The Dynamics of Wages and Employment

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Abstract:

In this paper, we demonstrate substantial heterogeneity in wage growth across firms within industry, and across workers within firm in Belgium. This variation does not appear to be consistent with simple measurement error stories, but rather seems to be evidence of a more complex labor market. We also empirically show how different the wage and employment adjustment process looks at different levels of aggregation.

Résumé:

Dans ce travail, nous montrons le haut niveau d'hétérogénéité dans la croissance des salaires entre firmes d'une même industrie et entre travailleurs d'une même firme. Ces différences ne semblent pas être causées par de l'erreur de mesure, mais semblent plutôt indicatrice de l'existence d'un marché du travail complexe. Nous montrons également les différences entre les processus d'ajustement de l'emploi et des salaires à différents niveau d'agrégation.

1. Introduction

Imagine that shifts in product demand were the dominant force shaping changes in wages and employment. This might seem plausible if only because the alternative case, for labor supply shifts, is so implausible. We know that employment growth at the firm level, as well as the underlying gross flows of job creation and destruction, or of accessions and separations, are idiosyncratic. Almost all of the variation in these gross and net employment flows is orthogonal to occupational structure, to region, to broad industry, and to the aggregate fluctuations of the macro-economy (Leonard, 1987). Moreover, firm or establishment growth rates tend to be negatively auto-correlated.

Shifts in labor supply predict a different pattern. Aside from wars, the black plague, the Marial boat-lift, and some strikes, we think of supply-shifts as being ponderous and pervasive, developing over years and affecting the economy broadly. If shifts in labor supply were the dominant force behind employment change, we would expect to see employment changes that were widely shared across the economy, persistently auto-correlated from year to year, and negatively correlated with wage changes. Instead the employment change we see at the firm or establishment level is idiosyncratic, high-frequency, and negatively auto-correlated.

Labor demand shocks could produce these patterns. This paper explores evidence of the relative importance of demand, supply, and measurement-error in determining wages and employment. Because the employment fluctuations seem too heterogeneous and transient to be caused by supply shifts, we focus on the adjustment path through product markets. The next section sketches the employment and wage implications of some common labor market models. To describe these changes, we use longitudinal matched employee-employer data, described in Section 3. Section 4 characterizes the extent of employee, firm, and job-match turnover. All are substantial. A broad measure of wage rigidity is the degree to which aggregate wages adapt through the entry and exit of firms and workers. If most adjustment occurs not within firm or job-match, but rather through changes in the composition of industries and work-forces, that indicates a high relative cost of adjusting wages within ongoing firms and job-matches.

While we find substantial worker and firm turnover, it has little net effect on wage growth or its variance. High infant mortality rates for new firms and for new job-matches

mean that the wages of exits look very much like the wages of the entrants they just recently were. The net effect of this churning is small because the two (entry and exit) offset each other.

Finding that most wage change occurs within ongoing firms and job-matches rather than through changes in the population of firms or workers, we turn in Section 5 to industry patterns of wage change. Product market shocks could be expected to cause broad wage changes within the associated labor market. We search across different levels of disaggregation for the common wage changes of a labor market.

Because of differences in cost-structures, the labor demand of all firms within an industry need not respond identically to a common product demand shift, so evidence on the heterogeneity across firms of net or gross employment flows need not preclude firms in the same market facing the same shock. But if they are in the same market and face the same demand shock, we would expect to see a common wage effect. That is one definition of a labor market.

We do not find any aggregation of firms into industries, or of workers into firms, in which the common component of wage changes dominates heterogeneity within units.

We end by examining the adjustment paths of wages and employment at the firm level. Section 6 shows the time series properties of these changes, and the correlation between wage and employment change. We demonstrate the pitfalls of attempting to infer the underlying micro-economic behavior from more aggregated data. The agglomeration effects are large enough to undercut attempts to infer micro behavior from macro patterns, or vice versa.

2. Some Theoretical Predictions of Wage Growth

A Simple Measurement-Error Model

This paper will demonstrate substantial heterogeneity in wage growth. It is natural to suspect measurement error (M.E.), and it is worthwhile to consider the implications of M.E. before delving into other possible interpretations of our results with more substantive implications.

While M.E. is a natural suspect for heterogeneity, there are some a priori reasons to discount it here. First, the data comes not from a survey, but from administrative records. The taxes paid by employers and the Social Security benefits received by employees are direct functions of the wage date used here. Unlike the usual survey situation, employers have a direct financial interest in correcting positive M.E., and employees have a direct financial interest in correcting negative M.E. To the extent that it cares about the integrity of the system, the government itself has an interest in reducing M.E. Indeed, with some frequency we encounter evidence of administrative corrections.

Of course motives and mechanisms to correct errors may reduce but not preclude errors. Because there is no limit to the complexity of M.E. models, it is impossible to conclusively test against all possible M.E. We can and do test against a simple common form of M.E. Suppose the measured logarithms of individual wage levels, W, equals the logarithm of the true wage, Z, plus an i.i.d. measurement error:

$$W_{it} = Z_{it} + e_{it}$$

First note that the law of large numbers states that as N, the number of individuals in the aggregate, increases, the signal to noise ratio increases.

Now the change in the logarithm of measured wages over time is:

$$\Delta W_{it} = \Delta Z_{it} + \Delta e_{it} .$$

If Z does not change, then this predicts that the correlation of wage growth rates will be negatively correlated – ½ in adjoining years and zero for years more than one year apart.

Finally, M.E.'s only real effect should be on the researchers that it misleads. If the wage changes we observe here are purely artifacts of M.E., then by definition they can have no impact on market behavior. In other work (Leonard and Van Audenrode, 1993) we observe significantly faster wage growth in firms receiving government subsidies. We also observe lower turnover rates in firms with steeper wage profiles. In a

following section, we shall consider the correlation between wage and employment changes, a correlation predicted to be zero if either of them represents M.E.

Equity Theories

Equity theories posit some (unspecified) comparison group that a worker looks to judge whether his wage is fair. A wage perceived to be unfairly low results in loss of morale and of output. The endogenous nature of the wage comparison group, the effect of "unfairly" high wages, and the impact of mobility and choice are not fully considered in these models. They do however predict a tendency toward common wage changes within comparison groups. The theory is only testable if a comparison group is specified. Our natural comparison group, among the infinite possibilities, is the group of workers within the same establishment. Strong firm wage effects are consistent with this testable version of equity theories.

Industrial Relations

Scholars of industrial relations have long stressed the rule of institutional factors in shaping wage structure. "Orbits of coercive comparison," "wage gradients" and "wage contours" have long been described in industrial relations studies that label the historical pattern of relative wages across industries. These studies can be considered antecedents of equity theory with the comparison group specified by direct institutional knowledge.

Unions act to reduce wage inequality within firms, across firms within industry. Descriptions of European unions as stronger than their counterparts in the US imply greater uniformity as unions attempt to take wages out of competition through collective-bargaining and through government regulation. One expects to see little individual worker heterogeneity in wage growth within firm, or firm heterogeneity within industry.

3. The Longitudinal Matched Employer-Employee Data

We use longitudinal matched employer-employee data for the population of private employment in Belgium in the years 1983, 1984 and 1985. We calculate the average daily earnings of each worker at each firm each year, and use this in the

subsequent analysis. We also calculate the total days worked at each firm each year for use in our measure of employment growth.

4. A Typically Inflexible Western European Economy

After more than a decade of double-digit unemployment and weak aggregate job growth, it has become common to describe the economies of Western Europe as ensnared in short-sighted regulations that hinder job creation and forestall job destruction. Besides directly raising the cost of terminating an employment spell, labor market flexibility is also reduced by collective bargaining, institutions and national laws that limit wage adjustments. Product market policies also affect the labor market. Industrial subsidies to failing companies reduce the incentive to moderate wages and reallocate jobs.

Despite these policies to promote a more sclerotic and ossified Europe, jobs and firms continue to be born and to die at substantial rates (see Table 1). Of all private establishments in existence (with at least one paid employee) in 1983, more than one in five had ceased to exist by 1985. Note that this 21% extinction rate should not include mergers and acquisitions. Perhaps more remarkable for a paragon of Eurosclerosis (Belgium has been a league leader in the duration of unemployment) is the establishment birth rate: 21.8% of all the establishments in existence in 1985 had come into existence after 1983. While these rates may be below those of the U.S., they still reveal an active margin of substantial establishment entry and exit concentrated among small firms. The difference between large established employers and new small employers appears greater in Belgium than in the US. While job and firm turnover among large firms is dampened in Belgium compared to the US, the cross-country differences among small firms are muted.

A high infant mortality rate for new firms (and for new employment spells) means that the characteristics of establishments (and employees exiting employment spells) will look much like those of the establishments that enter (and employees that begin employment spells). In this case, both entering and exiting establishments tend to be about 1/3 smaller than ongoing establishments.

The entry and exit of establishments are themselves significant factors in the creation and destruction of jobs. In other words, to understand employee turnover it helps to understand employer turnover. Roughly between 5 and 10 percent of new employment spells are in new establishments. A similar percent of ending employment spells are in dying establishments. One can, of course, make those rates as small or as large as one likes by compressing or expanding the time frame. As in the U.S., most job turnover occurs in ongoing establishments.

Each year about one in every six Belgian employment spells comes to an end or begins. Again, because of high infant mortality rates for new job matches, these are tightly linked events. These rates are also higher in smaller establishments. This reflects both the higher turnover rates of the establishments themselves, as well as the wage premium paid at larger establishments.

Labor markets adjust through the reallocation of workers across firms. The more mobile workers are, the less pronounced the wage differential required to promote this reallocation and the closer the approximation to a perfectly competitive market. Of the workers in private employment in both 1983 and 1985, 87.5 percent were in the same, continuous, employment spell. That means that more than 6 percent of workers move from one employer to another during a year. Again this rate is lower than in the U.S., but it suggests an active labor market with enough mobility to place pressure on competitive wage differentials. There are 10 to 13% more spells than workers in any year both because of this movement from one employer to the next, and because a small proportion of workers hold multiple concurrent jobs.

The Wage Adjustment Process: Adaptation or Extinction

Consider two extremes of wage rigidity. In the first, wages are perfectly flexible and fully and immediately change to re-equilibrate in response to shifts in demand or supply. Such supply and demand shifts would then result in widely shared wage changes within a labor market. At the other extreme lies a putty-clay model of wage adjustment. Nominal wage paths once set do not change. The only mechanisms for aggregate wages to respond to supply or demand shifts is through inflation of the turnover of workers and

firms. Worker and firms whose wages have become too high exit, and low wage workers and firms enter. Diffused wage changes are a sign that the cost of wage adjustment within firms are relatively low. Aggregate wage changes that occur primarily through firm and worker turnover indicate that it is costly to change wages within firms.

We disaggregate the growth of mean wages in the sample between 1983 and 1985 into wage growth among stayers (employees who stay in the same firm) and changes due to the changes in the composition of the workforce (entering and exiting firms, and workers beginning and ending employment spells) as follows:

The mean log wage in 1985 can be written as $\bar{w}_{85} = \sum \frac{w_{i,85}}{N}$, where i represents all the workers holding a job in 1985. This measure can be decomposed as the following weighted sum; $\bar{w}_{85} = \frac{S}{S+E}\sum \frac{w^{S}{}_{i,85}}{S} + \frac{E}{S+E}\sum \frac{w^{E}{}_{i,85}}{E}$, where S represents the number of workers staying within the same firm between 1983 and 1985, and E represents the number of workers starting a new spell of employment (new entrants and jobs switchers) in 1985. A comparable decomposition can be performed on the 1983 mean log wage, which can be written as: $\bar{w}_{83} = \frac{S}{S+L}\sum \frac{w^{S}{}_{i,83}}{S} + \frac{L}{S+L}\sum \frac{w^{L}{}_{i,83}}{L}$, where L is the number of worker ending their spell of employment in 1983. The change in mean log wage can be written as:

$\Delta\bar{w} = \frac{S}{S+E}\sum \frac{w^{S}{}_{i,85}}{S} - \frac{S}{S+L}\sum \frac{w^{S}{}_{i,83}}{S} + \frac{E}{S+E}\sum \frac{w^{E}{}_{i,85}}{E} - \frac{L}{S+L}\sum \frac{w^{L}{}_{i,83}}{L}$, which can be approximated as: $\Delta\bar{w} \approx \frac{S}{S+E}\sum \frac{w^{S}{}_{i,85} - w^{S}{}_{i,83}}{S} + \frac{E}{S+E}\sum \frac{w^{E}{}_{i,85} - w^{L}{}_{i,83}}{E} + \varepsilon$, where e captures the impact of the approximation, i.e. the variation in the proportion of stayers and leavers between the two years. An additional decomposition can be performed within entrants to distinguish entrants into new firms and entrants into existing firms, and to distinguish between leavers because of the death of the firm and others.

Most wage adjustment takes place in continuing employment spells within continuing firms. Between 1983 and 1985, the mean log wage increased by .069. Table

2 breaks this aggregate 6.9 percent wage change down into a 6.4 percent point change among stayers, a 0.2 percentage point increase because entering firms have slightly higher wages than exiting firms, a 0.5 percentage point increase because workers who enter have slightly higher wages than do workers who exit, and a 0.2 percentage point decline because the proportion of new firms and workers exceeds that of exiting firms and workers. Most of the aggregate wage change occurs in continuing employment spells among firms and workers that stay in the sample rather than through the entry and exit of firms and workers, or the ending and beginning of employment spells.

Similar result holds when we weight wages by days worked per year (bottom panel of Table 2) rather than weighting each employment spell equally irrespective of its duration (top panel of Table 2). In all categories considered, full-year workers are paid more per day than are part-year workers. The wages of full-time workers appear slightly more rigid.

One reason for the minor impact of firm or worker exit and entry on the change in aggregate wages is infant mortality. Wages are about 25 percent lower at new firms, and 27 percent lower at other new employment spells, than at continuing employment spells. Although they control for no other factors, these are large differences. Despite these large differences between the active margin and the stable core, and the substantial rate of entry into new employment spells (34% of all spells start within the past 2 years), worker and firm turnover hardly change aggregate wage levels. This is because the effects of entry are largely offset by those of exit. Both new firms and new employment spells have high infant mortality rates. In consequence, firms and workers that exit look very much like those that enter. Those that exit tend to be those which have recently entered. In this case the rates of exit are similar to the entry rates, and the wage levels among exits are similar to those among entrants.

Wages are 20 percent lower at exiting firms, and 17 percent lower at spells that end for other reasons, than they are in spells that continue (on a days weighted basis). That excessively high wages are harmful to the health of the firm does not imply that most firms deaths are caused by high wages. The low wages among exits and the substantial exit rate concentrated among recent entrants are consistent with a high rate of learning about mistakes and mismatches soon after entry

5. Heterogeneous Wage Growth Within Industries and Firms

If a labor market is defined as the unit within which common wage changes are commonly observed, then the heterogeneous wage changes we observe suggest the ideal type is elusive in practice, at least within the units examined here. We examine potential labor markets at progressively finer degrees of industry disaggregation but always find substantial remnant heterogeneity.

Table 3 shows a set of decompositions of the variance of wage growth for 1.7 million workers in continuing employment spells in firms whose industry could be identified. The top panel is for wage growth, the bottom panel is for the residual of wage growth after controlling for individual sex, blue-collar, age, tenure and the squares of the last two. Each panel reports progressively finer disaggregation of industry, until in the limit each firm is treated as a separate industry. Suppose each firm operated in a single industry. Then if any level of industry disaggregation corresponded to a labor market, we would expect to see evidence of that labor market here in the form of greater commonality of wage changes.

As the level of disaggregation increases, the proportion of wage growth variance accounted for by variation between rather than within units (industries) increases. However, this is an unavoidable result, so meaningless by itself. More than 98% of the variation in individual wage growth occurs within industries whether defined at the 1, 2, or 3 digit SEC level. Even 3-digit industry is not of much use in accounting for variation in individual wage growth. The vast majority of wage growth variation occurs within industry no matter how fine the dissaggregation. At the extreme, if each firm is assumed to be in a distinct industry, 83% of wage growth variation is still found within industry (in this case: firm).

Labor economics predicts a number of forms of individual heterogeneity within a firm. Different investments or returns to general or specific human capital could create heterogeneous wage growth, as could the revelation of information concerning productivity. In the absence of direct measures of productivity or of human capital, it has become commonplace to use tenure and age as proxies. The tenure and age proxies (together with their squares) typically used for human capital, together with individual

controls for sex and broad occupational category have significant impacts on wages, but still leave 82% of the variation in individual wage growth within firm, as the bottom panel of Table 3 shows.

In some settings, one might also expect that occupations rather than industries delineate labor markets. Even so, once we disaggregate to the firm level the distinction between industries and occupations may be minor. Each firm averages 15 employees who are likely to be found in a small number of occupations. In other words, the firm becomes a useful proxy for occupation. Perhaps, but the vast majority of wage growth variation still occurs within form, and within broad occupational category.

Finer disaggregation of industry cannot reveal a labor market with homogeneous wage growth. Maintaining the assumption of one industry per firm, any such dissagregation would be a linear combination of firms. But even when each firm is considered a separate industry, at most 18% of the variation in individual wage growth is accounted for by differences across firms. Firms are by far the most important single correlate of wage growth, but even so they leave much wage growth unaccounted for.

Homogeneous vs. Heterogeneous Wage Growth Industries

The list of factors that might affect wage growth is exceedingly long. The subset that is unobserved is only slightly shorter. Here we explore, rather than test, differences in the dispersion of firm and individual wage growth across industries. To ensure that firm wage growth is not affected by the entry or exit of workers, we limit the sample to continuing spells of employment within a firm. Firm wages then cannot change because of changes in the identity of employees. We control for wage growth due to age, sex and location, so differences in individual or firm wage growth in Tables 4, 5, and 6 cannot be due to the common returns to age, sex, or location. To guard confidentiality only industries with at least 25 firms are considered. Questions of dispersion across units become less meaningful as the number of units approaches either extreme: one unit per economy or one unit per underlying observation.

In every one, two and three digit industry with at least 25 firms, more than 90% of the variance in wage growth across employees is within rather than across firm.

We are interested not only in the degree of wage growth and dispersion across workers within firm, but also in the degree of wage growth dispersion across firm within industries. To reduce the impact of individual idiosyncrasies, and of measurement-error at the individual level, we calculate the average within firm of individual wage growth conditional on the economy-wide returns to individual age, sex and region.

In every 1, 2, or 3 digit industry with at least 25 firms, there is substantial variation in wage growth across firms. At the 1 digit SEC level, the standard-deviation of firm mean residual wage growth ranges from 9.5 percent in construction to 23 percent in finance.

Before considering substantive explanations for these differences across industry, consider what these differences across industry imply for the null hypothesis that residual wage growth variation represents measurement error. The simple measurement-error hypothesis does not predict systematic differences across industry that persist over time. The ranking of industries from high to low wage growth dispersions is similar over various time periods.

The simple measurement error hypothesis does predict that as the number of workers within a firm increases to N, the variance of average firm wage growth should fall by 1/N. The null hypothesis that all residual wage growth is i.i.d. measurement error does not fit the data. Taking the average of residual wage growth within firm hardly reduces its standard-deviation. Nor do industries with larger average firm size show systematically lower dispersion across firms. The standard-deviation of residual wage growth falls when we take the firm averages but it does not fill the factor of $1/N^2$ predicted by the measurement-error model.

While there are some cases, such as finance, where an industry has both high dispersion across firms and low average size, in general there is no significant correlation between wage growth dispersion and average firm size.

Consider then the substantive results in Table 4, 5 and 6. First, there is substantial dispersion across individuals in residual wage growth within nearly all industries. Table 5 shows selected 4 digit SEC industries (blue-collar) and 3 digit industries (white-collar) which we believe to be characterized by relatively homogeneous work forces. Consider for example, breweries or slaughter-houses. We believe there is little dispersion in

human capital or still requirements across plants, or across blue-collar workers within plant in these highly disaggregated industries. Nevertheless, the standard deviation across workers is 9.5% in breweries and 12-19% in slaughter- houses. Across firms the standard deviations are 6.4 percent and 9.0 percent respectively. In other words, to encompass two-thirds of the 86 breweries (with and across 5C continuing blue-collar employees each) requires a range of 12.8% in firm average wage growth. This range cannot be accounted for by employees or firm turnover, nor by differences in the age, sex, or location of the employees. On the product market side, slaughter-houses sell an undifferentiated product with stable demand.

Breweries sell differentiated products. In Belgium, brand preferences are handed down from father to son, and both the total market and market shares are stable. These sectors have been largely unaffected in recent decades by changes in technology, in tastes, in trade, or in market structure.

Table 7 shows the 2 digit industries at the extremes of the distribution of wage growth variance. The lower tail includes large scale manufacturing and mining industries often with strong unions or a small number of firms. In contrast, the high-variance industries are found in the service sector.

Dynamics

Here we examine the nature of the labor market adjustment process over time. We show how important aggregation effects are by comparing auto-correlation matrices of growth rates at the individual, firm, and 3,2, and 1 digit SEC industry levels. The most basic questions to ask concerning employment and wage changes are first, are they just measurement-error, and second, do they reflect shifts in demand or in supply.

The simple measurement-error model predicts that growth rates in neighboring years will be negatively correlated – ½ . Growth rates more than two years apart should be uncorrelated. Table 8 shows the auto-correlation matrices for individual wage growth and residual wage growth (controlling for age, sex, tenure, calendar year, and broad occupation). These do not match the patterns predicted by the simple measurement-error model.

There is little trend in individual wage growth, or in residual wage growth. Past wage growth is of little help in predicting future growth. The correlation of wage growth one year apart ranges from -.16 to +.14, far less in magnitude and often of the opposite sign than the – ½ predicted by measurement-error. The shift in behavior after 1983 may be associated with a change in government anti-inflationary policy intended to cap real wage growth at the firm level.

The absence of trends in individual wage growth is surprising from the perspective of many models. After all, these are not asset prices. We do not expect any innovation in the future value of human capital to be capitalized in today's flow price for labor services. Human capital models predict steeper wage profiles where greater investments have been made.

Increasing wage inequality has been observed in a number of developed economies. Trade and technology induced demand shifts are usually thought to be the causes. These forces are usually thought of as causing wages to adjust over a span of years. Increasing dispersion for such systemic reasons requires positively auto-correlated wage growth at the individual level. We do not see this.

Any model with quadratic adjustment costs predicts a drawn out process of partial adjustment, and so positively correlated growth rates. Fixed adjustment cost models predict lumpy adjustment and so can support the negative auto-correlation seen after 1983. We believe changes in labor supply, trade, or technology develop gradually over a number of years, and so would predict positive auto-correlations. Table 8 is then too successful in presenting evidence in conflict with a number of different models. Rather than the common problem of having too many models that could fit the data, we find ourselves in the unusual position of having one too few.

At the firm level there is less systematic behavior. The top panel of Table 9 shows the auto-correlation matrix for average wage growth at the firm level. All of these auto-correlations are negative, all are significant at conventional levels (which means little in such large populations), and all are small in magnitude. Firms with mean wage growth that is unusually fast one year tend to have below average wage growth in subsequent years, but the magnitudes are minor. There is also evidence (in regressions not shown here) of an error correction process, or market equilibration process at work at

the firm and individual level. Firms and individuals that start with unusually high wage levels subsequently have below average wage growth. Again, the magnitudes are small.

As the level of aggregation increases (on the identical underlying micro data), the auto-correlations change dramatically. At the 1-digit SEC level, we see strong positive auto-correlations. This type of evidence has long been taken as evidence of slow and costly adjustment. It is mistaken to infer micro-behavior from the macro-patterns (Bentollila and Bertola, Hamermesh). As we disaggregate more, the magnitude of the auto-correlations generally drop and then flip sign once we reach the firm level. Again, there is evidence of a shift in behavior after 1983. By construction, none of the differences across levels of aggregation can be due to entry or exit of workers from the sample, although the movement of workers across units within the sample can affect these correlations. Disaggregating does not reveal evidence of labor market supply or demand shocks that take more than one year to adjust to.

More importantly, the implicit weights differ across levels of aggregation. The top panel of Table 9 gives equal weight to each firm. The relative weight given to small firms drops once we aggregate to industry level. One interpretation of Table 9 then is that larger firms show more persistence in wage growth and take longer to adjust than do smaller firms. This is consistent with greater bureaucratic restrictions within larger firms, as well as with greater union power.

Table 10 repeats this analysis for employment growth. Here the aggregation patterns are simpler and clearer. What is essentially uncorrelated at the firm level becomes more strongly and positively correlated at more aggregated levels. The slow labor force adjustment traditionally observed at the macro level does not support an inference of slow adjustment at the micro-level. While aggregate employment may only slow shift across industry lines, the mass of small firms appear able to quickly adjust their employment.

A demand shift predicts positively correlated changes in wages and employment. A supply shift predicts negatively auto-correlated changes in wages and employment. Our prior is that supply shocks are an implausible source of transient and idiosyncratic changes in employment and wages. The competitive labor market model of course predicts zero correlations of wage and employment changes at the firm level within a

competitive market. There is one wage level within a competitive market, and by definition, all firms are wage-takers.

Contemporaneous wage and employment growth at the firm level tend to be negatively correlated (Table 11). By construction, none of this can reflect changes in composition within each firm. A growing firm tends to hire younger workers with lower wages and faster wage growth. A shrinking firm may layoff low tenure low wage workers, although this is less often the case in Belgium than in the US. The sample here is limited to workers in the same firm in both years, so the identity of the workers within each firm is held fixed.

In market clearing models, a negative correlation between employment and wages happens when supply shocks hit. As we have already noted, because of their nature, we do not believe that supply shocks can explain movements in wages which are so firm specific. There exists a variety of non-market clearing models, however, which would predict such relationship. Most models where wages are set by unions or insiders on the firm's demand curve for labor would predict a negative correlation between employment and wages, all else being equal. Rent seeking behavior (by unions or insiders) might explain these idiosyncratic movements in wages are firm level, but this would still leave substantial within firm heterogeneity in wage growth.

Employment growth tends to be followed by wage growth in the following year at the firm level, but the magnitude is small. All of the off-diagonal elements are positive, but small. Once we aggregate, most of the correlations are positive, but few are significant.

While the negative contemporaneous correlation deserves further investigation, the magnitudes of generally positive correlations between wage and employment growth at the firm level seem small enough that the model of these firms as wage-takers in a competitive model seems a decent approximation.

Conclusion

The results in this paper are simple, unfair, and disquieting. It is a paper about (1 minus R-squared). That perspective is inherently an unfair because the implicit standard is impractical. The social sciences cannot be expected to account for all of the variation in human or firm behavior. Rather we are successful when we can model and predict some of the systematic parts. We and others have previously shown evidence of heterogeneity in employment growth rates at the firm level, but economics makes stronger predictions for homogeneous wage changes than for homogeneous employment changes within a labor market. It is from this perspective that some of the results are disquieting.

We demonstrate substantial heterogeneity in wage growth across firms within industry, and across workers within firm in Belgium. This variation does not appear to be consistent with simple measurement error stories, but rather seems to be evidence of a more complex labor market. We also empirically show how different the wage and employment adjustment process looks at different levels of aggregation.

The overall picture is of a West European labor market (of the type typically described as suffering from Eurosclerosis) that shows wage and employment flexibility, and substantial heterogeneity in wage and employment growth within detailed industries.

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Table 1: Employment and Wages – Overview:

Workers

1983	2,450,133
1985	2,452,456
Present both years	2,072,265
Entering Database in 1985	380,191
Leaving Database in 1985	377,868

Firms

1983	171,716
1985	173,754
Present both years	135,872
Entering Database in 1985	37,882
Leaving Database in 1985	35,844

Spells of Employment

1983	2,705,794
1985	2,760,251
Spells continuing over both years	1,813,324
Spells Starting in 1985	946,927
Spells Ending in 1985	892,470

Wages

Mean Log. Wage in 1983	7.436 (.502)
Mean Log. Wage in 1985	7.505 (.497)
Δ Mean Log Wage	.069
Mean Δ Log Wage – Continuing Employment Spells	.097 (.180)
Mean Δ Log Wage – All Spells	.102 (.278)

Table 2: Decomposition of Wage Growth:Individual Workers

Unweighted Data Δ Mean Log Wage (All Employment Spells) = .069

	New Spells New Firm	New Spells Other Reasons	Continuing Spells	Ending Spells Other Reasons	Ending Spells Dying Firm
Mean Log Wage 1985	7.2977 (.5107)	7.3236 (.4631)	7.6019 (.4818)	-	-
Mean Log Wage 1983	-	-	7.5051 (.4739)	7.3004 (.5352)	7.2742 (.4899)
Number of Observations	177,603	769,324	1,813,324	730,122	162,438
Δ Mean Log Wage			.0968		
ΔEntrants / Leavers				.0232	
ΔNew Firm /Dead Firm					.0234

(standard deviation in parenthesis)

Decomposition of Δ Mean Log Wage = .069

Changes due to:

- Δ Mean Log Wage of Stayers: = .064
- Δ Mean Wage Entrants / Leavers = .005
- Entry and exit of Firms = .002
- Δ Proportion of Stayers/Entrants/New Firms = -.002

Weighted Data* Δ Mean Log Wage (All Employment Spells) = .071

	New Spells New Firm	New Spells Other Reasons	Continuing Spells	Ending Spells Other Reasons	Ending Spells Dying Firm
Mean Log Wage 1985	7.3924	7.3739	7.6393	-	-
Mean Log Wage 1983	-	-	7.5467	7.3802	7.3460
Number of Observations	177,603	769,324	1,813,324	730,122	162,438
Δ Mean Log Wage			.0926		
Δ Entrants / Leavers				-.0063	
ΔNew Firm /Dead Firm					.0464

Decomposition of Δ Mean Log Wage = .071

Changes due to:

- Δ Mean Log Wage of Stayers: = ..061
- Δ Mean Wage Entrants / Leavers = -.002
- Entry and exit of Firms = .003
- Δ proportion of Stayers/Entrants/New Firms = .009

* Weights = number of days worked during the year.

Table 3: Decomposition of the Variance of Wage Growth Continuing Spells Only

Wage Growth
Mean Wage Growth = .0966
Variance Wage Growth = .0289
N = 1,705,446*

Contribution to the Total Sum of Squares of Wage Growth

Grouping	Within	Between	% Explained by Between
1-Digit SEC (N=10)	49,228.5	143.8	.003
2-Digit SEC (N=62)	48,993.7	378.6	.008
3-Digit SEC (N=263)	48,825.0	547.3	.011
Firm (N=115,473)	41,082.1	8,290.3	.168
Men – Women	49,368.4	3.9	.000
Blue Collar – White Collar	49,211.4	160.8	.003

Wage Growth Residual

Residual Computed after regression of Wage Growth on Age, Age squared, Tenure, Tenure Squared, control for censored Tenure, Sex, and BC/WC Dummy.

Mean Residual = 0
Variance residual = .0281
N = 1,582,851*

Contribution to the Total Sum of Squares of Wage Growth Residuals

Grouping	Within	Between	% Explained by Between
1-Digit SEC (N=10)	44,395.7	99.6	.002
2-Digit SEC (N=62)	44,161.9	333.6	.007
3-Digit SEC (N=263)	43,972.9	522.5	.012
Firm (N=115,473)	36,676.5	7,818.9	.176

* Observations in Firms whose industry could not be identified and observations with missing values have been dropped.

Table 4: Dispersion in Wage Growth

Average wage growth at individual level not explained by age, sex or region. – by industry

Blue collars – Continuing spells only

	Number of Workers	Standard Deviation of Mean Wage Residual
Agriculture, Fisheries (SEC 0)	7,605	.2087
Water, Energy (SEC 1)	2,256	.1155
Quarrying, Mining, Chemicals (SEC 2)	106,100	.1396
Steel (SEC 3)	158,916	.1247
Other Manufacturing (SEC 4)	196,795	.1323
Construction (SEC 5)	100,078	.1065
Sales (SEC 6)	110,130	.1846
Transportation (SEC 7)	55,219	.1899
Finance (SEC 8)	21,372	.2091
Other (SEC 9)	123,630	.1922

Average wage growth at firm level not explained by age, sex or region. – by industry

Blue collars- Continuing spells only

	Number of Firms	Standard Deviation of Mean Wage Residual
Agriculture, Fisheries (SEC 0)	2,698	.1730
Water, Energy (SEC 1)	14	.0981
Quarrying, Mining, Chemicals (SEC 2)	1,619	.1211
Steel (SEC 3)	3,948	.1029
Other Manufacturing (SEC 4)	10,658	.1336
Construction (SEC 5)	14,352	.0950
Sales (SEC 6)	26,539	.1787
Transportation (SEC 7)	3,297	.1446
Finance (SEC 8)	5,558	.2303
Other (SEC 9)	14,121	.1882

Table 5: Dispersion in Wage Growth

Average wage growth not explained by age, sex or region. – by industry
Blue collars – Continuing spells only

	Individual Level		Firm Level	
SEC 2 Digit Industry Classification	Number of Workers	Standard Deviation of Mean Wage Residual	Number of Firms	Standard Deviation of Mean Wage Residual
Agriculture, Fisheries				
1	6,048	0.1838	2402	0.17136
2	852	0.3501	155	0.219
3	705	0.1546	141	0.1142
Quarrying, Mining, Chemicals				
22	48,212	0.1324	96	0.10126
23	3,861	0.1479	126	0.09902
24	24,879	0.1340	984	0.13464
25	28,296	0.1521	403	0.10047
Steel				
31	46,881	0.1517	2315	0.10233
32	28,153	0.1177	639	0.08807
34	40,271	0.1162	381	0.09748
35	30,479	0.0865	197	0.05355
36	10,645	0.1197	141	0.08167
37	2,033	0.1721	261	0.16813
Other Manufacturing				
41	29,953	0.1543	3342	0.17214
42	22,221	0.1671	666	0.1072
43	45,034	0.1117	1013	0.10857
44	1,703	0.1692	131	0.15981
45	28,499	0.1438	1548	0.13309
46	22,499	0.0920	1573	0.09408
47	28,072	0.1177	1467	0.10598
48	11,606	0.1293	392	0.09777
49	7,208	0.1232	526	0.10671
Construction				
50	100,078	0.1065	14352	0.09532
Sales				
61	38,145	0.1551	8009	0.14704
62	2,503	0.1450	304	0.12938
63	65	0.2065	44	0.14465
64	19,120	0.1906	6022	0.19234
65	5,343	0.1866	1733	0.16111
66	28,795	0.2325	6219	0.22524
67	16,159	0.1423	4208	0.13893
Transportation				
72	32,904	0.1421	2814	0.13578
73	410	0.1462	85	0.10154
76	14,679	0.2424	103	0.24252
77	2,761	0.1712	283	0.14862
Finance				

	81	4,257	0.1857	466	0.229
	82	974	0.1480	74	0.13703
	83	15,044	0.2199	4688	0.23191
	84	525	0.1820	113	0.19924
	85	572	0.1636	217	0.2144
Other					
	91	12,604	0.1304	243	0.14344
	92	12,346	0.2503	427	0.16044
	93	15,363	0.2368	2462	0.20232
	94	501	0.1307	82	0.11198
	95	14,027	0.1666	1312	0.17876
	96	22997	0.18829	2720	0.19697
	97	4899	0.20671	746	0.21071
	98	10672	0.15948	3267	0.15174
	99	30221	0.17405	2862	0.20746

Industries with 25 firms or less have been deleted for confidentiality reasons

Table 6: Dispersion in Wage Growth – Selected Industries

Average wage growth at individual level not explained by age, sex or region. – by industry
Blue collars – Continuing spells only

	Number of Workers	Standard Deviation of Mean Wage Residual
Total	20,826	.1790
Quarrying (SEC 2312)	1,218	.1730
Glass (SEC 2471)	4,478	.0981
Slaughter Houses (SEC 4121)	1,378	.1211
Milk Processing (SEC 4131)	5,40	.1029
Sugar Refinery (SEC 4202)	2,687	.1336
Breweries (SEC 4271)	4,822	.0950

Average wage growth at firm level not explained by age, sex or region. – by industry
Blue collars- Continuing spells only

	Number of Firms	Standard Deviation of Mean Wage Residual
Total	344	.0712
Quarrying (SEC 2312)	51	.0555
Glass (SEC 2471)	7	.0101
Slaughter Houses (SEC 4121)	110	.0904
Milk Processing (SEC 4131)	77	.0639
Sugar Refinery (SEC 4202)	13	.0346
Breweries (SEC 4271)	86	.0644

Average wage growth at individual level not explained by age, sex or region. – by industry
White collars – Continuing spells only

	Number of Workers	Standard Deviation of Mean Wage Residual
Total	17,350	.1681
Pharmacies (SEC 643)	5,122	.1638
Clothing Retail (SEC 645)	10,089	.1698
Travel agencies (SEC 771)	2,139	.1706

Average wage growth at firm level not explained by age, sex or region. – by industry
White collars- Continuing spells only

	Number of Firms	Standard Deviation of Mean Wage Residual
Total	4,168	.1656
Pharmacies (SEC 643)	1,907	.1511
Clothing Retail (SEC 645)	2,001	.1787
Travel agencies (SEC 771)	260	.1611

Table 7: Industries with Highest and Lowest Variance in Wage Growth

(Industries with 100 or more firms)

Industry		Number of Firms	Standard Deviation of Mean Wage Residual
Lowest:			
Automobile Industry	35	197	0.05355
Other Transportation Equipment	36	141	0.08167
Metal Works	32	639	0.08807
Furniture	46	1573	0.09408
Construction	50	14352	0.09532
Electric and Electronic Equipment	34	381	0.09748
Rubber and Plastics	48	392	0.09777
Mineral Extraction (excluding Coal)	23	126	0.09902
Chemicals	25	403	0.10047
Highest:			
Other Services	96	2720	0.19697
Rentals (Goods)	84	113	0.19924
Leisure and cultural services	97	746	0.21071
Rentals (Housing)	85	217	0.2144
Restaurants and Hotels	66	6219	0.22524
Banks	81	466	0.229
Other Financial services	83	4688	0.23191
Other activities related to transportation	76	103	0.24252

Table 8: Intertemporal correlation of wage growth of Individuals

Stayers only.
N=1,146,704 individuals

Intertemporal Correlation of Wage Growth

Wage Growth in:

	1982	1983	1984	1985
1981	.1374	.0386	-.0051	.0101
1982		.0788	-.0086	.0143
1983			-.1558	-.0098
1984				-.1106

Intertemporal Correlation of the Residual of Wage Growth*

Wage Growth in:

	1982	1983	1984	1985
1981	.0937	.0216	-.0315	-.0106
1982		.0628	-.0344	-.0056
1983			-.1423	-.0017
1984				-.1022

* Residual obtained from a regression of wage growth (1981 to 1985) on age, age squared, sex, Blue/White collar dummy, tenure, tenure squared, and 4 dummy variables for year.

Table 9: Intertemporal Persistence of Wage Growth

Intertemporal correlation of wage growth of stayers

At Firm Level (N=84,951)

Wage Growth:	1981	1982	1983	1984	1985
1981	1.0000	- .0235***	-.0073***	-.0156***	.0112***
1982		1.0000	-.0308***	-.0122***	-.0225***
1983			1.0000	-.0902***	-.0227***
1984				1.0000	-.0883***
1985					1.0000

At 3-Digits SEC Level (N=262)

Wage Growth:	1981	1982	1983	1984	1985
1981	1.0000	.0215***	.1581***	.2130***	.2168***
1982		1.0000	.1709***	.1199*	.3146***
1983			1.0000	-.1335*	.2200***
1984				1.0000	-.2266***
1985					1.0000

At 2-Digits SEC Level (N=62)

Wage Growth:	1981	1982	1983	1984	1985
1981	1.0000	.8603***	.4838***	.2299*	.2216*
1982		1.0000	.5152***	.1285	.3211**
1983			1.0000	-.0945	.0778
1984				1.0000	-.2141*
1985					1.0000

At 1-Digits SEC Level (N=10)

Wage Growth:	1981	1982	1983	1984	1985
1981	1.0000	.9902***	.8593***	.3276	.5367*
1982		1.0000	.8508***	.3333	.6298**
1983			1.0000	.1271	.3621
1984				1.0000	.0697
1985					1.0000

***: Significant at the 1% level
**: Significant at the 5% level
*: Significant at the 10% level

Table 10 Intertemporal Persistence Employment Growth

Intertemporal correlation of employment growth

At Firm Level (N=84,951)

Employment Growth	1981	1982	1983	1984	1985
1981	1.0000	.0619***	.0208***	.0086**	.0095***
1982		1.0000	-.0008***	-.0159***	.0150***
1983			1.0000	-.0088***	.0195***
1984				1.0000	.0476***
1985					1.0000

At 3-Digits SEC Level (N=262)

Employment Growth:	1981	1982	1983	1984	1985
1981	1.0000	.4166***	.2216***	.1337**	.1142*
1982		1.0000	.3652***	.0077	.2414***
1983			1.0000	.0295	.5088***
1984				1.0000	-.0585
1985					1.0000

At 2-Digits SEC Level (N=62)

Employment Growth:	1981	1982	1983	1984	1985
1981	1.0000	.5072***	.2453*	.2195*	.2580**
1982		1.0000	.5970***	.6025***	.5560***
1983			1.0000	.55241***	.4614***
1984				1.0000	.6574***
1985					1.0000

At 1-Digits SEC Level (N=10)

Employment Growth:	1981	1982	1983	1984	1985
1981	1.0000	.9141***	.9665***	.9238***	.8916***
1982		1.0000	.9480***	.9777***	.9480***
1983			1.0000	.9480***	.9070***
1984				1.0000	.9861***
1985					1.0000

***: Significant at the 1% level
**: Significant at the 5% level
*: Significant at the 10% level

Table 11: Wage Growth and Employment Growth

Correlation between wage growth of stayers and employment growth (measured as growth in the number of days worked) – dying and newborn firms excluded.

At Firm Level (N=84,951)

Wage Growth: Employment Growth:	1981	1982	1983	1984	1985
1981	-.0859***	.0797***	.0207***	.0157*	.0067**
1982	.0441***	-.0682***	.0440***	.0150***	.0158***
1983	.0184***	.0658***	-.1356***	.0431***	.0130***
1984	.0104***	.0105***	.0334***	-.1276***	.0478***
1985	.0116***	.0167***	.0146***	.0240***	-.0697***

At 3-Digits SEC Level (N=262)

Wage Growth: Employment Growth:	1981	1982	1983	1984	1985
1981	.0140	.0385	.0847	.0656	.1034*
1982	.2891***	-.2486***	.0332	.0001	.0124
1983	-.0533	-.0056	.1651***	-.1445**	-.1118**
1984	-.0585	.0728	-.2384***	-.0048	.1125*
1985	-.0048	-.0705	.0675	.0536	-.2463*

At 2-Digits SEC Level (N=62)

Wage Growth: Employment Growth:	1981	1982	1983	1984	1985
1981	-.0054	.0281	.3204**	.0081	.2429*
1982	-.0202	.0378	.2666**	-.1407	.1751
1983	.1995	.1606	.2790	-.1260	.0962
1984	-.0146	-.0015	.1344	-.1602	.0907
1985	.0391	.0860	.1697	.0114	.1595

At 1-Digits SEC Level (N=10)

Wage Growth: Employment Growth:	1981	1982	1983	1984	1985
1981	.2158	.2486	.3335	.2202	.1937
1982	.0208	.0657	.1505	-.0769	.2472
1983	.0564	.1062	.1930	.1702	.2198
1984	.0391	.0704	.1108	-.0035	.2119
1985	.0394	.0642	.0669	-.0255	.2188

***: Significant at the 1% level
**: Significant at the 5% level
***: Significant at the 10% level**