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Abstract

Wage policies of a Russian firm and the financial crisis of 1998: Evidence from personnel data - 1997 to 2002

We use a rich personnel data set from a Russian firm for the years 1997 to 2002 to analyze how the firm adjusts wages and employment during this period in which local labor market conditions changed in the aftermath of the financial crisis in 1998. We relate the development of turnover and wages for various employment categories to alternative models of wage and employment determination. We argue that the firm's behavior is consistent with the predictions of efficiency wage models of the shirking and turnover type.

JEL classification: J23, J31, P23
Keywords: internal labor markets, wage policies of a firm, personnel data, Russia

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Wage Policies of a Russian Firm and the Financial Crisis of 1998: Evidence from Personnel Data – 1997 to 2002

1. Introduction

Observing how a firm adjusts wages and employment in response to a large shock can yield important insights about the nature of adjustment processes in labor markets. We analyze a rich personnel data set from a Russian firm for a period (1997 to 2002) that spans the Russian financial crisis in 1998, in order to shed light on crucial but largely unresolved questions about the functioning of labor markets in general. We analyze how the firm adjusts wages and employment during this period and compare the firm's behavior to the theoretical predictions arising from alternative models of wage and employment determination.

For example, do firms adapt their wage policy to changes in labor market conditions? And if so, are all workers affected in the same way, or are incumbent workers shielded from external labor market shocks as early theoretical work on internal labor markets suggests (see Doeringer and Piore 1971)?[1] We investigate how the firm adjusts wages in response to the crisis and study whether all workers are affected in the same way. Although several studies have explored to what extent internal labor markets cushion incumbent workers from external labor market shocks (e.g., Baker, Gbbs, and Holmstrom 1994; Lazear 1999; Lazear and Oyer 2004), it is still not well understood how workers' welfare is affected by firm performance over the business cycle.[2] There is evidence that the conditions at the time of hiring have a persistent impact on future wages (see, e.g., von Wachter and Bender 2006). The

[1] Doeringer and Piore (1971, p. 2) argue that workers in jobs that are filled by promotion or transfer from within are "shielded from the direct influence of competitive forces in the external market", but that the internal and external labor markets are connected at the ports of entry.

[2] If firms adjust to accumulated shocks, for example because they face fixed adjustment costs (Hamermesh and Pfann, 1996), it is difficult to identify a close link between single shocks and wage or employment adjustments.

picture that has emerged in the empirical literature so far, i.e., that hiring wages track industry wages, and that differences in hiring wages are persistent, suggests that market-induced variations in marginal productivity are not fully reflected in wages of incumbent workers. However, it has been difficult so far to establish a direct link between shocks to (external) labor market conditions and changes of firms' personnel policies, potentially because shocks are typically rather small. For this reason, assessing how firms react to large macroeconomic shocks such as the financial crisis that occurred in Russia in 1998 is potentially very informative.

The remainder of the paper is organized as follows. The next section introduces the firm under study and describes the personnel data set, while section 3 gives a brief account of how it fared during the financial crisis and in its aftermath as well as how the local labor market was affected by the crisis. Section 4 discusses the choice of the appropriate model of wage and employment determination consistent with the observed large fall in the average real wage after the crisis, large fall in separations from the firm and steady increase in the firm's employment in the years 1997 to 2002. In particular, we consider the competitive, internal labor market, monopsony and efficiency wage models.[3] Section 5 then establishes some robust evidence about the evolution of wages, employment and turnover in the firm over the period that encompasses the financial crisis. We also discuss the local labor market conditions before and after the crisis. We then link our findings to the preferred model of wage and employment determination discussed in section 4. A final section concludes.

[3] We do not look at models of collective bargaining since in our firm trade union representatives have no influence on wage policy, and wages are set unilaterally by top management. In discussions with the firm's human resources manager it transpired that trade unions do not play a role in wage determination.

2. The personnel dataset

Our personnel dataset is an unbalanced year-end panel data set for the years 1997 to 2002 constructed using employee records from the personnel archive of a firm that is located in a provincial city in Russia. The firm operates in the "machine building and metal working" (MBMW) sector, according to the classification of industrial activity used in Russia at the time. The firm was founded in the early fifties of the last century and was privatized in 1992. In 2002, more than half of the shares were owned by managers and workers, about twenty percent by former employees and roughly a quarter by other Russian entities.[4] Following the conversion of production lines inherited from Soviet times, it produces well equipment for gas and oil production and smith-press equipment.[5] More than ninety percent of its production is destined for the Russian market. It has no local competitors, but nationally it has to compete with more than 5 firms, among them importers from the European Union.

Our firm is not representative of the MBMW sector or Russian industry at large. In the period under analysis (1997-2002), many privatized large firms in the sector and in Russian industry generally were shedding labor (Kapeliushnikov 2002), but the workforce in our firm was fairly steady and slightly increasing between 1997 and 2002. Rather, our firm is a member of the numerically small but economically

[4] It is noteworthy that this ownership structure, with a large component of shares held by current and former employees, had no practical impact on wage and employment policies in our firm. From published annual financial statements we know that employees with shares have no voting rights and that the CEO and a few leading managers have a large enough block of voting shares to dominate all aspects of firm decision-making, including wage and employment policies. In principle, large dividend payments, paid to a subset of employees and varying over time, could cause differential wage payments across the workforce. However, from the same published statements of the firm we know that annual dividend payments to employees are miniscule relative to annual total compensation. In essence, corporate governance structures in this firm neither give employees some direct influence over the wage setting process nor are they important for the levels and the differentiation of wages.

[5] Source: Interview with the director general of the firm in the spring of 2002.

important group of industrial firms that managed the transition to a market-based economy well.[6]

We have records of all employees who were employed at any time during this period, except for top managers whose information is not disclosed for reasons of confidentiality. The data contain information on individuals' demographic characteristics such as gender, age, marital status and number of children, on their educational attainment, retraining and other skill enhancement activities before joining the firm and during tenure at the firm. We also know the exact date when each employee started work at the firm. In addition we can distinguish between full-time and part-time employees.

In Russian industrial firms the workforce is typically divided into five employee categories: administration (i.e. management) which we label "managers"; accounting and financial specialists whom we label "accountants"; engineering and technical specialists (including programmers) whom we subsume under the term "engineers"; primary and auxiliary production workers, whom we label "production workers"; and finally, service staff.[7]

For the years 1997 to 2002 we have monthly wages averaged over the year. Wages are reported by the firm as the employee's average monthly wage in rubles for the year (or fraction of the year, if not employed for the full 12 months), with no adjustment for inflation. The inflation rate in Russia during this period was irregular and sometimes quite high – the price level more than doubled between the start of the financial crisis in July 1998 and April 1999, and was 0-2% per month before and after – and so some care is required to construct appropriate deflators. Because the nominal

[6] The CEO of our firm is considered one of the most successful managers in Russian industry: he was ranked among the top 35 managers in the machine building sector by *Kommersant* (2006), the leading business magazine in Russia.

[7] Only production workers are subdivided into levels, primary production workers having eight and auxiliary production workers having six levels.

average monthly wage is an average for the year, it is deflated into 1997 constant rubles using an annual average CPI, i.e., the average price level for the year relative to the average price level in 1997.[8]

3. The impact of the financial crisis on the firm and its local labor market

In November 1997 and during 1998 the Russian economy was confronted with two speculative attacks on the ruble. While the Central Bank of Russia was able to successfully defend the ruble in the first episode, in August 1998 a financial meltdown occurred and on August 17, 1998 the Russian government devalued the ruble, defaulted on domestic debt, and declared a 90 days moratorium on payment to foreign creditors.[9] The financial crisis had severe short-term consequences, leading to an upsurge of inflation, a collapse of a large part of the private banking sector and a virtual stop of economic activities for some weeks. After this period, however, rising oil prices, a real depreciation of the ruble and a large fall in real wages set the Russian economy on a growth path, which continued until the world financial crisis in 2008. A key reason why the collapse of the private banking sector had little effect on the real

[8] We have available monthly data on CPI inflation in Russia overall and in the oblast (region) where the firm is located (Rosstat, various years). In this paper we work primarily with monthly wages averaged over the year, and so we compare average annual inflation rates in the oblast with national rates. This comparison shows that inflation (in percent) in the oblast is very similar to national inflation:

	Russia	Oblast
1997	15.4	14.0
1998	38.1	38.7
1999	98.6	97.9
2000	20.8	20.4
2001	21.6	19.1
2002	16.0	14.5

These indices are based on average monthly price levels calculated using monthly inflation rates. Over the entire period of 1997 to 2002, the cumulative price indices diverge by less than 3 percent. Consequently, results using wages and bonuses deflated by the national CPI are virtually identical to those using the oblast CPI. We use the national CPI in what follows.

[9] For lucid discussions of the Russian financial meltdown, see Chiodo and Owyang (2002) and Kharas, Pinto, and Ulatov (2001), as well as the comments by Summers and Williamson (2001) on the latter paper.

economy after the meltdown in 1998 had to do with the fact that private banks pre-crisis operated mainly in the stock and bond markets and provided little lending capital to enterprises (see, e.g., Desai 2000). In the run-up to and during the crisis, probably only few firms suffered from decreased access to capital. Rather, the impact of the crisis on firms was felt via the temporary standstill in economic activity, reduction in demand for the products of most firms and collapse in confidence of consumers and producers.

Unlike Russian industry at large, our particular firm weathered the financial crisis well. Before the crisis, demand for the firm's products was only very briefly hit by the drop in oil production that was sparked by a sharp drop in oil prices and the real appreciation of the ruble which made it difficult for the firm to compete with importers.[10] Due to the devaluation of the ruble on August 17, and a rising oil price, demand for oil drilling equipment very rapidly recovered. In essence, the firm had a constant inflow of orders starting towards the end of 1996, which was not interrupted in a substantial fashion by the crisis. As a result, the size of the workforce was rather stable during the period of analysis. Table 1 shows that the number of full-time employees on a full-week schedule fluctuated only slightly around approximately 2,900 persons in all years, with a slight increase at the end of the period, and the composition of the workforce hardly changed throughout the period. There is a small increase in the share of production workers compensated by negligible falls in the shares of engineers and accountants.

Real output, capacity utilization and profits of our firm, which had been at a trough in 1998, recovered slightly in 1999 and then took off after the year 2000, as demonstrated in Figure 1, which shows both the profitability of our firm and the

[10] From the interview with the firm's director general it is clear that the shortage of lending capital in the immediate aftermath of the crisis was less relevant for this firm than the drop in oil production and the high real exchange rate of the ruble in the run-up to the crisis.

profitability of the sector. Further confirmation of the financial viability of the firm can be inferred from the absence of wage arrears in the years 1997 to 2002, a commonly-observed feature of the Russian labor market at this time (Lehmann, Wadsworth, and Acquisti 1999; Earle and Sabirianova 2002).[11]

As a consequence of the crisis local labor market conditions worsened considerably, manifested by a fall in the real average wage and a rise in the unemployment rate in the local labor market (see Figure 2), pointing to a deterioration of workers' outside options. This deterioration is also captured by falling separation and hiring rates in the firm after the crisis year 1998. Table 2a shows that turnover rates for all employee categories, calculated as the sum of hires and separations during a given year normalized by the stock at the beginning of the year, were high in 1997 and 1998 and fell quite dramatically after the crisis. Turnover was especially turbulent for accountants, production workers and service staff and much more modest for engineering staff throughout the period. The total separation rate fell from roughly 13.5 percent in 1998 to about 6 percent in 2002. The fact that the bulk of separations (about 80 percent) are coded as voluntary quits in our personnel data suggests that many employees refrained from quitting in the aftermath of the crisis.[12]

The firm's employees were thus likely confronted with a more limited array of outside options compared with the situation before the crisis. This reduced opportunity set was not confined to wage employment as self-employment opportunities also became more limited. For example, opportunities arising from the

[11] The available data on wage arrears tell us that wage arrears accumulated in this firm between 1994 and 1996, i.e. in a period before a constant stream of orders materialized. All the accumulated arrears were paid off by the time the crisis hit Russia.

[12] We are, however, aware of the fact that voluntary and involuntary separations are notoriously difficult to disentangle. At the same time, Lehmann, Muravyev, Razzolini and Zaiceva (2013) show with data from a country-wide supplement to the RLMS data that at least four fifths of annual separations in 2003 were voluntary quits. It is unlikely that this fraction was markedly different in previous years.

"suitcase trade" (the small-scale sale of goods bought abroad and transported by individuals for resale domestically) between Russia and China or Turkey nearly disappeared due to the large devaluation of the ruble (Eder, Yakovlev, and Çarkoglu 2003).

Additional evidence that lends support for the conjecture that workers' outside options worsened during the crisis comes from turnover statistics in a panel of approximately 30 industrial firms located in the same city as our firm.[13] Table 2b reveals that the turnover patterns in this regional sample are similar to those for the firm in the years 1998 to 2001. In particular, separation rates fall by similar percentages for all employee categories. If we take the turnover rate as an indicator of local labor market conditions, we can infer that outside opportunities have diminished in a substantial fashion for all employee types compared to the period before the crisis. These diminished opportunities can also be seen by the movements of the unemployment rate in the given region (oblast). Starting at a substantially lower level in the pre-crisis years 1995-1997 vs. the average rate in the Russian Federation, it shot up by roughly five percentage points between 1998 and 1999, and then showed a cumulative fall of one percentage point over the years 2000-01. Whereas the local unemployment rate was roughly six percentage points lower than the Russian average in 1998, it was two percentage points higher in 2001. The described trends and relative magnitudes of the unemployment rate as well as the presented turnover patterns in a regional sample of industrial firms demonstrate that local labor market

[13] We have available an unbalanced panel of 36 firms (not including the firm that is the subject of this study) that represent roughly 15 percent of industrial employment in this region only for these four years. A balanced panel of 28 firms is used for the turnover rates reported in the table. We should also stress that official regional labor market data from the Russian Statistical Office (Rossstat) are not available before 2005.

conditions were significantly worse after the crisis year of 1998 and did not recover as rapidly as in the Russian Federation in general.[14]

4. Theoretical considerations

Which theoretical set-up can best explain the fall in the real wage and the turnover patterns at the firm? Inspection of Figures 1 and 2 leads us to conclude that the standard competitive, monopsony and internal labor market models do not readily explain either the movements of the firm's wages or the relative position of these wages to average regional wages (a proxy for average regional sector-level wages[15]). The most appropriate standard model is, rather, an efficiency wage model.

To begin with, our firm pays wages that were far above the average regional wage before the crisis; in the aftermath of the crisis the firm's wage movements do not track average regional wage movements (see Figure 2). Both of these facts indicate that our firm does not operate in a competitive labor market. Next, one of the principal tenets of the internal labor market model is the shielding of incumbent workers from external labor market shocks. Consistent with evidence from studies using personnel data (e.g., Baker et al. 1994; Wilson 1996, 1999; Dohmen 2004), an inspection of the data reveals that the firm never cuts nominal wages.[16] But at our firm, this does not imply a protective attitude towards incumbent workers as nominal rigidity does not bring about real rigidity. In fact, most incumbents experience large

[14] The sample of firms is not necessarily representative in terms of development of total employment in the region. However, the estimated inflow and outflow rates are indicative of falling outside opportunities after the crisis in our regional labor market.

[15] Unfortunately we do not have a time series for regional wages of the MBMW sector; the regional wage comprises all sectors. However, we have data for the sector in 2002, when the average regional sector wage is actually slightly lower than the overall average wage. This comes about because in the region we have firms in the energy sector that play an important role and that pay far higher wages than the average wages in the MBMW sector. The average regional wage can, therefore, be taken as a relatively unbiased estimate of the average outside wage that workers of our firm are confronted with.

[16] The firm's director general told us that the firm never contemplated to cut nominal wages since such cuts might have resulted in even higher quit rates than the ones observed before the crisis. Bewley (1999) documents similar motives among managers in U.S. firms.

real wage losses after the crisis, as Figure 3 attests.[17] And this occurs in spite of a quite stable profit situation of the firm between 1998 and 2001 (see Figure 1). Rather than shielding its incumbent workers from outside shocks, the firm's top management seems to take advantage of the above discussed deteriorating local labor market conditions when it devises its wage policy.

Can a static or dynamic monopsonistic model of wage determination explain the observed facts? In the setting of a static partial equilibrium monopsony model the deterioration of outside options can be modeled with a downward shift and a flattening of the upward-sloping labor supply curve facing the firm. With a very inelastic marginal revenue product of labor curve[18] the resulting comparative statics can produce the results that we observe: a large fall in the wage and a slight increase in employment. However, the flattening of the upward-sloping labor supply curve can also translate into wages approaching the marginal cost of hiring, and thus in this model wages may actually rise. The indeterminacy of the predicted movement in wages makes the static partial equilibrium monopsony model an inappropriate choice of framework. A further reason for not choosing a static monopsony model for our analytical framework is that it does not take into account how a firm's wage policy can influence the dynamics of employment, i.e., the recruitment and separation of workers. To analyze this we would need instead a dynamic monopsony model.

Do the observed patterns in wages vs. hiring and separation rates point to monopsonistic behavior by our firm consistent with a dynamic monopsony model?

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[17] Clearly, nominal rigidity brings about real rigidity when there is zero or very low inflation (Fehr and Goette 2005). While Baker et al. (1994) and Dohmen (2004) also did not find evidence of real wage rigidity in their analyses of personnel data, it still remained controversial to what extent real wages are downward rigid as Card and Hyslop (1997) and Bauer, Bonin, Goette, and Sunde (2007) provide evidence for real wage rigidity using administrative micro data on wages.

[18] We cannot estimate the own wage elasticity for our specific firm. However, Konings and Lehmann (2002) find an own wage elasticity of -0.16 for a representative sample of manufacturing Russian firms in the years 1997 to 1998, pointing to a very inelastic labor demand in international perspective (Hamermesh 1993).

One of the key ingredients of such a model is that firms set wages to determine the turnover of workers, whereby it is assumed that separations depend negatively on the wage paid and recruits arrive at a rate that is increasing in wages. In a steady state when separations are equal to recruitments, such a model implies a long-run relationship between employment and wages that can be expressed as the long-run elasticity of the labor supply curve facing the firm.

Following Manning (2003) we can write this long run elasticity (ε_{nw}) as

$$\varepsilon_{nw} = \varepsilon_{rw} - \varepsilon_{sw} \qquad (1),$$

where the first term on the right-hand-side is the elasticity of hiring (recruitment) with respect to the wage and the second term is the elasticity of separations with respect to the wage. By assumption, the first term is positive, i.e., as wages fall recruitment should fall, a co-movement that we observe in our data. In the steady state, the second term is assumed to be negative; that is, with a falling wage separations should increase. This latter assumption does not hold since we observe falling wages and falling separations.

The pro-cyclical movement of wages and quits is, of course, a well-established empirical regularity (Pissarides 1994), so the assumption of an inverse relationship of wages and separations might be invalid in times of recession. A large enough positive second term in equation (1) then can render the labor supply elasticity to the firm negative. But as long as the second term is smaller in absolute value than the first term, even with a co-movement of wages and separations we can get an upward sloping long-run labor supply curve to the firm. In other words, this co-movement does not invalidate a dynamic monopsony set-up per se.

However, our firm experienced steady demand for its products during the period analyzed; thus we cannot really speak of a recessionary event affecting our

firm. Since the assumption of an inverse relationship of wages and separations, which should hold under the circumstances confronted by our firm, is violated by the observed data, a dynamic monopsony model is also an inappropriate choice of model for the analysis of the wage and employment movements in our firm.

Given the large fall of wages and separations and the increase in employment, the most plausible theoretical set-up is an efficiency wage model of the shirking type (Shapiro and Stiglitz 1984) or a turnover variant of the efficiency wage model (e.g., Salop 1979; Schlicht 1978), in which wages are set above workers' outside option to keep turnover at low, profit-maximizing levels. The firm we study experienced a strong and constant demand for its products starting in the years 1995 and 1996, which was rather unusual in the sector at that time. Our firm thus needed to keep and attract workers who competently and diligently performed their duties, i.e., who were not shirking. In particular, production workers, who account for over 60% of the workforce (see Table 1), were important to the firm in this respect.

In the period before the crisis it is likely that workers had many outside options in the local labor market and further afield (e.g., the "suitcase trade"). Because workers saw such outside opportunities, separation rates were high in the regional labor market as well as in our firm. As in the Shapiro and Stiglitz (1984) model, these separations can be considered exogenous. In this interpretation, to ensure a good performance of the incumbent workers (i.e., to ensure non-shirking) and to attract a large flow of competent incoming workers, which could compensate for this high level of exogeneously driven separations, the human resource management of the firm decided to offer very high wages. Then, in the aftermath of the crisis many outside opportunities disappeared, and there was a large rise in the regional unemployment rate in 1999-2001 (see Figure 2). Consequently, the firm's top

management allowed the erosion of real wages, being confident that the workforce would refrain from shirking even at substantially lower real wages.

That the firm indeed pursued an efficiency wage strategy can also be inferred from interview evidence, namely the CEO's description of the firm's wage policy during the analyzed period:

"Higher than regional wages contributed to retaining and attracting highly qualified personnel after difficult crisis years in the beginning of the 1990s, when episodes of forced downsizing due to the output decline took place. Later, in 1995-1996, the firm started to receive orders, production growth began, and there was a need for qualified personnel. Since economic improvement happened all over the country, the only way to retain and attract personnel was to pay high wages. After the 1998 crisis, it was economically expedient to stabilize wages at the regional and sector level."[19]

Slightly modifying Shapiro and Stiglitz (1984), the non-shirking condition (NSC) boundary in our firm can be written as:

$$w_i = ben + e_i + e_i(a + b_i + r)/q_i \qquad (2),$$

where w_i is the efficiency wage paid in the firm, *ben* is the unemployment benefit, e_i is the average effort in the firm, a is the average outflow rate from unemployment in the regional labor market, b_i and q_i are the separation rate and the probability of being detected shirking in our firm respectively, while r is the discount rate of workers in the regional labor market. Where we retain the subscript i we identify the firm-specific parameters determining the NSC boundary. Our assumption thus is that the wage schedule representing the NSC boundary was unique to this firm.

[19] These sentences are taken from an interview conducted in April 2007.

Equation (2) shows that the parameters a, b_i, and r are positively related, and q_i inversely related, to the efficiency wage, i.e. to the wage that ensures non-shirking.[20] The inverse of the average outflow rate from unemployment in the regional labor market, $1/a$, is the average duration of unemployment. The larger is a the shorter is this duration, and so the less costly it will be for a worker to shirk. Hence when a is large the firm has to offer a high wage to ensure non-shirking. Conversely, when a falls the firm can lower the efficiency wage. The same reasoning applies to the exogenously-given separation rate b_i. When this separation rate is high because workers perceive many outside options in the local labor market and beyond – as was the case in Russia before the financial crisis of 1998 – shirking is not very costly. Consequently the firm has to offer a high wage to ensure non-shirking. When separations fall, the firm can adjust downward the efficiency wage.[21]

A high discount rate r implies that workers put less weight on the (future) costs of shirking, i.e. being fired and passing through a period of unemployment, than on the immediate benefits of shirking. Hence the efficiency wage offered by the firm is increasing in the rate with which workers discount the future. On the other hand, it is decreasing in the probability q_i with which workers can be detected shirking. The better workers' performance can be monitored – the higher is q_i – the lower the wage that guarantees non-shirking. This inverse relationship of q_i and the efficiency wage implies for our firm that workers whose performance is easily monitored, such as service staff, could be paid a wage close to the competitive level, whereas managers,

[20] We do not discuss benefits here because they are very low in Russia and, more importantly, because they do not change over the period covered by the analysis. Also, the positive relation between effort and wage is a given and of little relevance for our discussion.

[21] We can also have a high exogenous separation rate because a firm has to lay off many workers. In that case it pays for workers to shirk while the job lasts, so the firm has to offer a very high wage to make it costly for workers to shirk. However, in the case of our firm the high separation rate comes about because of the presence of many outside options.

accountants and production workers, whose performance is harder to monitor, receive a high efficiency wage.

In the aftermath of the crisis outside opportunities diminished and regional unemployment rose substantially. These factors translated into a large fall in separations in our firm and the local labor market as well as into lower outflows from regional unemployment. Hence the parameters a and b_i in equation (2) fall substantially. Holding the other parameters constant, the ensuing fall of a and b_i then shifts the NSC boundary downward. So, at each level of employment the firm can elicit a good performance of its workers paying a much lower wage than before the crisis. It is able to do this since the cost to workers of shirking has risen substantially. Given an unaltered inelastic marginal revenue product of labor curve, this downward shift produces the small increase in employment and the large fall in wages that we observe in our data.

In sum, we can reasonably assume that local labor market conditions are a key element in the wage policy of the top management of the firm. The shirking version of the efficiency wage model sketched above (or a turnover variant of the efficiency wage model that formally has a similar structure as the shirking variant) is, we suggest, an appropriate model that can explain the presented empirical evidence. We next assess whether the personnel data that we have at our disposal generates evidence on wage structure, wage growth, and turnover that is consistent with the conjecture that the firm's top management pursued an efficiency wage strategy.

5. Evidence from personnel data on wages, employment and turnover

Wage structure

The personnel data reveal substantial heterogeneity in wages not only for the whole workforce but within employee categories.[22] Service staff had the lowest mean wages in 1997 followed, somewhat surprisingly, by engineers, then production workers and accountants. Managers had the highest wages on average. This wage structure tracks the ranking of average wages for employee categories in the local labor market, as data on average wages for these employment categories in our panel of 30-odd local industrial firms reveals. This ranking of employee group-specific average wages in the local labor market and in our firm remains largely unchanged throughout the observation period. Consistent with efficiency wage models and with the characterization above of the firm's wage setting, prior to the crisis the firm paid a large mark-up on the employee-category-specific average wage in the local labor market, and this mark-up fell substantially in the aftermath of the crisis. Thus in 1998, the earliest year for which we have data, the wage for production workers at our firm was 79% higher than those of production workers in the aforementioned panel of local firms; by 2002, this mark-up had fallen to just 20%. Similarly, managers at our firm were paid wages in 1998 that were more than double those obtained by managers in the comparator panel; this mark-up had halved to 53% by 2002.[23]

OLS estimates from an augmented Mincer wage regression of log wages of all employees in 1997, reported in column (1) Table 3, show that the wage differentials between employee categories remain statistically significant when controlling for

[22] In the discussion paper version of our paper we also analyze total compensation, which includes three types of bonuses. Since these other components of pay comprise only a small share of total compensation and since total compensation tracks wage adjustments closely, we only look at wage adjustments over time in what follows .

[23] The calculation of mark-ups compares the wage in our firm to the average wage in a balanced panel of 26 local industrial firms drawn from the larger unbalanced panel of 36 firms.

human capital differences (as proxied by tenure, age, and level of education). The estimated coefficients from the augmented Mincer wage regression in column (1) also illustrate that workers with longer tenure and more education receive higher wages.[24] The effect of education on wages, conditional on job categories, is stronger for women than for men as a comparison between estimates in columns (2) and (3) reveals.

Women earn significantly less than men, while marital status and the number of children does not have a significant impact on wages. In line with the traditional division of labor in the family, the estimates suggest a positive impact of children on the wages of men and a negative (but not significant) effect on wages of women in 1997. Marriage, however, does not affect men's and women's wages differently.

The mentioned factors significantly determine the wage structure throughout the observation period, but the size of the gender and tenure effects are attenuated over time as a comparison to the estimates for the year 2002, reported in columns (4)-(6) of Table 3 reveals.[25] Wage differences between employment categories also narrow. The wage gap between the service staff and production workers falls by about 20 percentage points, and the average wage premium of accountants relative to production workers falls by about 25 percentage points. Importantly, average real wages fall for all employment categories.

[24] Quantile regressions (not reported but available upon request) show that the effect of tenure on wages is similar across the entire wage distribution in 1997. Furthermore, employees with higher education (university graduates) have a positive relative return throughout the distribution, while for the other educational groups the highest premia are in the lowest deciles.

[25] The gender wage gap evolves in a similar fashion as can be observed in the Russian economy at large based on household survey data in this period (Kazakova 2007). In a companion paper, co-authored by two of us (Dohmen, Lehmann, and Zaiceva 2008) we study the evolution of the gender earnings gap in more detail.

Individual wage mobility

Even though average real wages fall, not all employees are affected by the crisis in the same way as the heterogeneous real wage growth rates in Figure 4 demonstrate. In order to assess whether particular characteristics systematically determine wage growth, we regress the growth rate of real wages between 1997 and 2002 on various individual characteristics and job characteristics. We restrict the sample to full-time employees on a full-week schedule.

We calculate wage growth over the five-year interval only for those who were continuously employed during the entire observation period. In order to control for selection effects that would bias our estimates of the determinants of wage growth if unobserved factors that influence workers' decisions to remain in the firm are correlated with unobserved determinants of wage growth, we estimate Heckman-type ("Tobit II") sample selection models. We perform these regressions for the whole sample and also separately for men and women since the determinants of wage levels and of wage growth have been found to have a different impact when estimating female and male earnings separately (see, e.g., Blau and Kahn 1996, 2006).

We use indicator variables for having one child and for having more than one child as our exclusion restrictions in the estimation of the sample selection model, assuming that the numbers of children determine a worker's probability to stay with the firm throughout the period 1997-2002, but do not affect wage growth.[26] In addition, the selection equation allows for more flexibility in the tenure and age (experience) effects since we define detailed step functions with these two variables

[26] These exclusion restrictions can be justified on the ground that in the discussion paper version of our study the sample-selection wage growth regressions included dummies capturing the number of children and that the estimated coefficients on these dummies turned out to be insignificant. In addition, the coefficients on the children dummies in the wage regressions for the whole sample are neither significant in 1997 nor in 2002 (see Table 3).

while in the wage growth regressions tenure and age are specified as cubic polynomials.

The coefficient estimates of the tenure and age dummies of the selection equations are reported in Table A1 of the appendix for the whole sample (column (1)) and for men (column (2)) and women (column (3)) separately. Relative to workers in the reference category, who are in their 10^{th} year of employment at the firm, all workers except those with more than 30 years of tenure have a lower likelihood of staying with the firm. Marginal effects estimates reveal that these negative effects are rather similar for men and women at virtually all tenure durations. The probability of staying with the firm is increasing up to the age of 50. The very young and those 50 years of age and older have far lower probabilities of staying than workers between 30 and 34 years of age. The age effects are somewhat more pronounced for women as marginal effects estimates reveal. Workers with professional education have a lower likelihood of staying with the firm than those who have only primary education or less. Women have higher separation rates than men. Male employees who find themselves in the lowest and the highest deciles of the employment category-specific wage distribution in 1997 tend to have left the firm more readily than employees in the 5^{th} decile female employees.

The estimated correlation ρ between the unobservable characteristics in the selection equation and in the wage growth equation is negative and significant for men, but not for women (see columns (4) and (6) of Table 4). This indicates that men whose unobserved characteristics make them more likely to separate from the firm, would enjoy higher wage growth at the firm compared to other incumbent workers. This finding is consistent with the efficiency wage model, as the non-shirking condition entails a higher wage for workers with more attractive outside options.

The wage growth estimates presented in Table 4 reveal that, conditional on the position in the employee category-specific wage distribution in 1997, neither tenure nor experience (age) have any explanatory power. Having completed basic or secondary professional education is associated with higher wage growth for male employees relative to the employees in the reference category who have primary education or less. Turning to the employee categories, service staff and engineers enjoy higher wage growth than production workers. Accountants and managers, in turn, have substantially lower wage growth than production workers.

Having controlled for job and demographic characteristics as well as for employee categories, we find the location in the firm's employee-specific wage distribution in 1997 is the most important determinant of wage growth. Workers who found themselves below the median decile in 1997 experienced positive wage growth, which is particularly strong for workers in the first decile and monotonically declining as we go up in the wage distribution. Above the median of the wage growth distribution, wage growth becomes negative; this penalty rises in absolute value as we go from the sixth to the tenth decile. This pattern is unlikely to be completely explained by regression to the mean. As the correlation in log wages of the years 1997 and 2002 is high (0.82), the scope for the regression to the mean in log wages is limited. Furthermore, we observe a compression of the wage distribution, which is driven predominantly by a reduction of real wages in the upper part of the distribution (see Figure 3).[27]

This wage movement is consistent with an efficiency wage model if the outside option of workers at the higher end of the skill-wage spectrum has been falling disproportionally: In fact, local labor market opportunities seem to have

[27] The implication of these wage trends is a dramatic fall in the inequality of earnings, which we have documented in a companion paper with declining Gini coefficients and falling general entropy indices (Dohmen, Lehmann, and Schaffer 2009).

worsened substantially after the crisis year of 1998. While there was substantial scope for a downward shift of the non-shirking condition boundary for the highly skilled, for the low skilled this scope was very limited.

Employment and Turnover

An inspection of tables 2 and 3 indicates already that wage and turnover dynamics at the firm are consistent with efficiency wage models, as mark-ups on average wages paid by competitors in the region are related to turnover rates, such that the firm seems to react to a decline in turnover by reducing the mark-up. Turnover variants of the efficiency wage model predict that the firm offers high wages in times of large and exogenously caused labor turnover in order to attract a competent pool of workers. We would conjecture that the firm lowers wages when the rate of quitting falls, as lower quit rates reduce the need to hire new workers in order to ensure a constant production level. At the same time, this conjecture implies that the large hiring that occurs before the crisis is replacement hiring, that is, if the firm reacts to quitting of workers by maintaining exceptionally high recruitment levels. To see whether we deal with replacement hiring we analyze the pattern of correlations between contemporaneous and lagged outflow and inflow rates. The correlation between inflow in a particular month and the outflow in the previous month is strongest. In an ARIMA model, in which contemporaneous inflow is regressed on contemporaneous outflow and two lags of inflow and outflow, contemporaneous outflow is insignificant whereas lagged outflow is highly significant (p-value<0.001) and the second lag of outflow is marginally significant (p-value$=0.1$), while lagged values of inflow are not significantly related to contemporaneous inflow. The conjecture that separations trigger hiring is corroborated by the fact that

contemporaneous and lagged inflow of employees is not significantly related to contemporaneous outflow in an ARIMA model. VAR models whose final specifications include two lags of inflow and outflow[28] indicate that outflow Granger causes inflow, but that inflow does not Granger cause outflow.[29] Consequently turnover is to a large extent the result of replacement hiring, and thus induced by quits.

In order to see what drives separation rates in our firm, we estimate Cox proportional hazard models in which we specify calendar time as the duration variable (cf. Dohmen and Pfann 2004) and assume the same baseline hazard for all five employee specific categories.[30] We employ two specifications, one without and one with controls for the position in the employee category specific wage distribution. In order to assess whether the determinants of the hazard rate differ during years of high turnover (1997-99) and the period of low turnover (2000-02), we also estimate the Cox proportional hazard models separately for the two sub-periods (see Table A2).

Conditional on the position in the job-category-specific wage distribution, tenure plays a minor role as far as separations from the firm are concerned. Employees with tenure up to two years and those who have been with the firm between 25 and 30 years have significantly lower hazard rates than workers in the reference category who are in their 10th year of employment at the firm; otherwise the tenure hazard profiles are rather flat. The small effects of tenure on separation are

[28] The results of a Granger causality test depend crucially on two things, the set of variables included in the VAR model and the lag structure (see, e.g., Granger and Newbold 1986). The first issue does not cause any problems here since we are confined to two variables. To minimize the bias of the test, we start out with VAR models of 12th order and test them down thus arriving at 2nd order VAR models.

[29] We can establish Granger causality here and not causality per se, i.e., we find that outflows significantly lead inflows and not vice versa.

[30] An extension of these models allows for employee category specific baseline hazards. The estimates of such models, available on request, are virtually identical to the estimates of the presented models in the time invariant part of the Cox model. Also the estimated secular patterns of the various baseline hazards in the extended model are very similar to each other. We, therefore, stick to our simple specifications of the Cox model.

consistent with the rather small effects of tenure on wages and wage growth documented in Tables 3 and 4.[31] Educational attainment only weakly affects the separation hazard in the periods of high turnover, while between 2000 and 2002 employees with only general basic education have a significantly lower propensity to leave the firm than more educated , indicating that external labor market options play a role in separation decisions. The very young and those who have reached retirement age have a much higher separation rate than those employees who are between 30 and 35 years of age. The age hazard profiles are also striking insofar as workers over the age of 45, but still far from retirement, have a substantially lower propensity to separate from the firm than other age groups. In both periods, engineers have the lowest separation rates, conditional on the other controls reported in Table A2, which might reflect relatively high levels of firm-specific skills. Consistent with the efficiency wage model, the difference in wages between engineers and production workers becomes smaller when their separation rates become more similar. Female employees have higher separation rates than their male counterparts, especially in the period of high labor turnover. In line with the efficiency wage model, the gender difference in separation rates becomes smaller when the gender wage gap shrinks. Employees with below median wages in the job-category-specific wage distribution are more likely to separate than their colleagues at the median, as the efficiency wage model predicts. When turnover is high, hazard rates are highest for those employees located in the polar deciles, while in the second period only persons in the lowest decile have a higher propensity to leave. Consistent with turnover variants of the efficiency wage model, we have seen that real wages for these workers fall least.

[31] It is also noteworthy that differences in tenure effects between the two sub-periods are consistent with changes in the wage structure as implied by an efficiency wage model. The estimates of the wage structure in 1997 and 2002 reported in Table 3 indicate that the tenure profile at the beginning of the career becomes flatter, which is in line with the finding that among employees with less than 10 years of tenure those with longer tenure become relatively less likely to separate in the second sub-period.

6. Conclusions

We have traced out the evolution of wages, employment and worker turnover using a rich personnel data set of one Russian firm for the years 1997 to 2002. The observed evolution points to "price" rather than "quantity" adjustment within the firm during the following the financial crisis of 1998, as employment slightly increased but real wages fell substantially.

Real wages had not recovered to pre-crisis levels by 2002, even though the firm's financial situation was then better than before the crisis. Wage growth regressions spanning the years 1997 to 2002 show disproportionate wage growth for those employees located in the lowest four deciles of the employee category-specific wage distribution in 1997 while employees positioned in the highest four deciles were confronted with wage losses relative to their colleagues around the median of the employee category-specific wage distribution. Relative to production workers, service staff and engineers had wage gains over the period, while accountants experienced relative wage losses. We can interpret these relative wage losses of high wage earners as an indication that the outside options of these workers worsened disproportionally. Such asymmetric changes in the outside options of different employment categories are plausible when those who are in low-skilled jobs that require little education and job-specific knowledge were always earning wages close to the unskilled competitive wage or the level of social security, so that the scope for wages to fall even further during the crisis was limited for these types of workers.

The financial crisis lead to a fall in local labor market conditions, marked by dramatically falling job flows after 1999 and rising regional unemployment, which allowed our firm to reduce real wages without risking higher turnover. In fact, the size of the work force did not shrink despite substantial real wage cuts. A simple shirking

model of wage determination or a turnover variant of the efficiency wage model captures the effect of declining outside opportunities for the firm's workers well: Given these reduced outside options, the costs of quitting or losing one's job rose substantially after the onset of the crisis. Firm management could thus lower the non-shirking contract boundary, i.e. it could offer lower real wages and still ensure a good performance of incumbent workers in production without risking higher turnover. At the bottom end of the firm's wage distribution, the firm seemed to pay a wage close to the opportunity cost for employees at that end of the distribution throughout the reported period. Most of the workers in this part of the distribution are low-skilled service staff who are not central to the production process in the firm. As a result, the mark up on the competitive wage that a firm using efficiency wages has to pay to meet the non-shirking condition is likely to be small. At the same time, paying efficiency wages for these workers might even be less relevant as monitoring costs for this employment category are likely to be low. At any rate, we take this differential treatment of employee groups within the firm as evidence that local labor market forces strongly influence the wage policies of our firm, which broadly seem consistent with an efficiency wage model.

References

Baker, George, Michael Gibbs, and Bengt Holmstrom. 1994. The Wage Policy of a Firm. *Quarterly Journal of Economics*, 109(4), 921-955.

Bauer, Thomas, Holger Bonin, Lorenz Goette, and Uwe Sunde. 2007. Real and Nominal Wage Rigidities and the Rate of Inflation: Evidence from West German Micro Data. *Economic Journal*, 117(524), F508 – F529.

Bewley, Truman F. 1999. *Why Wages Don't Fall During a Recession*. Harvard University Press.

Blau, Francine D., and Lawrence M. Kahn. 1996. Wage Structure and Gender Earnings Differentials: an International Comparison. *Economica*, 63, S.29-S62.

Blau, Francine D., and Lawrence M. Kahn. 2006. The U.S. Gender Pay Gap in the 1990s: Slowing Convergence. *Industrial and Labor Relations Review* 60(1), 45-66.

Boeri, Tito, and Katherine Terrell. 2002. Institutional determinants of labor reallocation in transition. *Journal of Economic Perspectives*, 16(1), 51-76.

Card, David, and David Hyslop. 1997. Does Inflation Grease the Wheels of the Labor Market?. in Romer, C. and D. Romer (eds.), *Reducing Inflation: Motivation and Strategy*, 71-113, Chicago University Press.

Chiodo, Abigail J., and Michael T. Owyang. 2002. A Case Study of a Currency Crisis: The Russian Default of 1998. In *The Federal Reserve Bank of St. Louis Review*, November/December.

Commander, Simon, McHale John, and Yemtsov Ruslan. 1995. Unemployment, Restructuring and the Labor Market in Eastern Europe and Russia: Russia. In Simon Commander and Fabrizio Coricelli, Eds., *Unemployment, Restructuring, and the Labor Market in Eastern Europe and Russia,* 147–191. Washington, DC: EDI/World Bank, 1995.

Desai, Padma. 2000. Why Did the Ruble Collapse in August 1998? *American Economic Review*: Papers and Proceedings, 90(2), 48-52.

Doeringer, Peter B., and Michael J. Piore. 1971. *Internal Labour Market and Manpower Analysis,* Heath Lexington Books, Lexington, MA.

Dohmen, Thomas J. 2004. Performance, Seniority, and Wages: Formal Salary Systems and Individual Earnings Profiles. *Labour Economics,* 11(6), 741-763.

Dohmen, Thomas J., and Gerard A. Pfann. 2004. Worker Separations in a Nonstationary Corporate Environment. *European Economic Review*, 48(3), 645-663.

Dohmen, Thomas J., Hartmut Lehmann, and Anzelika Zaiceva. 2008. The Gender Earnings Gap inside a Russian Firm: First Evidence from Personnel Data – 1997 to 2002. *Journal for Labor Market Research* 41 (2/3). 157-180.

Dohmen, Thomas J., Hartmut Lehmann, and Mark. E. Schaffer. 2009. Wage

Determination and Wage Inequality inside a Russian Firm in Late Transition: Evidence from Personnel Data – 1997 to 2002. In Kanbur, Ravi And Jan Svejnar, *Labor and Development: Emerging Analytical and Policy Issues*, 62-90, Routledge.

Earle, John S., and Klara Sabirianova. 2002. How Late to Pay? Understanding Wage Arrears in Russia. *Journal of Labor Economics,* 20(3), 661-707.

Eder, M., Yakovlev A., and A. Çarkoglu 2003. The suitcase trade between Turkey and Russia: microeconomics and institutional structure. Working Paper WP4/2003/07, Higher School of Economics, Moscow.

Fallon, Peter R., and Robert E.B. Lucas 2002. The Impact of Financial Crises on Labor Markets, Household Incomes and Poverty. *The World Bank Research Observer,* 17(1), 21-45.

Fehr, Ernst, and Lorenz Goette. 2005. Robustness and Real Consequences of Downward Nominal Wage Rigidity. *Journal of Monetary Economics* 52, 779-804.

Gibbons, Robert, and Michael Waldman. 1999. Careers in Organizations: Theory and Evidence. in Orley C. Ashenfelter and David Card (eds.), *Handbook of Economics*, Vol. 3b, 2373-2437, Elsevier Science, Amsterdam.

Granger, C.W.J., and Paul Newbold. 1986. *Forecasting Econometric Time Series*, Academic Press, 2nd edition.

Hamermesh, Daniel S. 1993. *Labor Demand*, Cambridge, MA: MIT Press.

Hamermesh, Daniel S., and Gerard Pfann. 1996. Adjustment Costs in Factor Demand. *Journal of Economic Literature*, September, 1264-1292.

Kapeliushnikov, Rostislaw. 2002. *Rossiiski Rynok Truda: Adaptatsia bez Restrukturizatsii (The Russian Labor Market: Adjustment without Restructuring)*, Moscow (in Russian).

Kazakova, Irina. 2007. Wages in a Growing Russia. When is a 10 percent Rise in the Gender Wage Gap Good News? *Economics of Transition* 15 (2): 365–92.

Kharas, Homi, Brian Pinto and Sergei Ulatov. 2001. An Analysis of Russia's 1998 Meltdown: Fundamentals and Market Signals. *Brookings Papers on Economic Activity*, 1, 1-67.

Kommersant. 2006. Rating of top managers 2006. No. 182, 29 September.

Konings, Jozef, and Hartmut Lehmann. 2002. Marshall and Labor Demand in Russia: Going Back to Basics. *Journal of Comparative Economics* 30, 134-159.

Lazear, Edward P. 1999. Personnel Economics: Past Lessons and Future Directions. Presidential Address to the Society of Labor Economists, San Francisco, May 1, 1998, *Journal of Labor Economics*, 17(2), 199-236.

Lazear, Edward P., and Paul Oyer. 2004. Internal and External Labor Markets: A Personnel Economics Approach. *Labour Economics*, 11(5), 527-554.

Lehmann, Hartmut, Jonathan Wadsworth, and Alessandro Acquisti. 1999. Grime and Punishment: Job Insecurity and Wage Arrears in the Russian Federation. *Journal of Comparative Economics*, 27(4), 595-617.

Lehmann, Hartmut, Alexander Muravyev, Tiziano Razzolini, and Anzelika Zaiceva. 2013. The Wage and Non-Wage Costs of Worker Displacement: Evidence from Russia". forthcoming in *Journal of Comparative Economics*.

Manning, Alan. 2003. *Monopsony in Motion: Imperfect Competition in Labor Markets*, Princeton and Oxford, Princeton University Press.

Pissarides, Christofer A. 1994. Search Unemployment with On-the-job Search. *The Review of Economic Studies*, Vol.61, No.3 (Jul.1994), 457-475.

Rossstat (various years), *Statistical Yearbook*, Moscow, Russian Statistical Office.

Salop, Steven C. 1979. A Model of the Natural Rate of Unemployment. *The American Economic Review*, Vol.69, No.1 (Mar.1979), 117-125.

Schlicht, Ekkehart. 1978. Labour Turnover, Wages Structure, and Natural Unemployment. *Journal of Institutional and Theoretical Economics* 1978, 134(2), 337-364.

Shapiro, Carl, and Joseph E. Stiglitz. 1984. Unemployment as a Worker-Discipline Device. *American Economic Review*, 74, 433-444.

Summers, Lawrence H., and John Williamson. 2001. An Analysis of Russia's 1998 Meltdown: Fundamentals and Market Signals. Comments and Discussion. In *Brookings Papers on Economic Activity*, 1, 51-67.

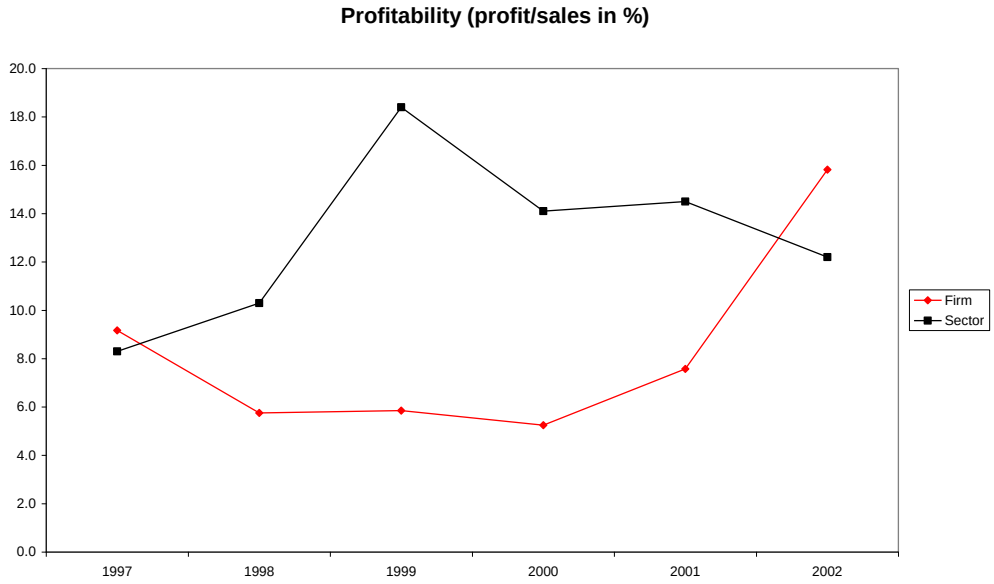
Von Wachter, Till, and Stefan Bender. 2006. In the Right Place at the Wrong Time: The Role of Firms and Luck in Young Workers' Careers. *American Economic Review*, 96(5): 1679-1705.

Wilson, Beth Ann. 1996. Movement of Wages over the Business Cycle: an Intra-Firm View. Board of Governors of the Federal Reserve System (U.S.), Finance and Economics Discussion Paper Series, 1997-1.

Wilson, Beth Ann. 1999. Wage Rigidity: A Look Inside the Firm. Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series.

FIGURES

Figure 1

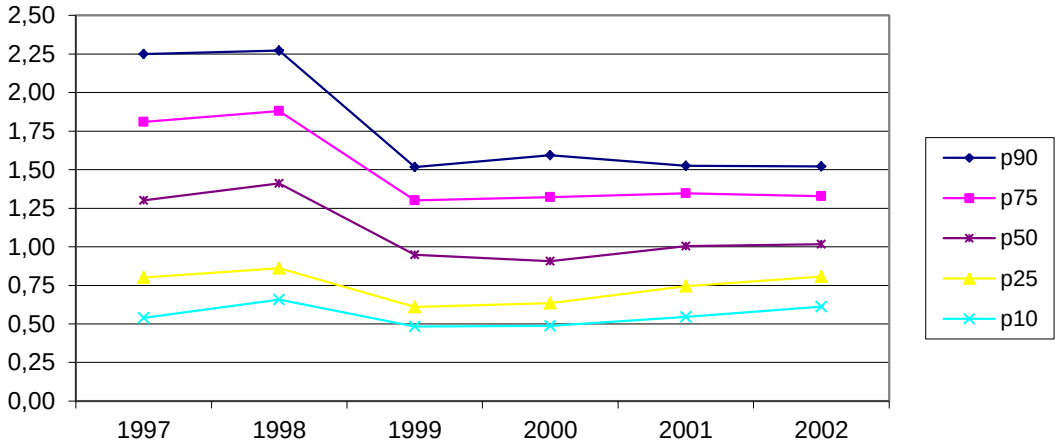


Notes: The figure shows the percentage of profits relative to sales for the firm and the average percentage of profits to sales for the machine building and metal working sector.
Source: Rosstat, authors' calculations.

Figure 2

Notes: The figure shows average real monthly wages in thousands of 1997 rubles for the firm and for the region in which the firm is located, and the unemployment rate in the region.
Source: Rosstat, authors' calculations.

Figure 3 Distribution of basic real monthly wage in thousands of rubles - all employees



Source: Personnel records of the firm, CPI deflator from Rosstat, authors' calculations.

Figure 4

Notes: The figure plots the smoothed density functions of the distribution of real wage growth between 1997 and 2002 for the all employees who stayed with the firm during the entire period. Wages were deflated using the national CPI. Wage growth is calculated as the percentage change in real wages relative to the real wage in 1997. The density function is estimated using a Gaussian kernel. The bandwidth is chosen to minimize the mean integrated squared error under the assumption that the data are Gaussian. In the graph we have cut-off the 0.5 percentiles (amounting to 20 observations) in the upper and lower tails for illustrative purposes. The minimum of wage growth in the sample amounts to -65.1 percent, while the maximum amounts to 417.7 percent

Source: Personnel records of the firm, CPI deflator from Rosstat, authors' calculations.

TABLES

Table 1: Composition of Workforce (in %), 1997 to 2002

Year	Service staff	Engineers	Production workers	Accountants	Managers	Total	Absolute number of employees	Average real monthly wage
1997	4.8	26.7	61.6	2.6	4.2	100	2902	1.357
1998	4.6	26.0	62.5	2.5	4.4	100	2942	1.428
1999	4.8	26.6	62.1	2.3	4.2	100	2873	0.984
2000	5.1	27.1	61.5	2.2	4.1	100	2872	0.995
2001	5.0	26.3	62.2	2.5	4.0	100	2966	1.048
2002	5.2	25.7	63.1	2.2	3.9	100	2979	1.082

Notes: The table shows the composition of the workforce in terms of the five employee categories in percentages. We restrict the sample to employees who always worked full-time and on a full-week schedule The absolute number of employees who always worked full-time and on full schedule is displayed in the rightmost column. Average monthly wage is given in thousands of 1997 constant rubles using an annual average CPI.

Source: Personnel records of the firm, authors' calculations.

Table 2a: Hiring and Separation Rates (in %), 1997-2002

	Service staff			Engineers			Production workers			Accountants			Managers			All Employment		
Year	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
1997	13.7	14.2	27.8	7.8	7.8	15.5	16.4	15.2	31.5	19.1	23.5	42.6	10.8	9.9	20.7	13.9	13.2	27.1
1998	13.3	13.3	26.5	6.3	5.8	12.1	18.0	16.1	34.1	20.0	23.1	43.1	16.1	13.4	29.5	14.7	13.5	28.2
1999	7.6	5.7	13.3	5.3	4.9	10.3	11.8	11.8	23.7	11.1	14.3	25.4	4.3	4.3	8.7	9.6	9.5	19.1
2000	9.3	7.4	16.7	6.4	5.7	12.1	10.7	7.6	18.3	8.2	0.0	8.2	3.5	0.0	3.5	9.2	6.7	15.9
2001	7.8	6.8	14.6	5.7	5.1	10.8	11.5	7.4	19.0	13.6	19.7	33.3	5.0	1.7	6.7	9.6	6.5	16.2
2002	5.4	3.6	9.0	2.9	3.0	5.9	8.7	7.8	16.5	8.1	9.7	17.7	0.0	0.0	0.0	6.7	6.1	12.8

Source: Personnel records of the firm, authors' calculations; In=hiring rate; Out=separation rate; Total=turnover rate.

Table 2b: Hiring and Separation and Turnover Rates (in %) in sample of industrial firms in the region - 1998-2001

	Service staff			Engineers			Production workers			Accountants			Managers			All Employment		
Year	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
1998	12.4	19.8	32.2	12.5	14.2	26.8	11.7	12.8	24.5	3.8	3.4	7.2	2.5	5.1	7.6	11.7	13.1	24.8
1999	16.8	14.9	31.7	9.2	7.5	16.6	13.2	12.6	25.8	4.5	4.1	8.6	4.1	2.6	6.6	11.9	11.0	22.9
2000	13.2	13.4	26.6	9.1	10.1	19.1	12.1	9.6	21.7	5.0	4.4	9.4	3.1	1.0	4.2	10.9	9.6	20.5
2001	9.7	8.4	18.1	9.1	5.0	14.1	8.6	6.8	15.5	1.9	1.1	3.0	2.1	1.4	3.5	8.7	6.1	14.8

Source: authors' calculations based on a balanced panel of 28 firms; In=hiring rate; Out=separation rate; Total=turnover rate.

Table 3: Determinants of wages in 1997 and 2002

Dependent variable:	log(real wage) in 1997			log(real wage) in 2002		
	All employees	Men	Women	All employees	Men	Women
Tenure in years	0.028***	0.023**	0.018	0.008*	0.014**	-0.007
	[0.008]	[0.009]	[0.013]	[0.005]	[0.006]	[0.007]
Tenure square/100 in years	-0.140**	-0.098	-0.094	-0.023	-0.068	0.073
	[0.068]	[0.081]	[0.127]	[0.034]	[0.043]	[0.059]
Tenure cube/1000 in years	0.026	0.015	0.023	0.004	0.013	-0.013
	[0.016]	[0.019]	[0.032]	[0.007]	[0.008]	[0.014]
Tenure marginal effect at 5 years	0.016***	0.015***	0.010**	0.006***	0.009***	-0.000
	[0.0028]	[0.0035]	[0.005]	[0.0020]	[0.003]	[0.003]
Tenure marginal effect at 10 years	0.008***	0.008***	0.006	0.005***	0.005***	0.004*
	[0.002]	[0.003]	[0.005]	[0.001]	[0.002]	[0.002]
Age in years	0.027	-0.050	0.160**	0.103***	0.119***	0.023
	[0.040]	[0.050]	[0.071]	[0.022]	[0.029]	[0.037]
Age squared/100 in years	-0.005	0.197	-0.378*	-0.229***	-0.258***	-0.039
	[0.106]	[0.133]	[0.198]	[0.055]	[0.071]	[0.094]
Age cube/1000 in years	-0.003	-0.020*	0.031*	0.017***	0.019***	0.002
	[0.009]	[0.011]	[0.018]	[0.004]	[0.006]	[0.008]
Age marginal effect at 25	0.018***	0.010*	0.028***	0.020***	0.025***	0.007
	[0.004]	[0.006]	[0.007]	[0.0030]	[0.004]	[0.005]
Age marginal effect at 40	0.007***	0.010***	0.004	0.001	0.002	0.001
	[0.002]	[0.003]	[0.003]	[0.001]	[0.001]	[0.002]
Age marginal effect at 50	-0.003	-0.005	0.011	0.001	0.001	-0.001
	[0.003]	[0.004]	[0.009]	[0.001]	[0.002]	[0.002]
Basic professional	0.030	-0.003	0.102*	0.051***	0.059**	0.012
	[0.030]	[0.036]	[0.053]	[0.019]	[0.025]	[0.027]
Secondary general	0.074**	0.057*	0.073	0.053***	0.028	0.081***
	[0.029]	[0.033]	[0.054]	[0.018]	[0.023]	[0.028]
Secondary professional	0.091***	0.015	0.241***	0.075***	0.041	0.114***
	[0.031]	[0.037]	[0.058]	[0.019]	[0.026]	[0.029]
Higher incomplete	0.173**	0.109	0.329***	0.072	0.036	0.122**
	[0.070]	[0.095]	[0.107]	[0.046]	[0.069]	[0.058]
Higher	0.117***	0.046	0.309***	0.098***	0.060*	0.167***
	[0.039]	[0.049]	[0.067]	[0.024]	[0.033]	[0.033]
1 if female	-0.324***	n.a.	n.a.	-0.165***	n.a.	n.a.
	[0.019]			[0.012]		
1 if single	0.025	0.133	-0.051	-0.035	0.157*	-0.023
	[0.071]	[0.095]	[0.105]	[0.039]	[0.091]	[0.050]
1 if divorced or widowed	0.007	-0.042	0.077	-0.068***	-0.067**	-0.055*
	[0.037]	[0.043]	[0.066]	[0.021]	[0.028]	[0.030]
1 if 1 child	-0.017	0.084	-0.131	0.017	0.194**	0.048
	[0.054]	[0.070]	[0.083]	[0.034]	[0.084]	[0.039]
1 if more than 1 child	0.042	0.142*	-0.090	0.026	0.183**	0.081*
	[0.058]	[0.074]	[0.092]	[0.037]	[0.086]	[0.045]
Service staff	-0.736***	-0.811***	-0.597***	-0.577***	-0.608***	-0.510***
	[0.041]	[0.051]	[0.069]	[0.024]	[0.031]	[0.038]
Engineers	-0.072**	-0.161***	-0.033	-0.009	-0.059**	0.045*
	[0.030]	[0.040]	[0.050]	[0.019]	[0.026]	[0.027]
Accountants	0.397***	-0.072	0.370***	0.157***	-0.090	0.156***
	[0.061]	[0.318]	[0.073]	[0.040]	[0.215]	[0.040]
Managers	0.650***	0.606***	0.852***	0.685***	0.644***	0.836***
	[0.051]	[0.056]	[0.119]	[0.032]	[0.039]	[0.057]
Constant	-0.558	0.347	-2.412***	-1.555***	-1.976***	-0.655
	[0.470]	[0.608]	[0.805]	[0.271]	[0.370]	[0.450]
Observations	2,899	1,772	1,127	2,974	1,853	1,121
R-squared	0.339	0.299	0.275	0.429	0.420	0.424

Notes: OLS estimates. Standard errors in brackets * significant at 10%; ** sign. at 5%; *** sign. at 1%.; estimates are based on personnel data, sample restricted to full-time workers working on full-week schedule; omitted category is production workers.

Table 4: Wage growth regressions – sample selection model

Dependent variable:	real wage growth over period from 1997 to 2002 [log(real monthly wage 2002)-log(real monthly wage 1997)]					
	All employees		Men		Women	
	(1) Wage growth equation	(2) Selection equation	(3) Wage growth equation	(4) Selection equation	(5) Wage growth equation	(6) Selection equation
Tenure in years	0.002		0.003		-0.001	
	[0.004]		[0.005]		[0.009]	
Tenure square/100 in years	-0.013	for tenure coefficients of step function in tenure see Appendix table	-0.029	for tenure coefficients of step function in tenure see Appendix table	0.009	for tenure coefficients of step function in tenure see Appendix table
	[0.039]		[0.046]		[0.083]	
Tenure cube/1000 in years	0.004		0.007		0.001	
	[0.009]		[0.010]		[0.021]	
Tenure marginal effect at 5 years	0.001		0.001		-0.000	
	[0.002]		[0.002]		[0.003]	
Tenure marginal effect at 10 years	0.001		-0.000		0.001	
	[0.001]		[0.002]		[0.003]	
Age in years	0.007		0.021		-0.018	
	[0.025]		[0.032]		[0.049]	
Age squared/100 in years	-0.028	for age coefficients of step function in age see Appendix table	-0.063	for age coefficients of step function in age see Appendix table	0.042	for age coefficients of step function in age see Appendix table
	[0.069]		[0.086]		[0.137]	
Age cube/1000 in years	0.003		0.006		-0.004	
	[0.006]		[0.007]		[0.012]	
Age marginal effect at 25	-0.002		0.001		-0.004	
	[0.003]		[0.003]		[0.004]	
Age marginal effect at 40	-0.002*		-0.001		-0.002	
	[0.001]		[0.002]		[0.002]	
Age marginal effect at 50	-0.000		0.002		-0.004	
	[0.002]		[0.002]		[0.006]	
Basic professional	-0.007	-0.429***	0.007	-0.534***	0.028	-0.231
	[0.019]	[0.088]	[0.024]	[0.112]	[0.033]	[0.152]
Secondary general	0.007	0.038	-0.001	-0.001	0.064**	0.015
	[0.016]	[0.084]	[0.018]	[0.104]	[0.032]	[0.154]
Secondary professional	0.024	-0.318***	0.028	-0.317***	0.069*	-0.226
	[0.019]	[0.091]	[0.022]	[0.114]	[0.039]	[0.167]
Higher incomplete	0.029	-0.204	0.070	-0.366	0.045	-0.010
	[0.039]	[0.215]	[0.057]	[0.319]	[0.060]	[0.321]
Higher	0.035	-0.246**	0.037	-0.252	0.084**	-0.122
	[0.022]	[0.115]	[0.028]	[0.155]	[0.041]	[0.191]
1 if female	-0.006	-0.549***	n.a.		n.a.	
	[0.012]	[0.060]				
1 if single	-0.075**	0.153	-0.058	0.900***	-0.096	-0.294
	[0.038]	[0.216]	[0.047]	[0.315]	[0.065]	[0.320]
1 if divorced or widowed	-0.050***	0.530***	-0.080***	0.415***	0.002	0.682***
	[0.018]	[0.112]	[0.023]	[0.138]	[0.031]	[0.200]
1 if one child		0.681***		1.291***		0.308
		[0.167]		[0.249]		[0.243]
1 if more than one child		0.919***		1.546***		0.417
		[0.178]		[0.260]		[0.265]

Table 4 (continued)

Service staff	0.159***	0.568***	0.095***	0.604***	0.278***	0.759***
	[0.020]	[0.113]	[0.026]	[0.154]	[0.034]	[0.174]
Engineers	0.098***	1.071***	0.051*	0.980***	0.142***	1.294***
	[0.020]	[0.091]	[0.027]	[0.134]	[0.038]	[0.146]
Accountants	-0.118***	0.340**	-0.204	0.539	-0.104**	0.448**
	[0.037]	[0.170]	[0.143]	[0.731]	[0.046]	[0.204]
Managers	-0.066**	0.527***	-0.092***	0.400**	-0.016	1.180***
	[0.027]	[0.156]	[0.032]	[0.184]	[0.062]	[0.356]
Position in job-specific wage decile in 1997						
Decile 1	0.596***	-0.181	0.607***	-0.509***	0.625***	0.276
	[0.023]	[0.117]	[0.036]	[0.175]	[0.034]	[0.175]
Decile 2	0.308***	-0.057	0.304***	-0.136	0.326***	0.191
	[0.023]	[0.118]	[0.032]	[0.169]	[0.035]	[0.180]
Decile 3	0.182***	0.037	0.205***	-0.025	0.184***	0.248
	[0.021]	[0.110]	[0.029]	[0.152]	[0.034]	[0.173]
Decile 4	0.114***	0.291**	0.120***	0.206	0.119***	0.462**
	[0.021]	[0.114]	[0.026]	[0.147]	[0.036]	[0.189]
Decile 6	-0.039*	-0.002	-0.049*	0.115	-0.018	-0.141
	[0.022]	[0.116]	[0.027]	[0.152]	[0.039]	[0.194]
Decile 7	-0.080***	0.245**	-0.067***	0.239*	-0.119***	0.261
	[0.021]	[0.113]	[0.025]	[0.145]	[0.037]	[0.193]
Decile 8	-0.171***	0.219*	-0.170***	0.085	-0.162***	0.472**
	[0.020]	[0.112]	[0.025]	[0.137]	[0.039]	[0.218]
Decile 9	-0.191***	0.195	-0.188***	0.024	-0.187***	0.566**
	[0.023]	[0.130]	[0.028]	[0.160]	[0.042]	[0.243]
Decile 10	-0.256***	-0.167	-0.261***	-0.312**	-0.184***	0.376
	[0.023]	[0.119]	[0.028]	[0.144]	[0.044]	[0.243]
Constant	-0.235	0.078	-0.393	-0.301	-0.055	-0.449
	[0.299]	[0.220]	[0.380]	[0.321]	[0.565]	[0.324]
ρ	-0.233**		-0.590***		-0.030	
	[0.114]		[0.175]		[0.149]	
Λ	-1.642***		-1.594***		-1.681***	
	[0.021]		[0.041]		[0.029]	
Observations	2976		1796		1180	

Estimates of wage growth regression from Heckman selection model based on personnel data; sample restricted to full-time workers working on full-week schedule. ρ is the correlation between the errors in the selection and regression equations; $\Lambda=\rho\sigma$, where σ is the variance of the error in the regression equation. Estimation is by maximum likelihood. Reference category: Worker with basic education who is married and in 5th decile of job specific wage distribution in 1997. Standard errors in brackets. * significant at 10%; ** sign. at 5%; *** sign. at 1%

Appendix

Table A1 – Coefficients of step function in tenure and age from selection equations reported in Table 4

	Sample		
	All employees	Men	Women
Tenure up to 1 year	-0.603***	-0.868***	-0.487***
	[0.107]	[0.171]	[0.147]
Tenure up to 2 years	-0.921***	-1.207***	-0.856***
	[0.110]	[0.174]	[0.150]
Tenure up to 3 years	-0.537***	-0.539***	-0.772***
	[0.100]	[0.158]	[0.145]
Tenure up to 4 years	-1.150***	-1.354***	-0.967***
	[0.118]	[0.167]	[0.194]
Tenure up to 5years	-1.227***	-1.452***	-1.089***
	[0.157]	[0.207]	[0.270]
Tenure up to 6 years	-1.376***	-1.470***	-1.427***
	[0.134]	[0.177]	[0.234]
Tenure up to 7 years	-0.729***	-0.885***	-0.844***
	[0.152]	[0.198]	[0.287]
Tenure up to 8 years	-0.811***	-0.868***	-1.251***
	[0.171]	[0.230]	[0.314]
Tenure up to 9 years	-0.583***	-0.818***	-0.592
	[0.215]	[0.275]	[0.410]
Tenure 10 to 15 years	-0.613***	-0.654***	-0.786***
	[0.119]	[0.180]	[0.184]
Tenure 15 to 20 years	-0.678***	-0.641***	-1.081***
	[0.128]	[0.187]	[0.214]
Tenure 20 to 25 years	-0.752***	-0.732***	-1.116***
	[0.146]	[0.192]	[0.271]
Tenure 25 to 30 years	-0.509***	-0.571**	-0.465
	[0.191]	[0.240]	[0.440]
Tenure 30 to 35 years	0.302	0.231	
	[0.514]	[0.536]	
Tenure more than 35 years	-0.403	-0.116	
	[0.541]	[0.655]	
Age less than 20	-0.789*	-1.363*	-0.676
	[0.406]	[0.788]	[0.522]
Age 20 to 25	-0.036	0.053	-0.190
	[0.106]	[0.138]	[0.172]
Age 25 to 30	-0.006	0.226*	-0.452***
	[0.088]	[0.115]	[0.149]
Age 35 to 40	0.234**	0.113	0.386***
	[0.092]	[0.121]	[0.140]
Age 40 to 45	0.235***	0.205*	0.360**
	[0.091]	[0.121]	[0.140]
Age 45 to 50	0.455***	0.413***	0.526***
	[0.097]	[0.132]	[0.144]
Age 50 to 55	0.342***	0.104	0.750***
	[0.129]	[0.172]	[0.200]
Age more than 55	-0.433**	-0.396**	
	[0.179]	[0.191]	

Notes: Standard errors in brackets * significant at 10%; ** sign. at 5%; *** sign. at 1%; sample restricted to full-time workers working on full-week schedule. Omitted categories are: tenure = 10 years; education = basic general; 30 < age ≤ 35; job category = production workers.

Table A2: Duration of employment till separation (Cox proportional hazard model)

Period:	1997-2002			1997-99			2000-02		
	All	Men	Women	All	Men	Women	All	Men	Women
Tenure:									
≤ 1 year	-0.758***	-0.482**	-1.213***	-1.041***	-0.310	-2.156***	0.028	-0.258	1.367
	[0.186]	[0.236]	[0.307]	[0.240]	[0.340]	[0.346]	[0.294]	[0.338]	[1.020]
> 1 year and ≤ 2 years	-0.530***	-0.363	-0.862***	-0.539**	0.033	-1.402***	0.070	-0.178	1.336
	[0.181]	[0.232]	[0.300]	[0.232]	[0.336]	[0.322]	[0.290]	[0.325]	[1.021]
> 2 years and ≤ 3 years	-0.385**	-0.257	-0.710**	-0.246	0.326	-1.095***	0.130	-0.124	1.329
	[0.179]	[0.227]	[0.298]	[0.230]	[0.332]	[0.320]	[0.288]	[0.320]	[1.020]
> 3 years and ≤ 4 years	-0.299*	-0.467**	-0.368	-0.003	0.175	-0.555*	-0.317	-0.804**	1.129
	[0.179]	[0.232]	[0.296]	[0.228]	[0.334]	[0.314]	[0.297]	[0.347]	[1.022]
> 4 years and ≤ 5 years	-0.428**	-0.636***	-0.379	-0.319	-0.277	-0.670**	-0.341	-0.805**	1.153
	[0.185]	[0.239]	[0.303]	[0.238]	[0.349]	[0.330]	[0.294]	[0.337]	[1.021]
> 5 years and ≤ 6 years	-0.079	-0.256	0.003	0.197	0.448	-0.327	-0.344	-1.081***	1.456
	[0.183]	[0.233]	[0.304]	[0.235]	[0.334]	[0.337]	[0.295]	[0.351]	[1.019]
> 6 years and ≤ 7 years	-0.062	-0.134	-0.082	0.274	0.530	-0.215	-0.333	-0.783**	1.317
	[0.190]	[0.236]	[0.322]	[0.245]	[0.343]	[0.359]	[0.298]	[0.332]	[1.030]
> 7 years and ≤ 8 years	0.018	0.154	-0.478	0.403	0.753**	-0.203	-0.417	-0.457	-0.085
	[0.196]	[0.235]	[0.370]	[0.249]	[0.342]	[0.391]	[0.318]	[0.333]	[1.159]
> 8 years and ≤ 9 years	0.142	0.242	-0.179	0.262	0.714**	-0.549	0.072	-0.242	1.568
	[0.205]	[0.247]	[0.375]	[0.265]	[0.356]	[0.444]	[0.318]	[0.348]	[1.058]
> 10 years and ≤ 15 years	-0.223	-0.165	-0.429	-0.269	-0.126	-0.627*	-0.180	-0.178	0.131
	[0.190]	[0.233]	[0.331]	[0.243]	[0.344]	[0.346]	[0.306]	[0.322]	[1.159]
> 15 years and ≤ 20 years	-0.011	-0.052	-0.010	-0.183	-0.044	-0.401	0.324	0.076	1.487
	[0.198]	[0.246]	[0.338]	[0.252]	[0.355]	[0.367]	[0.324]	[0.353]	[1.078]
> 20 years and ≤ 25 years	-0.164	-0.192	-0.252	-0.061	0.186	-0.438	-0.515	-0.752*	-0.024
	[0.218]	[0.262]	[0.411]	[0.268]	[0.362]	[0.433]	[0.397]	[0.420]	[1.428]
> 25 years and ≤ 30 years	-0.739**	-0.792**	-1.283*	-1.008**	-0.656	-2.097**	-0.293	-0.742	0.998
	[0.305]	[0.344]	[0.765]	[0.402]	[0.480]	[1.047]	[0.468]	[0.505]	[1.429]
> 30 years	-0.523	-0.927**	0.475	-1.083*	-1.217	-0.034	-0.037	-0.752	2.217*
	[0.352]	[0.419]	[0.658]	[0.626]	[0.786]	[1.074]	[0.454]	[0.512]	[1.247]

Table A2 (continued)

Basic professional	0.539***	0.652***	0.318**	0.131	0.058	0.198	1.126***	1.469***	0.524**
	[0.082]	[0.112]	[0.126]	[0.101]	[0.137]	[0.151]	[0.152]	[0.215]	[0.232]
Secondary general	0.176**	0.242**	0.120	-0.010	-0.019	0.051	0.342**	0.480**	0.176
	[0.086]	[0.115]	[0.135]	[0.103]	[0.135]	[0.162]	[0.164]	[0.227]	[0.252]
Secondary professional	0.542***	0.611***	0.392***	0.157	0.102	0.105	1.072***	1.299***	0.744***
	[0.087]	[0.117]	[0.134]	[0.107]	[0.144]	[0.167]	[0.156]	[0.220]	[0.230]
Higher incomplete	0.401*	0.410	0.265	-0.119	-0.289	-0.015	1.113***	1.203**	0.866*
	[0.219]	[0.328]	[0.304]	[0.293]	[0.465]	[0.387]	[0.336]	[0.504]	[0.503]
Higher	0.414***	0.613***	0.201	-0.033	0.160	-0.242	0.976***	1.112***	0.828***
	[0.117]	[0.167]	[0.170]	[0.149]	[0.213]	[0.218]	[0.197]	[0.290]	[0.280]
Age:									
≤ 20 years	0.229	-0.081	0.755*	1.509***	1.383***	1.847***	--	--	--
	[0.314]	[0.483]	[0.421]	[0.324]	[0.482]	[0.452]			
> 20 years and ≤ 25 years	-0.001	0.127	-0.098	0.127	0.261	-0.011	-1.047***	-0.935***	-0.679**
	[0.112]	[0.155]	[0.166]	[0.133]	[0.181]	[0.200]	[0.221]	[0.308]	[0.335]
> 25 years and ≤ 30 years	0.176**	0.175	0.252**	0.039	-0.125	0.325**	0.210	0.463**	0.102
	[0.083]	[0.116]	[0.119]	[0.105]	[0.146]	[0.151]	[0.137]	[0.198]	[0.196]
> 35 years and ≤ 40 years	-0.275***	-0.148	-0.439***	-0.118	-0.053	-0.238	-0.514***	-0.094	-0.940***
	[0.092]	[0.128]	[0.134]	[0.116]	[0.167]	[0.164]	[0.152]	[0.205]	[0.236]
> 40 years and ≤ 50 years	-0.363***	-0.211	-0.525***	-0.263**	-0.181	-0.358**	-0.501***	-0.071	-0.810***
	[0.095]	[0.131]	[0.139]	[0.121]	[0.167]	[0.176]	[0.153]	[0.214]	[0.229]
> 45 years and ≤ 50 years	-0.616***	-0.438***	-0.815***	-0.448***	-0.414**	-0.482***	-0.958***	-0.483**	-1.436***
	[0.102]	[0.141]	[0.148]	[0.129]	[0.184]	[0.182]	[0.165]	[0.224]	[0.252]
> 50 years and ≤ 55 years	-0.730***	-0.248	-1.481***	-0.651***	-0.343	-1.178***	-0.955***	-0.271	-1.938***
	[0.122]	[0.154]	[0.217]	[0.181]	[0.234]	[0.301]	[0.170]	[0.219]	[0.316]
> 55 years	0.143	0.160	0.186	0.512***	0.337	0.902***	-0.392**	-0.080	-0.508
	[0.136]	[0.175]	[0.225]	[0.188]	[0.239]	[0.317]	[0.199]	[0.263]	[0.322]
Service staff	-0.425***	-0.364**	-0.581***	-0.556***	-0.567**	-0.833***	-0.597***	-0.625**	-0.406
	[0.137]	[0.183]	[0.211]	[0.173]	[0.232]	[0.265]	[0.226]	[0.300]	[0.358]
Engineers	-0.998***	-0.940***	-1.039***	-1.125***	-1.259***	-1.181***	-0.774***	-0.732***	-0.738***
	[0.092]	[0.145]	[0.127]	[0.121]	[0.200]	[0.163]	[0.140]	[0.212]	[0.207]
Accountants	-0.194	0.448	-0.168	-0.097	-43.515	-0.061	-0.267	1.402*	-0.467
	[0.154]	[0.736]	[0.170]	[0.193]	[0.000]	[0.212]	[0.259]	[0.810]	[0.296]
Managers	-0.646***	-0.585***	-1.097**	-0.169	-0.256	-0.591	-2.614***	-2.349***	-46.602
	[0.195]	[0.225]	[0.434]	[0.213]	[0.255]	[0.445]	[0.720]	[0.727]	[0.000]

Table A2 (continued)

1 if female	0.592***	n.a.	n.a.	0.561***	n.a.	n.a.	0.246**	n.a.	n.a.
	[0.058]			[0.076]			[0.097]		
1 if single	0.011	-0.579***	0.410*	-0.048	-0.384	0.307	0.457*	-0.514	1.227***
	[0.158]	[0.216]	[0.237]	[0.200]	[0.269]	[0.300]	[0.265]	[0.359]	[0.387]
1 if divorced or widowed	-0.443**	0.176	-0.867***	-0.708***	-0.370	-1.091***	-0.386	0.610	-1.243***
	[0.193]	[0.254]	[0.302]	[0.267]	[0.349]	[0.422]	[0.299]	[0.388]	[0.454]
1 if 1 child	-0.429***	-0.960***	0.027	-0.505***	-0.886***	-0.162	-0.326	-1.216***	0.563
	[0.128]	[0.163]	[0.205]	[0.157]	[0.201]	[0.247]	[0.226]	[0.284]	[0.359]
1 if more than 1 child	-0.627***	-1.228***	-0.040	-0.962***	-1.327***	-0.628**	-0.104	-1.179***	1.043***
	[0.147]	[0.187]	[0.234]	[0.186]	[0.236]	[0.297]	[0.249]	[0.314]	[0.392]
Position in job-specific wage decile in 1997									
Decile 1	0.318***	0.212	0.188	0.444***	0.879***	0.041	0.472**	-0.041	0.554**
	[0.110]	[0.177]	[0.146]	[0.132]	[0.204]	[0.177]	[0.200]	[0.374]	[0.271]
Decile 2	0.038	0.069	-0.131	-0.009	0.153	-0.259	0.041	-0.210	0.168
	[0.120]	[0.184]	[0.161]	[0.143]	[0.222]	[0.192]	[0.218]	[0.332]	[0.302]
Decile 3	0.122	0.276	-0.115	0.137	0.444**	-0.228	-0.027	-0.273	0.150
	[0.119]	[0.172]	[0.166]	[0.141]	[0.205]	[0.196]	[0.225]	[0.327]	[0.318]
Decile 4	-0.004	0.034	-0.085	-0.012	0.061	-0.088	0.108	0.109	0.032
	[0.126]	[0.180]	[0.177]	[0.153]	[0.222]	[0.213]	[0.222]	[0.313]	[0.319]
Decile 6	0.110	0.173	0.039	0.003	0.037	0.035	0.367*	0.419	0.249
	[0.122]	[0.168]	[0.181]	[0.148]	[0.212]	[0.211]	[0.217]	[0.280]	[0.360]
Decile 7	-0.068	0.006	-0.132	0.073	0.208	-0.084	-0.431*	-0.383	-0.373
	[0.130]	[0.173]	[0.203]	[0.151]	[0.209]	[0.227]	[0.256]	[0.316]	[0.475]
Decile 8	-0.352**	-0.158	-0.699**	-0.361**	-0.108	-0.574*	-0.471*	-0.321	-1.168
	[0.143]	[0.178]	[0.280]	[0.167]	[0.214]	[0.306]	[0.280]	[0.326]	[0.749]
Decile 9	0.005	0.208	-0.552*	-0.089	0.202	-0.630*	0.084	0.081	-0.231
	[0.137]	[0.171]	[0.289]	[0.170]	[0.215]	[0.352]	[0.235]	[0.287]	[0.516]
Decile 10	0.464***	0.672***	-0.481	0.455***	0.777***	-0.566	0.344	0.310	-0.064
	[0.122]	[0.154]	[0.321]	[0.144]	[0.189]	[0.358]	[0.229]	[0.275]	[0.759]
Observations	211,924	138,002	73,922	94,167	58,650	35,517	110,425	71,851	38,574

Notes: Standard errors in brackets * significant at 10%; ** sign. at 5%; *** sign. at 1%; "--" indicates too few observations in cell to obtain estimate; sample restricted to full-time workers working on full-week schedule. Omitted categories are: tenure = 10 years; education = basic general; 30 < age ≤ 35; job category = production workers; wage decile 5 (40-50%).