}, K_{it})$, we can write the logarithmic differentiation of the production function as:

$$\Delta q_{it} = \varepsilon_{it}^{Q,N} \Delta n_{it} + \varepsilon_{it}^{Q,M} \Delta m_{it} + \varepsilon_{it}^{Q,K} \Delta k_{it} + \Delta \theta_{it} \qquad \text{(A.1)}$$

where, using the Tornquist approximation, the time log-derivatives Δx $(x = q, n, m, k, \theta)$ are replaced by the year to year log-changes $(x_t - x_{t-1})$ and the production function log-derivatives, i.e. the elasticities $\varepsilon_{it}^{Q,J} = \partial q_{it} / \partial j_{it}$ $(j = n, m, k)$, by their averages over adjacent years $\varepsilon_{it}^{Q,J} = \frac{1}{2}\left[\partial q_{i,t-1} / \partial j_{i,t-1} + \partial q_{it} / \partial j_{it}\right]$.

Under perfect competition, it is well known since Solow that Δq_{it} can be decomposed as follows:

$$\Delta q_{it} = \alpha_{Nit} \Delta n_{it} + \alpha_{Mit} \Delta m_{it} + \alpha_{Kit} \Delta k_{it} + \Delta \theta_{it} \qquad \text{(A.2)}$$

where $\alpha_{Jit} = \frac{P_{Jit} J_{it}}{P_{it} Q_{it}}$ $(J = N, M, K)$ is the share of inputs in total revenue. Consistent with the Tornquist approximation, these shares are computed as the averages over adjacent years.

Under imperfect competition in the product market and perfect competition in the input markets, Eq. (A.2) becomes (Hall, 1988):

$$\Delta q_{it} = \mu_{it} \left(\alpha_{Nit} \Delta n_{it} + \alpha_{Mit} \Delta m_{it} + \alpha_{Kit} \Delta k_{it} \right) + \Delta \theta_{it} \qquad \text{(A.3)}$$

where $\mu_{it} = \frac{P_{it}}{C_{Q,it}}$ is the mark-up of price over marginal cost evaluated at the competitive wage level.

Under increasing or decreasing returns to scale,

$$\frac{w_{it} N_{it}}{C_{Q,it} Q_{it}} + \frac{P_{M,it} M_{it}}{C_{Q,it} Q_{it}} + \frac{r_{it} K_{it}}{C_{Q,it} Q_{it}} = 1 + \gamma_{it} \quad \text{or} \quad \mu_{it} \left(\alpha_{N,it} + \alpha_{M,it} + \alpha_{K,it} \right) = 1 + \gamma_{it}$$

where γ can be higher than 0 (increasing returns to scale) or lower (decreasing returns to scale) and $1+\gamma$ is the local scale elasticity measure. Rearranging terms in Eq. (A.1) yields Eq. (1) in the main text.

A.2. Imperfection in both the Output and the Labor Market

Relaxing the assumption that labor is priced competitively has important implications for the derivation of the Solow residual. To see this, assume that the union and the firm are involved in an Efficient Bargaining procedure, with both wages (w) and employment (N) being the subject of an agreement (McDonald and Solow, 1981). Both parties maximize their respective utility during the bargaining process. The union is risk neutral and its objective function is specified in a utilitarian form: $U(w,N) = Nw + (\overline{N} - N)w_a$, where $\overline{N}$ is union membership $(0 < N \leq \overline{N})$ and $w_a \leq w$ is the alternative wage (i.e. a weighted average of the alternative market wage and the unemployment benefit). The firm's utility equals its profits π, with $\pi(w,N) = R(N) - wN - F$, where $R = PQ$ stands for total revenue $(R_N^{''} < 0)$, P for the output price, Q for output and F for all other costs associated with production. For simplicity, we assume that labor is the only variable input for the firm. Hence, F represents fixed costs. Moreover, we normalize for the present by assuming that $Q = N$.

The bounds of the bargaining range are given by the minimum acceptable utility levels for both parties. The threat point for the union is the alternative wage w_a. If no revenue accrues to the firm when negotiation breaks down, the firm's fall-back utility equals $-F$. The outcome of the bargaining is the asymmetric generalized Nash solution to:

$$\max_{w,N} \Omega = \left\{ Nw + \left(\overline{N} - N\right) w_a - \overline{N} w_a \right\}^{\phi} \left\{ R - wN \right\}^{1-\phi} \tag{A.4}$$

where $\phi \in [0,1]$ represents the union's bargaining power.

Maximization of Eq. (A.4) with respect to the wage rate (w) gives the following equation:

$$w = (1-\phi) w_a + \phi \frac{R}{N} \tag{A.5}$$

Maximizing Eq. (A.4) with respect to employment (N) leads to the following first-order condition:

$$w = R_N + \frac{\phi}{1-\phi}\left[\frac{R - wN}{N}\right] \Leftrightarrow w = R_N + \phi\left[\frac{R - R_N N}{N}\right] \tag{A.6}$$

From Eq. (A.6), it follows that unions extract a rent from bargaining, expressed as a premium over the marginal revenue of labor (R_N). By solving simultaneously both first-order conditions, we obtain an expression for the contract curve: $R_N = w_a$.

In section A.1, we defined μ as the mark-up of price over marginal cost evaluated at the competitive wage level. Similarly, the price-cost margin has to be evaluated at the competitive wage level, i.e. $\beta = \frac{P - C_Q}{P}$. Using the contract curve outcome, we can also write β in this setting as: $\beta = \frac{R/N - w_a}{R/N} = \frac{R - R_N N}{R}$. Hence, Eq. (A.6) can be rewritten as:

$$w = R_N + \phi\frac{R}{N}\beta \tag{A.7}$$

Eq. (A.7) shows that the union premium is part of the price-cost margin (β), set by a profit-maximizing firm facing an exogenously determined wage equal to R_N ($= w_a$ in our case). Hence, wage rents under Efficient Bargaining depend on the imperfect market structure in both the output market (as reflected by the firm's price-cost margin β) and the labor market (as reflected by the union's bargaining power ϕ). In other words, the positive union wage premium depends on the *size* of the surplus available for sharing between the workers and the firm as well as on the *fraction* of the surplus going to the workers. Both these factors are in turn related to the collective bargaining structure, the market structure and the technology of the firm.

Dropping the normalization assumption $(Q = N)$ and defining the mark-up parameter μ as the inverse of the elasticity of revenue with respect to output, i.e. $\mu = \left[R_Q \frac{Q}{R}\right]^{-1}$ where R_Q is the marginal revenue, we can express the marginal revenue of labor as: $R_N = \frac{PQ_N}{\mu}$ with Q_N the physical marginal product of labor. Using this expression for R_N in Eq. (A.6), the efficient bargaining labor share is written as:

$$\frac{wN}{PQ} = \alpha_N = \phi + (1-\phi)\frac{\varepsilon^{Q,N}}{\mu} \tag{A.8}$$

Rewriting Eq. (A.8) as $\varepsilon^{Q,N} = \mu\alpha_N + \mu\frac{\phi}{1-\phi}(\alpha_N - 1)$, an extra term can be added to Eq. (1) in the main text which gives us Eq. (2).

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Table 1 Summary Statistics

Variables	1988-1995			
	Mean	Sd	Q1	Q3
Real firm output growth rate Δq	0.029	0.173	-0.060	0.123
Real industry output growth rate Δq_{ind}	0.042	0.164	-0.028	0.107
Labor growth rate Δn	0.005	0.154	-0.029	0.041
Capital growth rate Δk	-0.024	0.214	-0.156	0.097
Materials growth rate Δm	0.030	0.198	-0.075	0.139
Labor share α_N in nominal output	0.272	0.153	0.158	0.361
Materials share α_M in nominal output	0.629	0.175	0.516	0.753
Solow residual SR (TFP)	0.012	0.093	-0.029	0.053
$\Delta(q - k)$	0.053	0.227	-0.092	0.210
$(\alpha_N - 1)\,\Delta(n - k)$	-0.020	0.170	-0.124	0.077

Note: (1) For all variables, the number of observations is 35 518.

(2) $SR = \Delta q_{it} - \alpha_{Nit}\Delta n_{it} - \alpha_{Mit}\Delta m_{it} - (1 - \alpha_{Nit} - \alpha_{Mit})\,\Delta k_{it}$.

Table 2 General Results

	Model 1	Model 2	Model 3	Model 4
		REDUCED FORM PARAMETERS		
Constant	0.0002 (0.002)	-0.009^{**} (0.004)	-0.002 (0.003)	-0.009^{**} (0.004)
Output per Capital $\Delta(q - k)$	0.164^{***} (0.030)	0.276^{***} (0.049)	0.259^{***} (0.046)	0.328^{***} (0.050)
Capital Δk		0.165^{***} (0.032)		0.099^{***} (0.037)
Share-weighted Labor per Capital $(\alpha_N - 1)\,\Delta(n - k)$			0.398^{***} (0.066)	0.322^{***} (0.070)
		STRUCTURAL PARAMETERS		
Mark-up μ	1.196^{***} (0.043)	1.381^{***} (0.093)	1.350^{***} (0.084)	1.488^{***} (0.111)
Scale Elasticity $1+\gamma$	1	1.228^{***} (0.044)	1	1.147^{***} (0.055)
Workers' Barg. Power ϕ			0.285^{***} (0.034)	0.244^{***} (0.040)
		SPECIFICATION TESTS		
Sargan IV Test $\sim \chi^2_{df}$	47.019	50.926	34.330	31.206
df	41	43	43	42
p-value	0.240	0.190	0.825	0.889
SOC $\sim N(0,1)$	0.209	0.159	-0.051	-0.200
# Obs.	28132	28132	28132	28132
# Firms	7086	7086	7086	7086

***Significant at 1%; **Significant at 5%; *Significant at 10%. Standard errors in parentheses.

(1) Sample period: 1988-1995.

(2) Dependent variable: Solow Residual, $SR = \Delta q_{it} - \alpha_{Nit}\Delta n_{it} - \alpha_{Mit}\Delta m_{it} - (1 - \alpha_{Nit} - \alpha_{Mit})\,\Delta k_{it}$.

(3) The equations are estimated in levels as the specifications are in differenced logs, i.e. growth rates.

(4) Sargan IV Test: two-step estimates Sargan test of correlation among instruments and residuals, asymptotically distributed as χ^2_{df}. The null hypothesis is that the instruments are valid.

(5) SOC: test for 2nd-order serial correlation (SOC) in the first-difference error term. This test statistic is asymptotically distributed as $N(0,1)$. The null hypothesis is that there is no second-order serial correlation in the first-difference error term.

(6) Instruments used are: Δn, Δm and Δk, all dated (t-2) and earlier.

(7) Time dummies are included as regressors and instruments in all equations.

Table 3 Sector Analysis: Model 1

	Code	Name	# Obs. (# Firms)	Output per Capital $\Delta(q - k)$	Mark-up μ
Sec 1	13	Ferrous and non-ferrous ores and metals, other than radioactive	331 (74)	0.217*** (0.004)	1.277*** (0.007)
Sec 2	15	Non-metallic mineral products	2359 (562)	0.183*** (0.031)	1.224*** (0.046)
Sec 3	17	Chemical products	1452 (319)	0.170*** (0.024)	1.205*** (0.035)
Sec 4	19	Metal products except machinery and transport equipment	3649 (1014)	0.135*** (0.051)	1.156*** (0.068)
Sec 5	21	Agricultural and industrial machinery	1504 (399)	0.185*** (0.028)	1.227*** (0.042)
Sec 6	23	Office and data processing machines, precision and optical instruments	448 (130)	0.198*** (0.030)	1.247*** (0.047)
Sec 7	25	Electrical goods	992 (267)	0.165*** (0.024)	1.198*** (0.034)
Sec 8	27	Motor vehicles	426 (111)	0.148*** (0.021)	1.174*** (0.029)
Sec 9	29	Other transport equipment	230 (64)	0.320*** (0.011)	1.471*** (0.024)
Sec 10	31	Meat preparations and preserves, other products from slaughtered animals	929 (214)	0.061*** (0.013)	1.065*** (0.015)
Sec 11	33	Milk and dairy products	264 (66)	-0.008** (0.004)	0.992*** (0.004)
Sec 12	35	Other food products	3320 (834)	0.168*** (0.048)	1.202*** (0.069)
Sec 13	37	Beverages	397 (88)	0.227*** (0.006)	1.294*** (0.010)
Sec 14	39	Tobacco products		na	na
Sec 15	41	Textiles and clothing	3200 (783)	0.125*** (0.040)	1.143*** (0.052)
Sec 16	43	Leathers, leather and skin goods, footwear		na	na
Sec 17	45	Timber, wooden products and furniture	2641 (668)	0.147*** (0.030)	1.172*** (0.041)
Sec 18	47	Paper and printing products	3585 (926)	0.167*** (0.027)	1.200*** (0.039)
Sec 19	49	Rubber and plastic products	1337 (322)	0.239*** (0.021)	1.314*** (0.036)
Sec 20	51	Other manufacturing products	570 (163)	0.125*** (0.014)	1.143*** (0.018)

Time dummies are included but not reported. Standard errors in parentheses. ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Instruments: Δn, Δm and Δk, all dated (t-2) and earlier.

Table 4   Sector Analysis: Model 2

	# Obs. (# Firms)	Output per Capital $\Delta(q - k)$	Capital Δk	Mark-up μ	Scale Elasticity $1+\gamma$
Sec 1	331 (74)	0.240*** (0.004)	0.041*** (0.006)	1.316*** (0.007)	1.054*** (0.008)
Sec 2	2359 (562)	0.329*** (0.043)	0.227*** (0.041)	1.490*** (0.096)	1.338*** (0.061)
Sec 3	1452 (319)	0.276*** (0.043)	0.116*** (0.041)	1.381*** (0.082)	1.160*** (0.057)
Sec 4	3649 (1014)	0.319*** (0.062)	0.203*** (0.045)	1.468*** (0.134)	1.298*** (0.066)
Sec 5	1504 (399)	0.388*** (0.034)	0.350*** (0.042)	1.634*** (0.091)	1.572*** (0.069)
Sec 6	448 (130)	0.330*** (0.053)	0.223*** (0.067)	1.493*** (0.118)	1.333*** (0.100)
Sec 7	992 (267)	0.285*** (0.031)	0.152*** (0.029)	1.399*** (0.061)	1.213*** (0.041)
Sec 8	426 (111)	0.173*** (0.026)	0.026 (0.031)	1.209*** (0.038)	1*** (0.037)
Sec 9	230 (64)	0.447*** (0.018)	0.406*** (0.032)	1.808*** (0.059)	1.734*** (0.058)
Sec 10	929 (214)	0.060*** (0.022)	-0.0003 (0.024)	1.064*** (0.027)	1*** (0.026)
Sec 11	264 (66)	-0.009** (0.004)	-0.003 (0.004)	0.991*** (0.004)	1*** (0.004)
Sec 12	3320 (834)	0.386*** (0.083)	0.256*** (0.080)	1.629*** (0.220)	1.417*** (0.130)
Sec 13	397 (88)	0.235*** (0.009)	0.016 (0.011)	1.307*** (0.015)	1*** (0.014)
Sec 14		na	na	na	na
Sec 15	3200 (783)	0.184*** (0.045)	0.127*** (0.040)	1.225*** (0.068)	1.156*** (0.049)
Sec 16		na	na	na	na
Sec 17	2641 (668)	0.354*** (0.053)	0.212*** (0.045)	1.548*** (0.127)	1.328*** (0.070)
Sec 18	3585 (926)	0.322*** (0.045)	0.172*** (0.042)	1.475*** (0.098)	1.254*** (0.062)
Sec 19	1337 (322)	0.369*** (0.034)	0.192*** (0.045)	1.585*** (0.085)	1.304*** (0.071)
Sec 20	570 (163)	0.209*** (0.020)	0.115*** (0.016)	1.264*** (0.032)	1.145*** (0.020)

Time dummies are included but not reported. Standard errors in parentheses. ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Instruments: Δn, Δm and Δk, all dated (t-2) and earlier.

Table 5 Sector Analysis: Model 3

	# Obs. (# Firms)	Output per Capital $\Delta(q - k)$	Share-weighted Labor per Capital $(\alpha_N - 1)\,\Delta(n - k)$	Mark-up μ	Workers' Barg. Power ϕ
Sec 1	331 (74)	0.265*** (0.009)	0.104*** (0.016)	1.361*** (0.017)	0.094*** (0.013)
Sec 2	2359 (562)	0.305*** (0.034)	0.259*** (0.043)	1.439*** (0.070)	0.206*** (0.027)
Sec 3	1452 (319)	0.315*** (0.033)	0.221*** (0.045)	1.460*** (0.070)	0.181*** (0.030)
Sec 4	3649 (1014)	0.342*** (0.054)	0.359*** (0.059)	1.520*** (0.125)	0.264*** (0.032)
Sec 5	1504 (399)	0.312*** (0.024)	0.411*** (0.044)	1.453*** (0.051)	0.291*** (0.022)
Sec 6	448 (130)	0.521*** (0.043)	0.651*** (0.054)	2.088*** (0.187)	0.394*** (0.020)
Sec 7	992 (267)	0.334*** (0.019)	0.363*** (0.033)	1.502*** (0.043)	0.266*** (0.018)
Sec 8	426 (111)	0.243*** (0.021)	0.187*** (0.033)	1.321*** (0.037)	0.158*** (0.023)
Sec 9	230 (64)	0.502*** (0.019)	0.464*** (0.071)	2.008*** (0.077)	0.317*** (0.008)
Sec 10	929 (214)	0.088*** (0.020)	0.035** (0.018)	1.096*** (0.024)	0.034** (0.017)
Sec 11	264 (66)	0.017*** (0.005)	0.044*** (0.005)	1.017*** (0.005)	0.042*** (0.005)
Sec 12	3320 (834)	0.307*** (0.051)	0.284*** (0.062)	1.443*** (0.106)	0.221*** (0.038)
Sec 13	397 (88)	0.289*** (0.008)	0.154*** (0.009)	1.406*** (0.016)	0.133*** (0.007)
Sec 14		na	na	na	na
Sec 15	3200 (783)	0.260*** (0.045)	0.310*** (0.059)	1.351*** (0.082)	0.237*** (0.034)
Sec 16		na	na	na	na
Sec 17	2641 (668)	0.330*** (0.043)	0.264*** (0.049)	1.493*** (0.096)	0.209*** (0.031)
Sec 18	3585 (926)	0.306*** (0.038)	0.263*** (0.057)	1.441*** (0.079)	0.208*** (0.036)
Sec 19	1337 (322)	0.396*** (0.027)	0.351*** (0.048)	1.656*** (0.074)	0.260*** (0.026)
Sec 20	570 (163)	0.220*** (0.027)	0.206*** (0.030)	1.282*** (0.044)	0.171*** (0.021)

Time dummies are included but not reported. Standard errors in parentheses. ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Instruments: Δn, Δm and Δk, all dated (t-2) and earlier.

Table 6 Sector Analysis: Model 4

	# Obs. (# Firms)	Output per Capital $\Delta(q - k)$	Capital Δk	Share-weighted Labor per Capital $(\alpha_N - 1)\,\Delta(n - k)$	Mark-up μ	Scale Elasticity $1+\gamma$	Workers' Barg. Power ϕ
Sec 1	331 (74)	0.268*** (0.010)	-0.012 (0.012)	0.117*** (0.020)	1.366*** (0.019)	1*** (0.016)	0.105*** (0.016)
Sec 2	2359 (562)	0.356*** (0.039)	0.152*** (0.055)	0.156*** (0.060)	1.553*** (0.094)	1.236*** (0.085)	0.135*** (0.045)
Sec 3	1452 (319)	0.325*** (0.043)	0.017 (0.044)	0.213*** (0.050)	1.481*** (0.094)	1*** (0.065)	0.176*** (0.034)
Sec 4	3649 (1014)	0.387*** (0.058)	0.106** (0.051)	0.275*** (0.069)	1.631*** (0.154)	1.173*** (0.083)	0.216*** (0.042)
Sec 5	1504 (399)	0.386*** (0.029)	0.185*** (0.051)	0.272*** (0.062)	1.629*** (0.077)	1.301*** (0.083)	0.214*** (0.038)
Sec 6	448 (130)	0.521*** (0.047)	0.008 (0.046)	0.668*** (0.058)	2.088*** (0.204)	1*** (0.096)	0.400*** (0.021)
Sec 7	992 (267)	0.382*** (0.025)	0.101*** (0.033)	0.313*** (0.045)	1.618*** (0.065)	1.163*** (0.053)	0.238*** (0.026)
Sec 8	426 (111)	0.235*** (0.025)	-0.006 (0.029)	0.186*** (0.034)	1.307*** (0.043)	1*** (0.038)	0.157*** (0.024)
Sec 9	230 (64)	0.559*** (0.015)	0.311*** (0.034)	0.301*** (0.030)	2.268*** (0.077)	1.705*** (0.077)	0.231*** (0.018)
Sec 10	929 (214)	0.068*** (0.025)	-0.042 (0.029)	0.052** (0.024)	1.073*** (0.029)	1*** (0.031)	0.049** (0.022)
Sec 11	264 (66)	0.006 (0.004)	-0.028*** (0.007)	0.054*** (0.006)	1*** (0.004)	0.972*** (0.007)	0.051*** (0.005)
Sec 12	3320 (834)	0.359*** (0.073)	0.096 (0.095)	0.220*** (0.080)	1.560*** (0.178)	1*** (0.148)	0.180*** (0.060)
Sec 13	397 (88)	0.254*** (0.011)	-0.093*** (0.016)	0.213*** (0.012)	1.340*** (0.020)	0.875*** (0.021)	0.176*** (0.008)
Sec 14		na	na	na	na	na	na
Sec 15	3200 (783)	0.284*** (0.048)	0.057 (0.040)	0.285*** (0.064)	1.397*** (0.094)	1*** (0.056)	0.222*** (0.039)
Sec 16		na	na	na	na	na	na
Sec 17	2641 (668)	0.386*** (0.050)	0.130*** (0.052)	0.154*** (0.065)	1.629*** (0.133)	1.212*** (0.085)	0.133*** (0.050)
Sec 18	3585 (926)	0.340*** (0.044)	0.107** (0.047)	0.142** (0.070)	1.515*** (0.101)	1.162*** (0.071)	0.124*** (0.050)
Sec 19	1337 (322)	0.407*** (0.031)	0.042 (0.048)	0.319*** (0.059)	1.686*** (0.088)	1*** (0.081)	0.242*** (0.034)
Sec 20	570 (163)	0.226*** (0.031)	0.005 (0.026)	0.206*** (0.032)	1.292*** (0.052)	1*** (0.034)	0.171*** (0.022)

Time dummies are included but not reported. Standard errors in parentheses. ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Instruments: Δn, Δm and Δk, all dated (t-2) and earlier.