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Equalizing Wage Differences and Bargaining Power

Evidence from a Panel of French Firms

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I. Introduction

Economists often claim that collective bargaining plays an important role on wage level. Indeed, in France, almost 90% workers are covered by an industry-level collective bargaining agreement. These national agreements set, among other things, theoretical minimum wages in the industry. They are accompanied by within-firm bargaining: in 1992, more than 20% of firms have signed an agreement on wages with unions or with employees’ representatives (The Wage Structure Survey - enquête Coûts et Structures, 1992). However the priority in industry bargaining is to update job descriptions and classifications used by all firms in the industry. When it deals with wages, it is concerned less by the wages that will effectively be paid by employers, and more by setting theoretical minimum wages in the industry: most of these theoretical industry minima are, in fact, below the actual national minimum wage (Salaire Minimum Interprofessionnel de Croissance or SMIC). Furthermore, firm-level bargaining is more and more centered on the level of employment and on working conditions.

Even if important, it is then not obvious that industry bargaining has, at the macroeconomic level, a significant effect on effective wages. Although collective bargaining is often pointed to as a contributor to mass unemployment in France, primarily among the unskilled workers, there is no evidence that wage bargaining mechanisms contribute to the rise in unemployment. In our view, it is important to determine the effective bargaining power of workers in wage-setting and to estimate their ability to capture a proportion of the firm quasi-rent. This issue has fueled a large series of debates in the economic literature, and until now there is still substantial disagreement over the extent to which bargaining power of workers creates unemployment.

One type of studies analyzes the effect of unions on the structure of wages by comparing compensation of union workers (or of employees who work in firms with at least one union) with compensation of nonunion workers. Araï, Ballot and Skalli (1996) show that the extent of unionization in the firm raises the workers’ wages. Unfortunately, their cross-section estimates do not control for unobserved heterogeneity between workers on the one hand, and between firms on the other. One can suspect that differences in wage levels between employees working in unionized firms and employees working in non-unionized ones reflect differences in individual abilities or in the wage policies of the firms, rather than an effect of trade unions. Using longitudinal data, Card (1996) shows that unions raise wages more for workers with lower levels of observed skills. In addition, he confirms the existence of a selection bias and reports that patterns of selection differ by skill groups.

A second type of studies models the bargaining mechanism between unions and employers. Such models yield an equation connecting negotiated wages and the bargaining power of unions (or workers). Using matched worker firm panel data, Abowd and Allain (1996) estimate a bargaining power for the employees in France.
of about 0.4 (measured on a scale going from 0 to 1). Their estimate depends on the opportunity cost of the workers, which they construct with microdata.

In this paper, we adopt the second type of approach. We investigate and estimate a wage equation derived from a dynamic bargaining model. The dynamic approach leads to a wage-setting equation where the basic parameter of the workers’ bargaining power is present twice. Accordingly this allows us to evaluate the robustness of our results. The second new feature comes from the dataset we used, which is a rich combination of several sources. We track firms from manufacturing industries for five years, between 1988 and 1992. We show that the workers have an average bargaining power of about 0.2, which is weaker than the estimate provided by Abowd and Allain (1996). Our data allow us to control for firm-specific effects and for the heterogeneity of skills within firms.

Finally, our model predicts that the higher the rate of job destruction within one firm, the higher the compensation of workers. The empirical estimates are fully consistent with this prediction of equalizing differences (Murphy and Topel, 1987): workers who recognize the importance of the continuity and stability of their intertemporal discounted revenue will settle for lower wages when they benefit from lower unemployment risks. This result is the third new feature of our paper and, in our opinion, the most interesting one. It shows that even in a regulated labour market, the wage bargaining process can lead to a « competitive » quasi rents division, which partly ensures workers against higher risk of wage fluctuations.

Consequently, depending on cyclical variations, and more precisely on the rhythm of job destruction in the firm, each firm will carry out a different wage policy. Several recent studies (Abowd, Kramarz and Margolis, 1996, Goux and Maurin, forthcoming) show that wage differences between apparently identical workers, who work in different firms or industries, essentially reflect differences in unobserved characteristics. These studies also conclude that, even if weak, there remain real inter-firm wage differences. One purpose of this paper will consist in estimating to what extent the actual bargaining mechanism between employers and employees may explain these inter-firm wage differences.

Our study is organized as follows. In section II, we present a dynamic model of collective bargaining, along the lines of Manning (1993). We determine a non symmetric equilibrium at the firm level. Section III describes our data sources. In section IV, we discuss the econometric estimates of our firm-level wage equation.
II. A dynamic model of collective bargaining with heterogeneous firms

Models of firm-level bargaining used to estimate wage equations are usually standard spot market models of quasi-rent division (Brown and Ashenfelter (1986) or Blanchflower, Oswald and Sanfey (1996)). However, recent empirical studies highlighted the importance of the process of job creation and job destruction within firms (Abowd, Corbel and Kramarz (1997)) and we can easily suspect that the history of labour force flows within firms play a role in wage setting. This is illustrated, for instance, by Beaudry and Di Nardo (1991) who found that wages are much more sensitive to unemployment conditions than most previous studies in a dynamic model of implicit contract had found.

Therefore, we have integrated the flows of entry and exit in a dynamic model of quasi-rent division, along the lines of Manning (1993) and Cahuc and Zylberberg (1996). Contrary to Manning (1993), whose empirical study uses macroeconomic data, we keep the microeconomic dimension of the model and we use panel data to estimate an « exact » firm-level wage equation.

We assume that workers bargain only over wages according to the « right-to-manage » model. Firms decide unilaterally the level of employment, after wages are set by collective bargaining. Time is discrete and, at each date, the economy works according to the following sequence of decisions (see Appendix 1) :

a. At the end of each production period \( (t) \), technological shocks occur and an exogenous proportion \( (q_{t}^i) \) of employees of firm \( i \) are fired.

b. At the beginning of next period \( (t+1) \), each firm and its employees bargain over the current wage and the agreement obtained is supposed to hold for a single period.

c. Then, each firm \( i \) determines its level of employment \( (L_{t+1}^i) \). This adjustment is made either by hiring workers if \( L_{t+1}^i \geq (1 - q_{t}^i)L_{t}^i \), or by firing workers if \( L_{t+1}^i < (1 - q_{t}^i)L_{t}^i \).

d. Production occurs, output is sold, wages are paid and new shocks occur at the end of \( (t+1) \). We will now turn to the precise description of firms and workers’ behavior.
II.1. Firms

There is a continuum of firms in the economy of density 1 on \([0,1]\). For now, we do not make any assumption about the market of goods, which can be either perfectly or imperfectly competitive. We denote \(R(\lambda_t^i L_t^i)\) the revenue function of firm \((i)\) where \(L_t^i\) is the level of employment and \((\lambda_t^i)\) a parameter of productivity \((R\) is increasing and concave)\(^1\). At each period, firms are subject to two types of technological shocks: shocks on the productivity parameter \((\lambda_t^i)\) and idiosyncratic shocks on a certain proportion \((q_t^i)\) of job-worker pairs. When a job-worker pair experiences such an adverse technological shock it becomes unproductive at the end of the period and it separates.

We assume that \((\lambda_t^i)\) has two components: a temporal component of technical progress, common to all firms in the economy, and an individual component which represents a specific shock. So the productivity parameter can be written \(\lambda_t^i = \phi_t + \eta_t^i\).

We assume that \((\eta_t^i)\) and \((q_t^i)\) are random variables which are known only at the beginning of the period and which distribution is identical across firms. The two types of shocks can of course be correlated within one period, but we assume that they are independent across time. So both \((\eta_t^i)\) and \((q_t^i)\) are iid\(^2\). This is not the case for the productivity \((\lambda_t^i)\), since we do not make any hypothesis on the evolution of the technical progress.

For simplicity, we will from now consider the case \(L_{t+1}^i \geq (1-q_t^i) L_t^i\). It means that insiders negotiate the wages at the beginning of the period so that they are sure to keep their job for at least one period\(^3\). It implies that following the productivity shock firms never shrink within a period, i.e. between the wage negotiations and the production. Dismissals occur only at the end of the period. This is a reasonable hypothesis in the case of a growing economy, for which the technical progress \(\phi_t\) is growing at each period (for example at a constant rate)\(^4\).

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\(^1\) We could easily re-write our model with capital. It does not change the forthcoming development but complicates the presentation.

\(^2\) In our data the rate of firing is weakly autocorrelated (0.3). For the productivity parameter there is no direct possibility to test this hypothesis without specifying explicitly the production function.

\(^3\) This will be always true if \(q_t^i\) is high enough, or if \(\phi_t\) is growing at a sufficient rate. In the neighbourhood of equilibrium, when employment is growing at a constant rate, we can even have the condition \(L_{t+1}^i > L_t^i\).

\(^4\) In our view these apparently strong hypotheses are also justified by the findings of Abowd, Corbel and Kramarz (1997). They show that, in France, when a firm is shrinking, the adjustment of employment is made by reducing entry and not by increasing the separation rate. Furthermore, the description of our data will show that the rate of dismissals is rather independent of the level of employment in our panel (see section III.). And finally, the period we consider (1988-1992) is a period of expansion, where dismissals are more likely to be caused by exogenous shocks rather than too high wages.
According to the sequence of decisions previously defined, we have to compute the labour demand of each firm before analyzing the wage determination process. Let \( \rho_i \) denote the tax wedge (including both employer-paid and employee-paid payroll taxes) and let \( w_i \) be the net real wage in firm \( i \).

The firm \( i \) adjusts the level of employment to maximize its current profit \( \pi_i \).

\[
\text{Max } \pi_i = R(A_i L_i) - \rho_i w_i L_i
\]  

(1)

The first order condition of (1) defines a labour demand function \( L_i(\rho, w_i) \) such that:

\[
\forall t \geq 0 \quad A_i \frac{\partial R}{\partial L_i}(A_i L_i) = \rho_i w_i
\]  

(2)

II.2. Workers

We assume perfect homogeneity and mobility of the labour force: all individuals are identical and can apply for any job in any firm without search costs. Furthermore agents are risk-neutral, have an infinite life-time horizon, and supply one unit of labour at every date \( t \). Each worker employed in firm \( i \) is paid the net real wage \( w_i \) and, as explained before, loses his job at the end of period \( t \) with a probability \( (q_i^t) \). In this case he can immediately seek a new job and is employed at period \( t+1 \) with probability \( a_{t+1} \).

Under these assumptions we can define the value functions of the workers and the unemployed. The expected revenue of a worker of firm \( i \) at the beginning of period \( t \) will be written as follows:

\[
V_t^i = w_i + \beta \left[ q_i^t (a_{t+1} \hat{V}_{t+1}^e) + (1-a_{t+1}) \hat{V}_{t+1}^u \right] + (1-q_i^t) \hat{V}_{t+1}^i
\]  

(3)

where \( \beta \) is the discount factor, \( \hat{V}_{t+1}^e \) the expected value of being employed elsewhere at \( t+1 \), \( \hat{V}_{t+1}^u \) the expected value of being unemployed at \( t+1 \) and \( \hat{V}_{t+1}^i \) the expected value of being employed next period in firm \( i \).

According to our assumption on the process of the shocks \( (A_i^t) \) and \( (q_i^t) \), expectations about future wages and future job destructions are uniform. Then the expected value of being employed in the same firm next period \( (\hat{V}_{t+1}^i) \) must be equal to the expected value of being employed elsewhere \( (\hat{V}_{t+1}^e) \).\(^{5}\)

\(^{5}\) We thus suppose that being fired is not a signal of the poor quality of the worker. Notice however that it is possible to solve and estimate the model without making this assumption. We have chosen a simple representation of expectations. We could have kept heterogeneity in the anticipated value functions of
This assumption can be justified by several empirical studies about inter industry wage differentials: Abowd, Kramarz and Margolis (1996) or Goux and Maurin (forthcoming) have shown that these differentials reflect primarily the differences in measured and unmeasured labour quality. The average variation in wages for workers who switch industries does not exceed 3%.

Let $z_t$ denote the level of real unemployment benefits $^6$ and $(1 - \eta_{t+1})$ denote the probability that a worker who is unemployed this period remains unemployed next period$^7$. The value of being unemployed at date $t$, $V_t^u$, is then given by

$$V_t^u = z_t + \beta (\eta_{t+1} V_{t+1}^c + (1 - \eta_{t+1}) V_{t+1}^u)$$ (4)

II.3. Insiders and firms objective function

Wages are set at the beginning of each period after a bargaining process at the firm level between employers and unions. We have seen in the previous section that insiders who negotiate keep their job during the period. It is therefore useless for them to have an employment objective during the negotiations. When negotiations break down, workers quit the firm $i$ and have some employment opportunities elsewhere with the same probability $a_t$ as a worker who has just been fired. The expected utility of workers after negotiations have been broken off is$^8$

$$V_t^g = a_t V_t^c + (1 - a_t) V_t^u$$ (5)

The fall-back payoff of workers is then $V_t^g$ and their objective function in the Nash criterion is simply the difference $(V_t^g - V_t^i)$. Since there is no on-the-job search in the model, it is not in the workers’ interest to quit their employers; if they do so they will only obtain $V_t^g$ which is always lower than $V_t^i$.

Under the assumption of constant and exogenous real interest rate $r$, the expected profit of each firm $i$, denoted $\Pi_t^i$, can be written

$$\Pi_t^i = (\pi_t^i)^* + \frac{1}{1+r} \Pi_{t+1}^i$$ (6)

---

$^6$ In fact the term $z_t$ represents not only unemployment benefits, but also all replacement income and the non monetary utility or desutility of being out of work. It is therefore closer to an opportunity cost.

$^7$ The probability of being reemployed can be different for short term or long term unemployed. However unemployment duration has no effect on workers’ productivity.

$^8$ The fall-back point is never reached and negotiations are always successful.
where $\pi^*_i$ is the maximum of the current profit defined in section II.1 by equation (1).

When negotiations break down, the situations of workers and firms are asymmetric: workers who leave the firm immediately seek another job, while for firms it is impossible to fire the workers on strike and to replace them immediately at date $t^9$. In the case of strike, firms produce nothing and current profit $\pi^*_i$ is therefore zero. However, forthcoming profits are not modified because firms can hire workers for the next period without adjustment costs. Under these assumptions, the fall-back position of each firm is $\Pi_{i,t}^{o,i} = \frac{1}{1+r} \Pi_{i,t+1}$ and its objective function is the current profit $(\pi^*_i)' = \Pi_{i,t}^{o,i}$.

II.4. Within firm wage determination

We assume that the outcome of the negotiations is given by the maximization of a Nash bargaining program. Workers are rational and know that firms are on their labour demand curve. The issue of negotiations is given by the following program:

$$\max_{w^i} \left[ R(A^i_t L^i_t(\rho_t w^i_t)) - \rho_t w^i_t L^i_t(\rho_t w^i_t) \right]^{1-\gamma} [V^i_t - V^i_{\gamma}] \gamma$$

(7)

where $\gamma$ is the bargaining power of unions ($0<\gamma<1$). Using equation (1a) and the « envelope theorem » the first order condition implies:

$$V^i_t - V^i_{\gamma} = \frac{\gamma}{1-\gamma} \frac{R(A^i_t L^i_t)}{L^i_t} - \rho_t w^i_t$$

(8)

Denoting $w^i_t + \chi^i_t = V^i_t - V^i_{\gamma}$, equation (8) gives after some rearrangement the expression of the wage set in firm $i$ as an implicit function of the exogenous parameters and of the expected values functions of date $t+1$.

$$w^i_t = \frac{\gamma}{\rho_t} \frac{R(A^i_t L^i_t)}{L^i_t} + (\gamma - 1)\chi^i_t$$

(9)

---

9 This is justified by institutionnal delays or legal restrictions on firing.

10 Empirically, we will consider a short period of time, so that $\gamma$ can be considered constant over time. We will challenge the hypothesis that $\gamma$ is constant across firms by running estimations for different industries.

11 The second order condition holds if $\gamma$ is not too high, i.e., if $\gamma < e_{L,w} (\rho w^i_t (R(AL_t) - \rho w^i_t))$ where $e_{L,w}$ is the wage elasticity of labour demand. With our data we find the condition $\gamma < 2e_{L,w}$ which is usually valid, since several empirical studies show that this elasticity is above 0.5 (see Dormont 1993).
The term \( \chi'_t \) can be rewritten using relations (3), (4) and (5)

\[
\chi'_t = -z_t + \beta (1-q'_t)(1-a_{t+1}) - \eta_{t+1}) (\bar{V}_t^e - \hat{V}_{t+1}^e) - a_t (V_t^e - V_t^u) 
\]  

(10)

To get a wage equation in terms of observables we need to eliminate the differences of values functions \( V_t^e - V_t^u \) and \( \bar{V}_t^e - \hat{V}_{t+1}^e \). Using (5) we have \( V_t^e - V_t^u = (1-a_t)(V_t^e - V_t^u) \), and taking the expectation value in equation (8) we obtain :

\[
V_t^e - V_t^u = \frac{\gamma}{1-\gamma} E \left[ \frac{R(A'_t L'_t)}{\rho_t L'_t} - w_t^i \right] = \frac{\gamma}{1-\gamma} \left[ \frac{ALP_t}{\rho_t} - \bar{w}_t \right] 
\]  

(11)

where \( ALP_t \) is the average labour productivity and \( \bar{w}_t \) the average net wage in the economy at date \( t \).

Finally \( \chi'_t \) is determined by (10) and (11). The wage equation in each firm can be expressed in the following way :

\[
w_t^i = \frac{\gamma}{1-\gamma} \frac{R(A'_t L'_t)}{\rho_t L'_t} + (1-\gamma)z_t + \gamma \frac{a_t}{1-a_t} \left( \frac{ALP_t}{\rho_t} - \bar{w}_t \right) 
\]

\[
- \gamma \beta \frac{1-\eta_{t+1}}{1-a_{t+1}} - q'_t \right) E \left[ \frac{ALP_{t+1}}{\rho_{t+1}} - \bar{w}_{t+1} \Omega_t \right] 
\]  

(12)

where \( E \) denotes the expectation operator conditionally on \( \Omega_t \), the set of information available at date \( t \).

\( w_t^i \) is an implicit solution of equation (12). Giving a specific form to \( R(A'_t L'_t) \) allows to explicit \( w_t^i \). In the simple case of a Cobb-Douglas function, we can derive the explicit wage equation. Wages are increasing with the bargaining power of unions \( (\gamma) \)\(^{12} \). An increase in the unemployment benefits or in the probability of finding another job \( (a_t) \) raises also negotiated wages : in fact if unemployed people become better off, workers will have a higher fall-back position and will set higher wage claims.

The most remarkable result concerns the positive impact of the rate of job destruction \( (q'_t) \) on negotiated wages. Workers intend to maximize their discounted revenues and therefore the higher the risk of losing one's job, the higher the wage to compensate for this risk. Putting it in another way, the wage bargaining mechanism leads to « equalize differences ».

The aggregate level of unemployment in the economy also has an influence on the negotiated wage through the probabilities of finding a job \( a_t \) and \( \eta_t \). A decrease in

\(^{12} \) See Appendix 3 for the complete derivation of that case.
one of these parameters leads to lower wages because being unemployed becomes worse. In the model, $a_i$ and $\eta_i$ are exogenous at the firm level, but are endogenous at the macroeconomic level. In fact these probabilities are decreasing functions of the unemployment rate. Therefore wages are effectively decreasing with the aggregate unemployment rate.\textsuperscript{13}

Taxes are not neutral in our model, since an increase in the tax wedge reduces profits and hence decreases net negotiated wages.

To sum up, negotiated wages depend on the one hand on firm specific variables, such as productivity and the rate of job destruction, and, on the other hand, on external parameters (at the firm level) such as unemployment benefits, aggregate productivity, aggregate labour cost and the unemployment rate. In our model, wages are set simultaneously in each firm -and solve a Nash equilibrium. We could easily calculate the theoretical average wage of the economy but it is not our purpose. Our aim is precisely to study inter-firm wage differentials. Our model predicts that these differentials reflect heterogeneity in productivity and in the job destruction rate. It is interesting to note that there is no reason for these differentials to be persistent since the labour force is flexible and the probability of job loss exogenous. These predictions have an empirical support: Goux and Maurin (1996) show that inter-firm and inter-industry wage differences are primarily explained by unobserved individual characteristics and secondly by firm specific effects. Furthermore, these differentials are not structural.

Finally we can observe that when workers bargain over employment -see appendix 1- and agree to a wage decrease in return for a lower rate of dismissals, they behave exactly as the model predicts. In this case the probability of being fired becomes endogenous and is simultaneously set with wages.

\textsuperscript{13} It is easier to see this point by writing the equilibrium of employment flows (see Cahuc and Zylberberg, 1996).
III. The Data

The data are derived from the merging of three annual surveys by the Institut National de la Statistique et des Etudes Economiques (INSEE) and the Direction de l’Animation de la Recherche des Etudes et des Statistiques (DARES), two main governmental statistics agencies. We matched the Occupational Structure Survey (Enquête sur la Structure des Emplois, ESE), the Monthly Worker Movement Declaration (Déclarations de Mouvements de Main-d’Oeuvre, DMMO) and the Survey of Corporate Tax Returns (Bénéfices Industriels et Commerciaux, BIC). The sample contains about 1,000 firms, from the private manufacturing sector, with at least 50 employees. The sample is balanced over the period 1988-1992, so that the number of available observations is around 5,000.14

For each firm and for each year, the sample covers the data items that are standard in surveys of this kind: value added, turnover, output, wage bill (total labour costs) and the occupational structure using a 4-digit standardized classification of occupations. From this classification, we use only six positions: (1) managers and professionals; (2) technicians and supervisors; (3) skilled clerical workers; (4) unskilled clerical workers; (5) skilled manual workers; and (6) unskilled manual workers.

One of the interesting features of our panel is that it provides the number of employees fired and makes it possible to distinguish (1) quits; (2) endings of short-term contracts (Contrats à Durée Déterminée, CDD); (3) contracts terminated for economic reason or for cause; and (4) retirements, early retirements and other reasons. Summary statistics on the average rate of exit and entry of workers are reported in table 1. These statistics confirm that when a firm reduces the number of employees, it reduces the number of entries, and it can even be observed that the entry and the exit rates are higher in firms with increasing employment.

For each firm, the job destruction rate is calculated as follows: we sum the rate of lay-offs (economic and for cause) and the rate of destruction of short-term contracts15. We do not take into account quits in the definition of the rate of job destruction, because quits rather are an endogenous process, which we have not considered in our model. However, we could have assumed that workers who quit their firm find another job immediately, and these flows would not have had any influence in our model if they occur before the wage bargaining process.

A simple calculation of the Pearson correlation coefficient between the rate of job destruction within a year and the variation of employment is equal to 0.012 and is not statistically different from zero. Thus the assumption of the exogeneity of our job destruction rate seems to be realistic. It is also worth noting that the entry rate

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14 We are grateful to Marianne Pauchet who kindly gave us the access to the original matched data source she created on the basis of a panel put together by S. Lagarde, E. Maurin and C. Torelli (Lagarde, Maurin and Torelli, 1995). We supplemented this panel with other sectorial and geographical variables.

15 The average value of the rate of job destruction we consider is 10.8% over the whole period (see table 2). It represents about half of total job outflows.
is superior to the exit rate in 80\% of the cases, a fact which supports the interpretation of shocks on job-worker pairs.\textsuperscript{16}

In the model, all individuals are supposed identical. Gross differences in average wages between firms reflect mostly differences in the occupational structure: a company which employs 5 managers and 5 unskilled manual workers will surely have a higher wage bill than another one which employs 1 manager and 9 unskilled manual workers, even if both unskilled manual workers and managers receive the same compensation. To take into account the « quality » of the labour force specific to each firm, we calculate, at each date and for each firm, the equivalent wages for unskilled manual workers.\textsuperscript{17}

Additional macroeconomic data such as income of the unemployed people and rate of job creations come from the annual Labour Force Surveys (LFS).\textsuperscript{18} Furthermore, the LFS provides estimates of the probability of getting a job for individuals unemployed for more than one year (\(\eta_t\)) and for individuals unemployed for less than one year (\(a_t\)). In accordance with the intuition that long-term unemployed are more or less excluded from the labour market, these two probabilities are very different. The approximation \(a_t = \eta_t\) is not valid (these probabilities are respectively around 0.6 and 0.3).

Average productivity and labour costs are estimated from the BIC, for the same sector as our panel, i.e. manufacturing industries. Each year, this survey consists of about 26,000 companies. It makes it possible to measure the average productivity and the average labour cost for the 1987-1993 period. Productivity is supposed to be equal to the value added per employee.\textsuperscript{19} Table 2 shows summary statistics for the firm-level variables used in our statistical analysis and table 3 the decomposition of variance for these variables.

\textsuperscript{16} Another feature confirms our interpretation of terminations: the rate of job destruction is not correlated with lagged wages. We can not therefore accept the conclusion that higher \((q_t)\) are synonymous with decreasing employment because of higher wages.

\textsuperscript{17} The French Labour Force Surveys, from 1987 to 1993, allow the estimation of relative wages of the six occupational positions identified in each firm. Between occupations average wage differences are rather constant over time: in average, a professional or manager earns three times more than an unskilled manual worker, a technician or supervisor 1.8 time more, a skilled clerical worker 1.2 time more, a skilled manual worker 1.3 time more and an unskilled clerical worker 1.2 time less.

\textsuperscript{18} Conducted by the INSEE.

\textsuperscript{19} In our model, the output per employee would be less appropriate, because the purchasing costs of intermediate consumer goods are not taken into account.
IV. Empirical results

In our theoretical model, we avoid questions like incentive constraints for supplying labour or choice between leisure and work. In all rigor, we should take into account the non monetary advantages and disadvantages of being unemployed in the expression of $V_u$. Furthermore it is extremely difficult to measure the level of replacement income ($z_t$) because of the heterogeneity of fiscal situations and the influence of various allocations (mother’s help, home help etc.). Considering the sole unemployment benefits would therefore be quite rough and would underestimate the replacement income. If we calculate an indicator of replacement incomes for unemployed people from the Labour Force Survey, we find values close to the ones published by the OECD (OECD, 1994) and these values are relatively constant over the short period covered by our panel. For all those reasons it seems reasonable to replace the term $(1 - \gamma)z_t$ in equation (12) by a constant ($l$) and to add temporal dummies.

Finally equation (12) becomes:

$$w_t' = l + \gamma \left[ \frac{R_t'}{L_t'} + \frac{a_t}{1 - a_t} (ALP_t - \rho_i w_t) \right] - \beta \gamma (\lambda_{\tau+1} - q_t') \mathbb{E} \left[ \frac{ALP_{\tau+1}}{\rho_{\tau+1}} - \overline{w}_{\tau+1} \mid \Omega_t \right]$$

where $\lambda_{\tau+1} = (1 - \eta_{\tau+1}) / (1 - a_{\tau+1})$

If we include temporal dummies in equation (13), we do not need to calculate either the rates of exit from unemployment $\eta_t$ and $a_t$, nor the parameter $\lambda_{\tau+1}$. The coefficients ($\gamma$) and ($\beta$) are then identified only by time-varying and individual-varying independent variables, according to the following equation:

$$w_t' = l + \gamma \cdot \frac{R_t'}{\rho_i L_t'} + \beta \gamma \cdot q_t \left( \frac{ALP_{\tau+1}}{\rho_{\tau+1}} - \overline{w}_{\tau+1} \right) + \delta_t + u_t$$

The bargaining power ($\gamma$) appears twice in equations (13) and (14). A first strategy to estimate this parameter would consist in fixing arbitrarily a value of the discount factor ($\beta$) compatible with the real interest rate on financial markets. This rate is approximately constant around 5% over the period 1988-1992, giving a value for $\beta$ of 0.95. But it is not obvious that workers have an easy access to financial markets and take the same interest rate into account. They could be either more or less patient than capital owners. We will then estimate (14) without giving an a priori value to the discount factor.

In the theoretical model, the labor productivity is endogenous and depends on the wage set within the firm. In the case of constant return to scale this is no more the case and we will first ignore this source of endogeneity in our estimations.
a) *OLS, within and FGLS estimates*

The OLS estimate of equation (14) shows that the bargaining power of workers is around 0.22 (table 4, row 1). The most striking result is the strong validation of the equalizing wage differentials prediction since the sign of the estimator $\gamma \hat{\beta}$ is positive. Wages are an increasing function of the rate of job destruction\(^{20}\). Furthermore, almost half of the wage variance is explained. The comparison between the estimates obtained with or without temporal dummies clearly shows that it is important to take time specific effect into account, especially for the estimate of the second parameter $\hat{\beta} = \gamma \hat{\beta} / \hat{\gamma}$, which varies between 0.6 and 1. From now on, we will always add temporal dummies in the regressions, and only present the results obtained for equation (14).

It is possible that some key firm-level determinants of wages may be correlated with the independent variables. If that is so, OLS estimates are biased. Theoretically, one can imagine that the shocks are persistent ($A_t = \phi_t + \alpha_t + \nu_t$) which also induces that there is a firm specific component in the determination of wages. Therefore we performed two specification tests: the Fischer test for the existence of an individual effect and the Hausman test which compares « between » and « within » estimates, in order to check whether the individual effect is correlated with the explanatory variables or not. Results are reported in table 5. These tests show there exist individual effects and that these individual effects are fixed effects.

The within firm and first difference estimators enable us to get rid of this bias. Once we take firm specific policy into account, the bargaining power of workers ($\gamma$) is smaller and fluctuates around 0.15 and 0.18 for within, first difference and long difference estimators (tables 6a and 6b). It is worth noting that the estimates of ($\gamma$) are almost similar. However this is not the case for $\hat{\beta} = \gamma \hat{\beta} / \hat{\gamma}$, which is greater than one in the first difference estimates: it would mean that agents give more weight to the future than to the present. A non linear estimation of $\hat{\beta}$ confirms these results (see table 6b). The long difference estimator is much more satisfactory ($\hat{\beta}$ is around 1), and we will see below how to get rid of potential biases like measurement errors that could lead to an overestimation of $\hat{\beta}$.

Another source of potential bias in the previous estimates lies in the possibility of heterogeneity in the bargaining power. First it is possible that the bargaining power of workers depends on the size of the productivity per worker, the size of the firm or the rate of job loss. However Abowd et Allain (1996) have shown that the first hypothesis is not consistent with their empirical results. The second must be

\(^{20}\) The correlation between these variables is 0.12 and clearly significant.
rejected too, because if we allow $\gamma$ to be linearly dependent on $(q_t^i)$ or on $(L_t^i)$ the corresponding coefficient is not significant\textsuperscript{21}.

Second, the bargaining power could be heterogeneous between industries, since collective agreements are often signed at the industry level. Table 7 reports within and QGLS\textsuperscript{22} estimates at two levels of aggregation. As we only have a few number of observations in our sample for some industries, we first consider a rough decomposition in three different sectors: the intermediate manufactured products industries, the equipment goods industries and the consumer goods industries. We also compute the within and QGLS estimates for a level of aggregation which corresponds to the industry collective bargaining agreement. The tests show that there are firm specific effects within each industry, but they are not always correlated to the explanatory variables (in some case the QGLS estimates is convergent and optimal). It is quite remarkable to see that the bargaining power coefficient $\gamma$ is stable across industries, it varies between 0.05 and 0.25, and is always significant. The coefficient seems to be lower in mining, steel and ferrous industries, and paper and board industries (about 0.1). The parameter $\hat{\beta}$ fluctuates usually between 0.5 and 1, with absurd values for paper and board industry and rubber industry ($\hat{\beta}$ is greater than 1, but we do not have many firms for these sectors). Anyway these estimations by industry confirm the result of equalizing wage differences and, except for small sectors, the firms we consider seem to be rather homogenous across sectors.

Notice that the bargaining power we found is lower than the value obtained for France by Abowd and Allain (1996) and much closer to the result found by Abowd and Lemieux (1993) for Canada (0.2 in the later case). As these papers clearly showed, it is important to take into account the potential sources of bias. First of all independent variables may be endogenous. In the theoretical model, wages, employment, quasi-rent per worker are jointly determined, so that the OLS estimates, as well as the within estimates, of $\gamma$ and $\gamma\beta$ are potentially inconsistent\textsuperscript{23}.

Measurement errors are another potential source of bias. For example the corporate entity for which financial information is available does not always correspond to the firm involved in collective bargaining. In the case of endogeneity, even the within estimator is biased and we have to adopt the Generalized Method of Moments (henceforth GMM) to estimate the model. We shall also take care of the heterogeneity issue.

---

\textsuperscript{21} If we replace $\gamma$ by $\gamma_t^i = \gamma_o + \gamma_1 q_t^i$ (respectively $\gamma_t^i = \gamma_o + \gamma_2 L_t^i$) the coefficient $\gamma_1$ (resp. $\gamma_2$) is not significant.

\textsuperscript{22} QGLS stands for Quasi-Generalized Least Squares.

\textsuperscript{23} We have already pointed out that the labour productivity is endogenous in equation (12).
b) Generalized Method of Moments Estimates

We write the model in first differences in order to eliminate the individual fixed-effect. Equation (14) becomes, for each firm \((i)\) at every date \((t)\):

\[
\Delta u_i^t = \gamma \Delta L_i \frac{R_i^t}{\rho} + \beta \gamma \Delta q_i^t \left( \frac{ALP_{t+1}^i}{\rho_{t+1}} - \overline{w}_{t+1} \right) + d_i + u_{it} - u_{i,t-1} \quad \text{with} \quad d_i = \delta_i - \delta_{i-1}
\]

(15)

GMM estimation allows us to take a large number of moment conditions to estimate the model. Following Arellano and Bond (1991), we use the conveniently lagged left-hand variable as an instrument as well as lags of independent variables. We assume that our explanatory variables are weakly exogenous, so that the disturbance is uncorrelated with strictly past values of the regressors. We will use these instruments in levels with at least two lags, and not in first differences, in order to keep an additional year of data.

Moreover, we will use other exogenous instruments to get other moment conditions. Following Abowd and Allain (1996), the instrumental variables used are the sector-based prices of imports and prices of exports (600-heading classification of industries, NAP600). We use also the Herfindhal index, which measures the concentration of the various markets covered by the firm. Several studies have in fact detected a positive link between the rent-sharing and the product market power of firms (see for example Rose, 1987). In our panel, this index is correlated with the added value of the firm (correlation of 0.19). We could however suspect that the bargaining power of unions is greater in firms which operate in less competitive industries. We have tested this hypothesis by specifying in our wage equation a bargaining power which depends linearly on the Herfindhal index\(^{24}\). In our sample we find no effect of this index on the bargaining power, when we estimate such an equation with instrumental variables. To take the opportunity cost of working into account, we add the regional unemployment rate and the regional average wage in the set of instruments.

The second term of equation (15) contains the average labour productivity and is therefore endogenous too. For the rate of job destruction we used its lagged values as instrumental variables, and also the lag of the turnover rate. The latter seems to be a better instrument. To check the validity of our instruments, we use the Sargan test of overidentifying restrictions from the two-step GMM estimator.

We give the results for the one-step estimator and the two-step estimator (see table 8). The explanatory power of lagged exogenous variables is weak (column 2), but they give more precision for the second parameter. For both set of instruments (column 1 and 2) the test of overidentification is quite satisfactory as well as the test of compatibility between exogenous instruments and lagged instruments. With the complete set of instruments we obtain a value of the bargaining power of about 0.21 (column 3). The discount factor is equal to 0.57. We have then corrected the first differences estimator from the endogeneity and measurement errors bias and it

\(^{24}\gamma\) is replaced by \(\gamma_i' = \gamma_{0i} + HI_i\), where HI is the Herfindhal index.
is worth noting that the coefficient $\beta$ becomes less than one. If we add dummies for each industry to eliminate industry specific trends in wages, we get values of the bargaining power and of the discount factor very close to those obtained with the within estimator (table 9). We will retain these values ($\gamma=0.18$ and $\beta=0.76$) as our best estimates.

The theoretical model assumed the rate of job destruction was exogenous. The econometrics tests do not reject this hypothesis: if we compare the values obtained with GMM techniques and within estimator (table 9) and if we run an Hausman-Wu test (for the global model), we can not reject the hypothesis of equality between these estimates. However, if we add the destruction rate in the set of instruments, the overidentification test is no longer valid. We can nevertheless notice that the model does not lose its pertinence in the case of endogeneity, since the mechanism of equalizing differences still holds in this case, except that the trade-off between wages and job security is no longer exogenous but endogenous.

We finally conduct a GMM estimation by industry (table 10) and compare the results to the estimates obtained by within and QGLS estimates (table 7). For some industries there are not enough individuals to run a GMM procedure with the complete set of instruments (chemicals industry and paper and board industry). The estimates are very close, and the bargaining power seems to be a little higher for the finest level of aggregation with GMM estimates. When we aggregate in three sectors $\gamma$ is lower than the within estimate for the two step estimator. Finally, the discount rate becomes lower than one for wood and furnitures and rubber products industries. And for mining, steel work industries and printing and publishing, the equalizing differences coefficient has increased and become more significant. We find little heterogeneity among sectors: the bargaining power fluctuates between 0.12 and 0.25 and the discount rate between 0.5 and 1 (or sometimes more than one). The discount factor of workers is usually lower than the discount rate on financial markets and we were right not to give an $a$ priori value to this parameter.

These sector-based estimations show that composition effects should not influence strongly our estimation for the entire sample, and confirm that the endogeneity bias is weak.
Conclusion

The first interesting feature of the paper is the estimate of the bargaining power of employees. Our estimates show how important it is to take into account firm specific effects and the heterogeneity of skills within firms. Once you have taken into account these firm specific effects and the potential endogeneity of quits and shocks, the estimated bargaining power of workers falls from 0.4 to 0.18.

We also show that there is no strong heterogeneity of the bargaining power across industry. First when we allow the bargaining power of workers to depend on firm variables (such as the size of the firm or the size of the quasi-rent per worker or on market conditions), it appears that these variables are not significant. We have also conducted our estimates for different industries, at a level of aggregation which corresponds to the industry collective bargaining level, and it still appeared that the bargaining power fluctuates around 0.2. Moreover, our data cover only the manufacturing sector and one can imagine that the bargaining power is still lower in the trade and services sector.

The second main result of the paper is to give an empirical support to the theory of equalizing wage differences. When workers bargain over wages in a dynamic framework they will impose a trade-off between the level of wages and the risk of being unemployed. Even in a regulated labour market, we find a competitive mechanism of compensations. We do not find a strong bargaining power, but we show that workers can play the role of an insurance system: in firms where few jobs are removed, workers get a lower wage. These differences can then be interpreted as a risk premium to be insured against unemployment risk. This result may explain inter-firm wage differences, which are really firm specific effects and do not reflect unobserved heterogeneity of workers.
References


Appendix 1: The sequence of decisions in each firm

Beginning of period (t)  

1) The agents anticipate the new values of the shocks $q_t^i$ and $A_t^i$.  
2) Wages are negotiated.  

An exogenous proportion $q_{t-1}^i$ of employees are fired at the end of period t-1.  

End of period (t)  

3) Firms adjust the employment. This adjustment is made by hiring new workers, since we have the condition: $L_t^i \geq (1 - q_{t-1}^i)L_{t-1}^i$.  
4) As before, a proportion $q_t^i$ of employees are fired.  

Production
Appendix 2 : Wage equation in the case of an efficient contract

When unions bargain over wages and employment (it means that the level of employment is one of the insider’s objective even if they know they will keep their job until the end of the period), the new program is given by :

\[ \text{Max}_{w_i, L_i} \left[ R(A_i^i, L_i) - \rho_i w_i^i L_i \right]^{1+\gamma} \left[ L_i (V_i^i - V_i^s) \right]^\gamma \]

and the first order conditions are :

\[ V_i^i - V_i^s = \frac{\gamma}{1-\gamma} \left[ \frac{R(A_i^i, L_i)}{\rho_i L_i} - w_i^i \right] \] (1)

\[ A_i \frac{\partial R}{\partial L_i}(A_i^i, L_i) = \rho_i w_i^i - \frac{\gamma}{1-\gamma} \left[ \frac{R(A_i^i, L_i)}{L_i} - \rho_i w_i^i \right] \] (2)

In the « efficient contract » model, the level of employment is higher than in the « right to manage » model and wages are lower (since the productivity is decreasing in L if R is concave). It is worth remarking that equation (1) is formally identical to equation (4) in the paper. The only difference is that firms are no more on their labour demand curve (workers are paid above their marginal productivity).

Solving this program is equivalent to solving two different Nash equilibria -one on wages and the other on employment -with the same bargaining power (\(\gamma\)).
Appendix 3: Wage equation in the case of decreasing return to labour

In order to illustrate the impact of our exogenous variables in our model, we derive the wage equation (12) when the revenue function is a Cobb-Douglas, \( R(A^i_t, L^i_t) = (A^i_t L^i_t)^\alpha \). After simplification, the wage equation in firm \( i \) becomes

\[
{w'}_i(1-\gamma/\alpha) = (1-\gamma)z_i + \gamma \left[ \frac{a_t}{1-a_t} \left( \frac{ALP}{\rho_t} - \bar{w}_t \right) - \beta \left( \frac{1-\eta_{t+1}}{1-a_{t+1}} - q'_t \right) E \left( \frac{ALP_{t+1}}{\rho_{t+1}} - \bar{w}_{t+1} \right) \right]
\]

The second term in parenthesis in the right member can be either positive or negative, but is negligible compared to the replacement revenue - for reasonable values of parameters. Since \( \alpha < 1 \), it is then easy to show that wages are increasing with the bargaining power (\( \gamma \)). The influence of the other exogenous variables on wages is trivial to compute (comparative statics is developped at the end of section II.4).
### Table 1: Annual average rates of Entry/Exit of workers in the BIC-ESE-DMMO panel

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All firms of the sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entry rate</td>
<td>0.187</td>
<td>0.218</td>
<td>0.199</td>
<td>0.151</td>
<td>0.127</td>
</tr>
<tr>
<td>Total exit rate</td>
<td>0.180</td>
<td>0.198</td>
<td>0.194</td>
<td>0.168</td>
<td>0.155</td>
</tr>
<tr>
<td>Quit rate</td>
<td>0.042</td>
<td>0.052</td>
<td>0.054</td>
<td>0.040</td>
<td>0.027</td>
</tr>
<tr>
<td><strong>Rate of Job Destruction</strong></td>
<td>0.111</td>
<td>0.117</td>
<td>0.112</td>
<td>0.103</td>
<td>0.102</td>
</tr>
<tr>
<td><strong>Firms with increasing employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entry rate</td>
<td>-</td>
<td>0.241</td>
<td>0.216</td>
<td>0.166</td>
<td>0.146</td>
</tr>
<tr>
<td>Total exit rate</td>
<td>-</td>
<td>0.213</td>
<td>0.202</td>
<td>0.176</td>
<td>0.159</td>
</tr>
<tr>
<td>Quit rate</td>
<td>-</td>
<td>0.055</td>
<td>0.057</td>
<td>0.043</td>
<td>0.029</td>
</tr>
<tr>
<td><strong>Rate of Job Destruction</strong></td>
<td>-</td>
<td>0.124</td>
<td>0.116</td>
<td>0.106</td>
<td>0.108</td>
</tr>
<tr>
<td><strong>Firms with decreasing employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entry rate</td>
<td>-</td>
<td>0.186</td>
<td>0.172</td>
<td>0.130</td>
<td>0.114</td>
</tr>
<tr>
<td>Total exit rate</td>
<td>-</td>
<td>0.183</td>
<td>0.184</td>
<td>0.160</td>
<td>0.152</td>
</tr>
<tr>
<td>Quit rate</td>
<td>-</td>
<td>0.046</td>
<td>0.049</td>
<td>0.037</td>
<td>0.025</td>
</tr>
<tr>
<td><strong>Rate of Job Destruction</strong></td>
<td>-</td>
<td>0.106</td>
<td>0.107</td>
<td>0.099</td>
<td>0.096</td>
</tr>
</tbody>
</table>


Reading: The entry rate includes long term hiring contracts (CDI) and short-term hiring contract (CDD). The total exit rate includes lay-offs, endings of short term contracts, quits and other exits (retirements, military service, deaths...). The rate of job destruction ($q_t^j$) we consider in the paper includes lay-offs and endings of short term contracts and excludes voluntary quits.
Table 2: Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real gross wage (weighted by the structure of employment) in constant 1980 Francs.</td>
<td>65 438 (11 654)</td>
<td>29 371</td>
<td>147 433</td>
</tr>
<tr>
<td>Productivity per worker (also weighted by the structure of employment) in 1980 Francs.</td>
<td>98 198 (35 407)</td>
<td>31 442</td>
<td>442 105</td>
</tr>
<tr>
<td>Rate of Job Destruction</td>
<td>0.108 (0.119)</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Standard Deviation in parentheses.

Table 3: Decomposition of total variance

<table>
<thead>
<tr>
<th></th>
<th>% Between</th>
<th>% Within</th>
<th>Total Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real gross wage per Worker</td>
<td>97.29</td>
<td>2.71</td>
<td>100</td>
</tr>
<tr>
<td>Productivity per Worker</td>
<td>97.83</td>
<td>2.17</td>
<td>100</td>
</tr>
<tr>
<td>Rate of Job Destruction</td>
<td>93.19</td>
<td>6.81</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4: OLS estimates
(with and without temporal dummies)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>OLS estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without temporal dummies</td>
</tr>
<tr>
<td>Bargaining power ((\gamma))</td>
<td>0.220 (0.005)</td>
</tr>
<tr>
<td>Bargaining power time discount factor ((\gamma\beta))</td>
<td>0.225 (0.050)</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Note: standard errors are indicated in parentheses. They are robust to heteroscedasticity and autocorrelation.

Table 5: Between, Within and FGLS estimates (with time dummies).

<table>
<thead>
<tr>
<th>Dependent variable w</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within firm</td>
</tr>
<tr>
<td>(\gamma)</td>
<td>0.175 (0.017)</td>
</tr>
<tr>
<td>(\gamma\beta)</td>
<td>0.150 (0.036)</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Note: standard errors are indicated in parentheses. They are robust to heteroscedasticity and autocorrelation.

Tests of the existence of an individual effect:

Fischer test: \(\frac{\sigma^2_B}{\sigma^2_W} = 3.952 > F_{5\%} (3648,3656)\)

Tests of the exogeneity of the individual effect:

Hausman test: \(8.73 > \chi_{95\%} (2)\)
Table 6a : Within, first differences and long differences.

<table>
<thead>
<tr>
<th>Dependent variable w</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within firm</td>
</tr>
<tr>
<td>( \gamma )</td>
<td>0.175</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
</tr>
<tr>
<td>( \gamma \beta )</td>
<td>0.150</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.28</td>
</tr>
</tbody>
</table>


*Note: standard errors are indicated in parentheses. They are robust to heteroscedasticity and autocorrelation.*

Table 6b : Within, first differences and long differences
(Non linear least squares estimates).

<table>
<thead>
<tr>
<th>Dependent variable w</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within firm</td>
</tr>
<tr>
<td>( \gamma )</td>
<td>0.174</td>
</tr>
<tr>
<td></td>
<td>(0.0038)</td>
</tr>
<tr>
<td>( \beta )</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
</tr>
</tbody>
</table>


*Note: standard errors are indicated in parentheses.*
Table 7: Within and FGLS estimations by industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Within</th>
<th>FGLS</th>
<th>Tests</th>
<th>Fischer</th>
<th>Hausman</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\gamma$</td>
<td>$\beta$</td>
<td>$R^2$</td>
<td>$\gamma$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>I. Intermediate Manufactured Products (N=383)</td>
<td>0.128</td>
<td>0.125</td>
<td>0.216</td>
<td>0.151</td>
<td>0.110</td>
</tr>
<tr>
<td>I.1) Mining, Metal, Steel basic industries and Materials (N=72)</td>
<td>0.092</td>
<td>0.067</td>
<td>0.17</td>
<td>0.121</td>
<td>0.077</td>
</tr>
<tr>
<td>I.2) Chemicals (N=49)</td>
<td>0.055</td>
<td>0.042</td>
<td>0.18</td>
<td>0.076</td>
<td>0.010</td>
</tr>
<tr>
<td>I.3) Metal-Founding, Metalwork (N=155)</td>
<td>0.253</td>
<td>0.107</td>
<td>0.35</td>
<td>0.260</td>
<td>0.064</td>
</tr>
<tr>
<td>I.4) Paper and board industry (N=42)</td>
<td>0.103</td>
<td>0.316</td>
<td>0.23</td>
<td>0.125</td>
<td>0.334</td>
</tr>
<tr>
<td>I.5) Rubber Products (N=65)</td>
<td>0.229</td>
<td>0.276</td>
<td>0.45</td>
<td>0.219</td>
<td>0.280</td>
</tr>
<tr>
<td>II. Equipment Goods (N=253)</td>
<td>0.232</td>
<td>0.211</td>
<td>0.35</td>
<td>0.224</td>
<td>0.221</td>
</tr>
<tr>
<td>II.1) Houseware and Electrical Machinery (N=58)</td>
<td>0.148</td>
<td>0.161</td>
<td>0.28</td>
<td>0.168</td>
<td>0.121</td>
</tr>
<tr>
<td>II.2) Machinery, Rail and Road transportation Equipment (N=195)</td>
<td>0.257</td>
<td>0.191</td>
<td>0.37</td>
<td>0.243</td>
<td>0.251</td>
</tr>
<tr>
<td>III. Consumer Goods (N=279)</td>
<td>0.209</td>
<td>0.102</td>
<td>0.33</td>
<td>0.232</td>
<td>0.138</td>
</tr>
<tr>
<td>III.1) Textile, Leather and Footwear (N=138)</td>
<td>0.210</td>
<td>0.110</td>
<td>0.31</td>
<td>0.232</td>
<td>0.113</td>
</tr>
<tr>
<td>III.2) Wood and Furnitures (N=90)</td>
<td>0.230</td>
<td>0.370</td>
<td>0.36</td>
<td>0.234</td>
<td>0.279</td>
</tr>
<tr>
<td>III.3) Printing and Publishing (N=51)</td>
<td>0.213</td>
<td>-0.03</td>
<td>0.34</td>
<td>0.204</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Note: N= number of firms in the industry. Standard errors in parentheses.
Table 8: GMM estimates

<table>
<thead>
<tr>
<th>Dependent variable w</th>
<th>Model (a)</th>
<th></th>
<th>Model (b)</th>
<th></th>
<th>Model (c)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GMM1</td>
<td>GMM2</td>
<td>GMM1</td>
<td>GMM2</td>
<td>GMM1</td>
<td>GMM2</td>
</tr>
<tr>
<td></td>
<td>(first step)</td>
<td>(two step)</td>
<td>(first step)</td>
<td>(two step)</td>
<td>(first step)</td>
<td>(two step)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.201</td>
<td>0.205</td>
<td>0.080</td>
<td>0.081</td>
<td>0.205</td>
<td>0.208</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.035)</td>
<td>(0.049)</td>
<td>(0.047)</td>
<td>(0.047)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>$\gamma\beta$</td>
<td>0.066</td>
<td>0.070</td>
<td>0.109</td>
<td>0.107</td>
<td>0.118</td>
<td>0.119</td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
<td>(0.048)</td>
<td>(0.040)</td>
<td>(0.036)</td>
<td>(0.045)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Sargan test (p-value)</td>
<td>34.0</td>
<td>29.8</td>
<td>0.58</td>
<td>0.80</td>
<td>50.5</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Note: standard errors are reported in parentheses.

The instrumental variables are:
Model (a) Exogenous instruments:
  import and export prices, regional unemployment rate, Herfindhal index (at t, t-1, t-2).
Model (b) Lagged instruments:
  quasi-rent per worker, regional wage and turnover rate (at t-2, t-3, t-4).
Model (c) Exogenous instruments + Lagged instruments (a)+(b).
The standard error of $\hat{\beta}$ is computed from the matrice of variance of $(\hat{\gamma}\beta, \hat{\gamma})$.

Test of compatibility of both sets of instruments:
Sargan(x)-Sargan(y) < $\chi_{95\%}^2(DF(x) - DF(y))$ for x=c and y=a and b, where DF is the number of degrees of freedom.

Table 9: Comparison between GMM estimates and within estimates

<table>
<thead>
<tr>
<th>Dependent variable w</th>
<th>Without industrial dummies</th>
<th>With industrial dummies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within</td>
<td>GMM (two step)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.175</td>
<td>0.208</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.035)</td>
</tr>
<tr>
<td>$\gamma\beta$</td>
<td>0.150</td>
<td>0.119</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.86</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.057)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.28</td>
<td>Sargan (p-value)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.28</td>
</tr>
</tbody>
</table>

Note: standard errors are reported in parentheses.
The instrumental variables for GMM are :
- import and export prices, regional unemployment rate, Herfindhal index (at t, t-1, t-2).
- quasi-rent per worker, regional wage and turnover rate (at t-2, t-3, t-4).
Table 10: GMM estimates by industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>GMM1</th>
<th>GMM2</th>
<th>Sargan (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>γ</td>
<td>γβ</td>
<td>γ</td>
</tr>
<tr>
<td>I. Intermediate Manufactured Products (N=383)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.1) Mining, Metal, Steel basic industries and Materials (N=72)</td>
<td>0.080</td>
<td>0.229</td>
<td>0.080</td>
</tr>
<tr>
<td>I.2) Chemicals (N=49)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.3) Metal-Founding, Metalwork (N=155)</td>
<td>0.329</td>
<td>0.106</td>
<td>0.332</td>
</tr>
<tr>
<td>I.4) Paper and board industry (N=42)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.5) Rubber Products (N=65)</td>
<td>0.210</td>
<td>0.211</td>
<td>0.234</td>
</tr>
<tr>
<td>II. Equipment Goods (N=253)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.1) Houseware and Electrical Machinery (N=58)</td>
<td>0.259</td>
<td>0.162</td>
<td>0.235</td>
</tr>
<tr>
<td>II.2) Machinery , Rail and Road transportation Equipment (N=195)</td>
<td>0.193</td>
<td>0.142</td>
<td>0.162</td>
</tr>
<tr>
<td>III. Consumer Goods (N=279)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III.1) Textile, Leather and Footwear (N=138)</td>
<td>0.239</td>
<td>0.070</td>
<td>0.225</td>
</tr>
<tr>
<td>III.2) Wood and Furnitures (N=90)</td>
<td>0.235</td>
<td>0.255</td>
<td>0.233</td>
</tr>
<tr>
<td>III.3) Printing and Publishing (N=51)</td>
<td>0.265</td>
<td>0.226</td>
<td>0.264</td>
</tr>
</tbody>
</table>

Note: Standard errors in parentheses.
The set of instruments used is the same as the one described in table 9.