

# **Wage determination in oligopsonistic labour markets: evidence from Russia and Central Asia**

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## **Introduction**

The key prediction of perfectly competitive labour markets is the “law of one wage”, which holds that there should be a single market wage for a given quality of labour. It also implies that the observed wage dispersion should be fully explained by differences in jobs/occupations that are vertically differentiated by degree of hazardousness, risk of injury and other aspects of working conditions.

Despite of its popularity and recognition as a mainstream framework in analyses of wages and employment determination, theory of competitive labour markets faces serious criticism concerning its theoretical grounds as well as conformity to empirical evidence. Particularly, Kaufman (2007) argues that zero transaction costs implied by the competitive theory make it impossible for multi-employee firms to exist due to the following reason – zero transaction costs indicate that market contracts are always chosen to undertake the transactions, including employment relations, which means that all employees are replaced by independent contractors with complete spot contracts and none of the firms grow beyond a single-person sole proprietorship. As a result, merely existence of multi-employee firms requires transaction costs to be positive, which contradicts the assumptions of competitive labour market and results in imperfect competition with upward-sloping labour supply curve (Kaufman, 2007).

Another strand of criticism comes from studies questioning compatibility of the “law of one wage” with empirical evidence. Studies of US and UK data by Bowlus et al. (1995), Machin and Manning (2004), and Bhaskar et al. (2002) demonstrate the existence of wage dispersion beyond the level, which can be explained by variations of labour quality and job/occupation specifications. The most important finding is that inter-firm wage dispersion for similar job duties is the biggest in all studies. Simply saying there is no uniform market wage rate for any work occupation. Bhaskar et al. (2002) also present the indirect evidence of wage differentiation for workers of

similar qualities but working in different firms. Particularly, they suggest that if wages are set according to the workers' productivities then there should be little on-the-work job search, since high productive workers receive high wages in all firms. The same logic is valid for low productive workers as well. However, if considerable wage dispersion exists then switching jobs may lead to increase in the worker's wage and low-wage worker is expected to be more active in on-the-job search, since he/she have better chance that the next wage will be higher, although the job may be still at the low skill level. Empirical tests generate the results strongly supporting the suggestion (Bhaskar et al. 2002).

Another widely reported evidence that contradicts predictions of the competitive labour market is the strong effect of employer's characteristics, such as financial performance, on wage determination. In competitive labour market, where the wage is set exogenously to the firm, financial performance of the employer should play little role in wage determination. However, a number of empirical works indicate the contrary. The most notable ones are Nickell and Wadhvani (1990), Denny and Machin (1991), Abowd and Lemieux (1993) and Blanchflower et al. (1996). Using British, Canadian and U.S. data all studies report positive relationship between the firm's wage and its financial performance measured by revenue, profit or value added per employee. Similar results are obtained by Dong (1998) and Christev and FitzRoy (2002) using Chinese and Polish firm-level datasets respectively. It seems sensible to suggest that the given evidence is observed in different parts of the world and is not a specific feature of a particular country, region or economic system.

Theoretical frameworks used to explain the given divergences of competitive labour market theory and empirical evidence include suggesting market power to employers forming so-called monopsony or more generally oligopsony in labour markets. In monopsony/oligopsony the market power of employers is explained by their sizes being large, relative to the whole market. As a result, in traditional understanding there are one or few employers in the labour market.

Alternative framework is based on institutionalized nature of the labour market, with strong trade unions and large employers, where wage (and employment) is determined through bargaining process between employers and trade union or group of workers. Market power possessed by both sides of the bargaining leads to creation of rents, which are shared between the employer and its employees and each side gets the share of rents according to its bargaining power. Employees' bargaining power

could be the result of their unionization and/or possession of firm specific skills and knowledge giving rise to employment turnover costs for the employer.

Since monopsony/oligopsony models and unionized labour markets are considered as rather exceptions of generally competitive structures, it is perceived that their existence does not compromise the validity of the theory of competitive labour market. On the basis of this, it is also commonly accepted that wage dispersion and association of wages with the employers' financial position should not be observed in the unspecialized and/or non-unionized markets. However, findings of Bowlus et al. (1995), Machin and Manning (2004), and Bhaskar et al. (2002) suggest wage dispersion for such occupations as janitors, day care workers and fast food employees, which are usually unspecialized and non-unionized. Dong (1998) and Clarke (2002) indicate dependence of wage on the employer's financial characteristics for labour markets of China and Russia respectively, where trade unions are weak and have little participation in wage determination.

Recent research suggests that common sources of market power – product differentiation and imperfect information apply in labour markets on the same way as in product markets. Models assuming employers to have non-negligible market power due to these reasons may be referred as 'modern monopsony' models. One strand of them is search models. Particularly, Burdett and Mortensen (1998) demonstrated that imperfect information about the job vacancies led to non-degenerate wage distribution even if there were homogeneities in employers' productivity and workers' ability levels. More general version of their model, where employers vary in productivity levels, predicts positive relationship between the firm's productivity and its wage (Burdett and Mortensen, 1998).

Another type of 'modern monopsony' can be oligopsonic model by Bhaskar and To (2003), which suggests that heterogeneity of workers' preferences for non-wage characteristics causes dependence of wages on the employers' productivity levels. Heterogeneity of employers in productivity levels leads to equilibrium wage dispersion.

Distinctively from the traditional version, 'modern monopsony' models explain the existence of the employers' market power not by their fewness in the labour market, but by the presence of market frictions caused by heterogeneity or imperfect information. The logic of the models is as follows: there may be a large number of

employers in the market; nevertheless a particular worker will have only a handful set of employers to choose from due to market frictions.

Since the existence of the market frictions is perceived to be a generic feature of the most of the labour markets, it may be argued that ‘modern monopsony’ models should replace competitive labour market theory as a central framework for the analysis. Manning (2003) provides substantial discussion trying to convince that ‘modern monopsony’ models, particularly, search models, provide better explanation for many observed empirical regularities, like wage dispersion, wage-productivity relationship, gender, race wage discriminations and others.

The importance of deciding whether to consider labour markets inherently competitive or to accept that employers, in general, have non-negligible market power in wage determination is explained by Manning (2004). He demonstrated that market intervention policies, like minimum wages, enhancement of trade unions, unemployment benefits and others, which are believed to reduce efficiency in competitive structures, may be concluded to improve efficiency if underlining model assumes employers’ market power.

In our work we will try to contribute to the literature supporting the view that ‘modern monopsony’ models are valid representations of the processes in labour market. Using the data of the 2005 Business Environment and Enterprise Performance Survey, undertaken by the European Bank for Reconstruction and Development and the World Bank we try to verify whether the predictions of the oligopsonitic model are observed in data for Kazakhstan, Kyrgyzstan, Russia, Tajikistan and Uzbekistan.

The paper is organized in the following way: in Section 2 we will provide background information about the countries studied. Section 3 contains detailed information about the model of oligopsonistic labour market by Bhaskar and To (2003). Also there we will discuss the econometric model estimated in our work. Section 4 gives information about the dataset used. Section 5 presents the econometric model. Section 6 discusses the results and concludes.

## **Section 2. Labour markets of Russia and Central Asia**

For the last 10-15 years labour markets of Russia and Central Asia underwent substantial transformation from the structures characterised by centralized wage setting, no open unemployment and very high levels of unionization into the markets with decentralized wage determination, where employers have non-negligible market

power, especially in the private sector. Particularly, the 2009 Transition Report by EBRD recognizes the absence of wage regulation from the side of the government for all considered countries, except of Uzbekistan<sup>1</sup>.

Membership in trade unions is still widespread, but high level of unionization is rather the heritage from previous Soviet system of labour relations than the independent factor affecting wage determination. Surveys and exploratory studies reveal that trade unions in Russia and Central Asian countries play very little, if any, role in wage determination, focusing on administering enterprises' welfare benefits, health and safety programmes and other similar tasks (Kapelushnikov, 2003; Kaser, 2005; Pavlova and Rohozynsky, 2005).

Minimum wages are set in each country, but being at very low level they are not binding constraints in labour markets. Particularly, since the mid-1990s till 2005 the minimum wage was less than 10% of average wage in Russia (Pavlova and Rohozynsky, 2005). Since 2006 the relative size of minimum wage is growing, but it still is around 20% only. Kazakhstan had slightly higher ratio, although it was declining over time, from 25% in 1999 to 17% in December 2003. In Kyrgyzstan, the minimum wage was a mere 4% of the average wage in 2004, and 8.6% in Tajikistan (Kaser, 2005). Unfortunately, there is no recent data available for Uzbekistan.

Low degree of labour market interventions with wage decentralization imply that wages should be set as described by competitive labour market theory. Empirical studies, which are mostly about the labour market of Russia, reveal, however, the contrary. Particularly, observed wage dispersion appears to be of the type that is difficult to ascribe to the competitive labour market. Namely, Clarke (2002) identified that the 71% of the variation in wages was within occupations, while only 27% were between occupations. In other words, wage differences between two identical occupations in two different firms were, on average, larger than wage differences between two different occupations within a firm. Clarke (2002) stresses that the given feature of the wage dispersion is observed across all industries and occupations, hence, it can be considered as a general phenomenon (p.635).

As it was stated in the previous section, substantial within occupational and inter-firm wage differences are perfectly compatible with competitive labour market

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<sup>1</sup> It is commonly believed that wage caps in Uzbekistan are implemented with the aim of preventing firms from circumventing cash withdrawal restrictions imposed by Uzbek government as an administrative measure to reduce inflation (Foreign Labor Trends Report, 2006).

framework as long as wage differentials can be explained by differences in workers' human capital levels. Clarke (2002) estimates the joint effect of human capital variables to be between only 7-11% in explaining the variance of wages. Brainerd (1998) measures the gross effect of human capital factors to be around as low as 13-17%.

Brainerd (1998) argues that skills obtained under "old" system were not highly rewarded in the "new" system. As a result, observable characteristics of a worker's quality such as education and worker experience do not truly reflect his/her productivity. Clarke (2002) opposes this idea suggesting that, despite of the skills mismatch, experience and education are the only observable characteristics to potential employers. Therefore, if there is unobserved heterogeneity between employees, it is equally unobservable as for econometrician as well as for the employer (Clarke 2002, p. 640).

Multi-level regression results also suggest low explanatory power of human capital variables. Clarke (2002) estimates that human capital factors account for only 4% of the wage variance within occupations and 5% of the variance between occupations.

At the same time, employer characteristics, such as industrial attainment, size, financial performance, stability of pay, were found the most powerful wage determinants (Clarke 2002). Luke and Schaffer (2000) also report positive relationship between the firm's financial performance and the wage level it paid. Survey results by Kapelushnikov (2003) suggest that employers had almost unilateral power in setting wages and this could explain the strong relationship between the financial resources available to the firms and the wages it afforded to pay.

Wage dispersion and positive association of wages with the employers' financial positions suggest that labour market in Russia should not be characterized as competitive, although wage setting has been decentralized and labour market interventions are low. As it was presented in the previous section 'modern monopsony' theories are useful in explaining this controversy.

Unfortunately, there is no much empirical evidence on the labour market of Central Asian countries. Lack of applied research, probably, is a result of difficulties in obtaining firm-, household- or individual-level data. The only empirical study known to us is by Anderson and Pomfret (2002), who identified that location of the household, number of children in it, and education level of its head were significant

factors and played the largest role in determining the relative living standards, measured as sum of household expenditures per adult. This study sheds some light on the matter of wage determination suggesting expenditure, and therefore, income variation across various location units and education levels. It is obvious that this sort of indirect evidence is not enough to conclude whether the labour market is competitive or not. At the same time, sources of the employers' market power in 'modern monopsony' models are quite generic and should be observed in any labour market, unless their effects are hampered by centralized wage setting or trade unions. Since none of these factors are strong in Central Asian economies we believe that 'modern monopsony' models may be applicable in these countries too.

In the next section we will consider the oligopsonistic model of labour market developed by Bhaskar and To (2003), implications of which we tried to test in this work.

### **Section 3. Oligopsonistic labour market**

One group of the 'modern monopsony' models assume that jobs are differentiated in some way. Workers are heterogeneous as well, but each model makes its own assumptions about the features the workers and the firms differ by. For example, Bueckner et al. (2002) assume that workers differ in the skill levels, while employers vary in skill needs due to the differences in their technologies. In Hamilton et al. (2000) workers, again, have different levels of skills, but this time, firms are differentiated by the geographical location. Bhaskar and To (2003) do not specify particular feature the firms differ, but rather set a general assumption that jobs are differentiated in non-wage characteristics like job specifications, hours of work, distance of the firm from the worker's home, social environment in the workplace and others. Workers have heterogeneous preferences over these non-wage characteristics.

All these theories are based on the model of product differentiation of Salop (1979) and, therefore, assume that workers and firms are distributed along some characteristics space, which is typically modelled as a circle. Workers are uniformly and continuously located along the circle. Employers are uniformly distributed too, but they don't exist at all points of the characteristics space because of the fixed costs of firm creation. Equidistant location of the firms along the characteristics circle is

assumed<sup>2</sup>. Analogously to the Salop’s model, the distance between the firms along the characteristics circle determines the degree of the market power the employers have, since the larger the distance between the firms the higher the “commuting” or “transportation” costs for the workers. Other simplifying assumptions are perfect information and zero mobility costs as the workers are not allowed to change their locations on the characteristics space.

Although all the models have similar basic features, the one by Bhaskar and To (2003) has a strong advantage over others in terms of having no restrictions on the structure and type of characteristics the firms may differ by. This feature of the model allows considering existence of monopsonic labour markets, and therefore of employers’ market power, almost everywhere, since it implies that even seemingly equal firms differ in the eyes of the workers due to the workers’ heterogeneity in preferences over the characteristics of the firms. For this reason we concentrate on the model by Bhaskar and To (2003).

Bhaskar and To (2003) argue that if firm differ discretely along the characteristics space and workers have heterogeneous preferences over these characteristics then each firm encounters an upward-sloping labour supply function given by  $L_i(w_i, W_{-i})$ .  $W_{-i}$  represents the wages in other firms. Since there are many firms in the market they compete with each other to employ the labour. It is evident from the structure of the labour supply function that Bhaskar and To (2003) model implies Bertrand competition, where the problem of the firm is  $\max_{w_i} R_i L_i(w_i, W_{-i}) - w_i L_i(w_i, W_{-i})$ .

As it has already been stated it is assumed that job characteristics space is a unit circumference. The preferences of a worker determine his/her location point on the characteristics circumference, and since the preferences vary continuously workers are uniformly distributed at all points of the circumference. It should be noted that all workers have equal abilities. Diversity of workers is allowed in the simplest way: there are only two types of workers - a unit mass of workers with zero reservation wage, and a mass of  $\delta$  of workers with positive reservation wage,  $v$ . Since the firms are located only on selected points of the circumference (due to fixed set-up costs) most of the workers have to “travel” from their location to those of their employers.

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<sup>2</sup> The assumption is based on the conclusion made regarding the equilibrium location of firms on the product characteristics space (line or circle). See d’Aspremont et al. (1979), Economides (1989) and Katz (1995) for details.

This suggestion implies that rarely one can find the job that suits absolutely all his/her preferences. Most of the people have to compromise and accept the jobs that they would not find best for themselves. Need for compromise arises because for the most of the workers, the best job (when worker and employer share the location) does not exist<sup>3</sup>. Degree of compromise is measured through the distance  $d$ , the worker is located away from his/her employer. As a result the worker has to incur  $td$  “transportation” costs ( $t$  is a unit “transportation” cost). The worker will choose to work as long as his wage net of “transportation” costs is at least equal to his reservation wage.

In order to understand the effect of workers’ and employers’ heterogeneity onto the formation of the labour supply function let’s consider this matter in full details.

Since there are  $n$  uniformly distributed firms the distance between any two firms is  $1/n$ . Let’s first consider zero reservation wage worker located at some point between firms  $i$  and  $j$ . The worker is located at distance  $x$  from firm  $i$  and  $1/n-x$  from firm  $j$ . The worker will work at firm  $i$  as long as  $w_i-tx \geq w_j-t(1/n-x)$ , and at firm  $j$  if the inequality reversed. The worker at the location  $x^0 \in [0, (1/n)]$  is indifferent whether to work at firm  $i$  or  $j$  as long as  $w_i-tx^0 = w_j-t(1/n-x^0)$ . Solving it for  $x^0$  gives  $x^0 = (t/n + w_i - w_j)/2t$ , provided that  $|w_i - w_j| \leq t/n$ . Since there is the same set of workers on the other side of firm  $i$ , its labour supply of zero reservation wage workers is given by  $\frac{t/n + w_i - \bar{w}_j}{t}$ , where  $\bar{w}_i = \frac{w_{i+1} + w_{i-1}}{2}$ .

A worker with positive reservation wage,  $v$ , located at distance  $x$  from the most attractive employer will work only if  $w_i-tx > v$ . Let  $x^v \in [0, (1/n)]$  be the distance at which the worker is indifferent between employment and unemployment:  $x^v = \frac{w_i - v}{t}$ , given that  $w_i \geq v$ . All workers located up to  $x^v$  away from firm  $i$ , will choose to work at it. Total supply of  $v$ -reservation wage workers is  $2\delta x^v$ .

Combining zero and  $v$ -reservation workers willing to work in firm  $i$ , the firm labour supply is obtained:

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<sup>3</sup> Since the model is focused on the market power due to workers’ and employers’ heterogeneity, another source of market frictions – imperfect information – is ruled out in the model.

$$L_i = \frac{t/n - 2v\delta + (1 + 2\delta)w_i - \bar{w}_i}{t} \quad 4.$$

The labour supply function indicates that labour is increasing in the firm's own wage,  $w_i$ , which is consistent with the notion of monopsony. Economic intuition for this relationship is simple: if the firm needs to increase employment it will have to attract the workers located at further points than the current marginal worker. The new workers will agree to work at the firm only in return of higher wages, as they have higher "transportation" costs. Wage discrimination is difficult since non-wage preferences of workers are usually unobservable. Therefore wage for all workers has to be raised to increase employment in a particular firm.

However, if other firms increase their wages the firm  $i$  loses some of its workers – the ones, who are located furthest from it.

Substituting the labour supply function into profit maximization equation and solving it with respect to wage produces the reaction function given by

$$w_i = \alpha_i + \beta \bar{w}_i, \text{ where } \alpha_i = \frac{(1 + 2\delta)\phi_i - t/n + 2\delta v}{2(1 + 2\delta)} \text{ and } \beta = \frac{1}{2(1 + 2\delta)}.$$

$\phi_i$  denotes net revenue product of labour when the firm  $i$  optimally adjust its capital labour ratio.  $\alpha_i$  is referred as productivity of the firm  $i$  (Bhaskar, To 2003, p. 377).

Solving the profit maximization problem with respect of labour using the inverse labour supply function  $w_i(L_i, W_{-i})$  produces

$$\text{familiar } E_i = \frac{MRP_L - w_i}{w_i} = \frac{t}{1 + 2\delta} \frac{L_i}{w_i} > 0, \text{ indicating positive "exploitation" in the}$$

market. It is obvious that if the "travel" were costless ( $t=0$ ), the wage would be equal to its competitive level.

The reaction function demonstrates that the firm  $i$ 's wage is an increasing function of its productivity and the wages set by its neighbours. Such a representation

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<sup>4</sup> Although  $\bar{w}_i = (w_{i-1} + w_{i+1})/2$  is an arithmetic mean of the wages of two neighbouring firms only, it is wrong to conclude that the wages of the firms located further away from the firm  $i$  do not affect its labour. Remembering the circled shape of the characteristics space one can easily see that  $\bar{w}_{i-1} = (w_{i-2} + w_i)/2$  and so on. Since  $\bar{w}$  is present in the labour supply function of each firm, employments in all firms are affected by the firm's own wage and those of *all* other firms. So, truly, the labour supply is given by  $L_i(w_i, W_{-i})$ .

of the firm's wage equation implies an important feature of the oligopsonistic labour market – strategic complementarity of firms in wage setting. In other words, wage in a firm is determined by not only its internal factors, like productivity, but also external ones, like wages paid by other firms in the local labour market. Firms are interdependent in their wage setting decisions. Such interdependence resembles to the framework of oligopolies and that's why the model of Bhaskar and To (2003) can be titled as oligopsony.

Bhaskar and To (2003) provide an explicit solution for the equilibrium wage distribution for all firms. The wage equation is defined in a matrix notation as

$$\mathbf{w}^* = \boldsymbol{\alpha} + B\mathbf{w},$$

where  $B$  is a circulant matrix and therefore can be defined by its first row, which is  $\mathbf{B}=(0, \beta/2, 0, \dots, 0, \beta/2)^5$ . Nash equilibrium is given by  $\mathbf{w}^* = (I - B)^{-1} \boldsymbol{\alpha}$ . Solving for  $Q = (I - B)^{-1}$  produces another circulant matrix  $Q$ , which is given by  $\mathbf{q} = (q_0, q_1, \dots, q_{n-1}) = (q_{0,0}, q_{0,1}, \dots, q_{0,n-1})$ . As a result, the equilibrium wage of firm  $i$  is determined as:

$$w_i^* = \sum_{j=0}^{n-1} q_j \alpha_{i+j}$$

for  $i=0, 1, \dots, (n-1)$ , where  $q_j = q_{n-j}$  for  $j=0, 1, \dots, [n/2]$  and  $q_0 > q_1 > \dots > q_{[n/2]} > 0$  (Bhaskar, To 2003, p. 378).

Matrix  $Q$  provides mapping from the vector  $\boldsymbol{\alpha}$  to the equilibrium wage distribution. The elements of the mapping depend on  $\delta$ , the mass of high-reservation wage workers, and therefore they are not affected by the firm-specific factor, like its productivity.

The given equilibrium wage distribution demonstrates that firm  $i$ 's optimal wage is weighted sum of the firm's own productivity  $\alpha_i$  and productivities of all other firms. The firm's own productivity has the highest weight, while weights of its rivals' productivities are declining the further the particular firm is located from firm  $i$  along the circumference line<sup>6</sup>.

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<sup>5</sup> A square matrix  $C$  is circulant if the element of each row of  $C$  are identical to those of previous row, but are moved one position to the right and wrapped around – definition given in Bhaskar and To (2003).

<sup>6</sup> In order to ensure that the equilibrium wage distribution is globally optimal, the range of productivities the firms may have is restricted to  $\boldsymbol{\alpha} \in (\alpha_*, \alpha^*)$ , which implies that no firm will choose

The given way of wage determination leads to a number of interesting implications. First of all, oligopsony model by Bhaskar and To (2003) predicts non-degenerate wage distribution as an equilibrium solution. The only assumption it requires to make is that there is at least some heterogeneity in employers' productivity levels. In fact Bhaskar and To (2003) argue that employers' productivity differentials are natural, since firms employ different technologies and face different prices. Such a differentiation applies not only to the firms in different industries but also to the firms in the same industry, although the intra-industry productivity, and therefore wage differentials are expected to be less than the inter-industry ones.

Since the wage in the firm  $i$  is affected by the productivities of other firms, two firms of the same productivity but different location on the characteristics circumference may also pay different wages, as each firm has a different set of neighbouring firms. In fact, the interaction of the firms in wage setting implies that no two firms will offer the same wage. Wage non-uniformity is a norm in this model (Bhaskar and To 2003).

As all weights are positive, it is obvious to expect that more productive firms pay higher wages. At the same time, increase in productivity of the firm  $i$  affects not only its own wage but also that of other firms, due to the interaction in wage determination, implied in the model. Let  $\alpha_1$  and  $\alpha_2$  be two different productivity vectors.  $w_1^*$  and  $w_2^*$  denote that equilibrium wage vectors associated with  $\alpha_1$  and  $\alpha_2$ , respectively. If the productivity vectors are such that  $\alpha_{1i} \geq \alpha_{2i} \forall i$  and  $\alpha_1 \neq \alpha_2$ , then  $w_{1i}^* > w_{2i}^* \forall i$ . We can see that increase in the productivity of just one firm raises wages of all other firms as well.

As we have seen the model presented by Bhaskar and To (2003) suggests that the firm heterogeneity in non-wage characteristics and workers' differences in preferences result in the environment, where the firm's wage is determined by its productivity and those of its rivals in the labour market. Existence of the positive "transportation" costs results in positive "exploitation" in the labour market, which implies that employers have non-negligible market power. It is also important to note that the static structure of the model assumes long-run decision making and therefore the observed monopsony power is not just a result of slow response of employment to

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to offer a wage so high that its neighbour employs no workers. The given bounds are effective if that  $t$ ,  $\delta$  and  $v$  are sufficiently large (Bhaskar, To 2003).

the wage changes but rather is caused by its own reason - workers' and employers' heterogeneity. Another aspect is that the applicability of the assumption of the firms' and workers' heterogeneity is not limited to a particular type of the labour markets. Firms' characteristics and workers' preferences vary in almost all markets. Therefore we may conclude that employers' market power may exist in all types of labour markets, although the extent of it may vary depending on the value of  $t$ .

#### **Section 4. Data**

In this work we use 2005 Business Environment and Enterprise Performance Survey (BEEPS), firm-level survey conducted by the European Bank of Reconstruction and Development (EBRD) and the World Bank. The survey covered 26 post-socialist economies: 15 from Central and Eastern Europe and 11 from the Commonwealth of Independent States. The dataset includes detailed firm-level data about 9500 firms, with 200-600 per country. The survey sample for each country has been constructed by self-weighted stratified random sampling from the national registry of the firms. Apart from the sectoral attainment, the strata were designed by the type of the ownership (private vs. state), firm size, size and type (capital or not) of location unit. The sample includes only registered firms, having at least 2 employees and not more than 10 000. Firms that operate in sectors subject to government price regulation and prudential supervision, such as banking, electric power, rail transport, and water and waste water were excluded from the design of the sample.

The strong sides of the given survey were that it contained detailed information about many characteristics of the firms including number of employees, amount of revenues and main costs and many other details; survey was conducted in all 26 countries in the same year. Main weakness in our perspective was the small sample size for individual countries, although it was attempted to include several geographical regions for each country. This resulted in a very small number of firms being covered in each particular town or city.

Another weakness of the dataset was quite a substantial amount of missing observations, especially for financial variables. From one side it led to a substantial drop in number of observations, for Russia and Central Asia<sup>7</sup> it was from 1888 firms

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<sup>7</sup> Although we have data for many countries we had to focus on smaller set given to the time consuming nature of gathering additional information used in our study. The nature of the additional information needed will be revealed in the next section.

to 1225. At the same time, missing observations were not all the time caused by the absence of the answers, but more often resulted from the inability of confirming the given figures from the firm's financial documents during the interview (BEEPS Report, 2005). We, therefore, may conclude that financial figures given in the dataset are of satisfactory reliability.

### **Section 5. Econometric model**

Traditional view on the effect of jobs' non-wage characteristics, like job specifications, amount and flexibility of working hours, working conditions and others has been set by the theory of compensating wage differentials. According to this theory the firms with "unpleasant" characteristics will have to offer a premium above the market wage to attract workers. Usual characteristics considered "unpleasant" are bad and hazardous working conditions, higher risk of death and injury at work and other alike. The general philosophy of the theory is that there are "good" and "bad" jobs, and workers in "bad" jobs should be compensated for accepting less "pleasant" working conditions. In other words, there is a vertical differentiation of jobs.

Differently, the oligopsonistic labour market model assumes horizontal differentiation of jobs<sup>8</sup>. It implies that there are no commonly accepted "good" or "bad" jobs, while each separate worker decides individually how "bad" or "good" the particular job is according to his/her preferences. In fact, the uniform and continuous distribution of workers across the characteristics circumference implies that employer of any type has equal number of workers willing to work for him/her. However, it is difficult to believe that there are equal numbers of workers willing to work in hazardous and risky conditions and the opposite. Therefore certain vertical differentiation is likely to exist and therefore need to be controlled for. Since the vertical differentiation is mostly related to the industry attainment of a firm, the most obvious control variable for the jobs' vertical differentiation is the industry dummy.

Another assumption of the oligopsonistic model is equal abilities of the workers. Obviously, there are differences in abilities of the workers caused by variation in their human capital. Therefore control for the human capital differentials of the workforce is necessary. Given to the firm-level nature of the BEEPS dataset we have only

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<sup>8</sup> Mccue and Reed (1996) provide some evidence for the horizontal variation of the workers preferences over the non-wage characteristics of the jobs.

limited information on the parameters measuring the quality of the labour force employed. The possible available control is the percentage measure of employees with university education.

Firm's non-wage attributes determine its location along the characteristics circumference space, where the "distance" between it and its neighbours measures the extent of difference in non-wage characteristics between them. To test the theoretical wage equation we have to identify the firm  $i$ 's "neighbours" along the characteristics circumference. In reality, most of the job attributes, like social environment in the work place, flexibility of working hours, job specifications and others are not observable or measurable. The only firm's characteristics available to us are the firm's location (at village/town/city level) and its industrial attainment, measured through NACE code. Simple thought analysis suggests that the easiest way to control the effect of unobservable and immeasurable attributes is to assume that they are consistently related to the observable ones, which are, in our case, industry code and village/town/city of the firm's location. Given to the fact that most of the unobservable and/or immeasurable characteristics are specific to a particular type of production or service we think that it is sensible to assume that unobservable and immeasurable attributes are related to the firm's industry. Our suggestion does not necessarily mean that there is no differentiation in unobservable/immeasurable characteristics among the firms of the same industry. It only requires that the difference ("distance") in unobservable/immeasurable characteristics between any two firms of the same industry group were not larger than difference between any two firms of different industries.

The given assumption leads to differences between the firms ("distances") measured using observed characteristics to be consistent with the "distances" in more general characteristics space, where differences in all characteristics are taken into account.

The oligopsonistic labour market theory suggests that we should be able to measure the "distance" between any two firms. If we can easily measure the distance between two firms using the location units, it is impossible to do it for industry codes. Therefore we suggest to identify the firm  $i$ 's "neighbours" first according to industry code "proximity" and then by geographical distance. For this purposes we define the following industry groups for each firm  $i$ , according to its two-digit NACE industry code:

*Y* group – all firms within the same location unit (village/town/city) with equivalent 2 digit NACE industry codes;

*Z* group – all firms within the same location unit and within the same NACE industry group excluding those in *Y* group;

*H* group – all firms within the same location unit with equivalent production or services group code<sup>9</sup> excluding those in *Z* and *Y* group.

The next step is, for each firm *i*, to identify two geographically closest location units, where at least one other firm from the same industry group exists. If there is at least one other firm of the same industry group exists in the firm *i*'s own location unit, then that location unit is taken as the first closest one. As a result, we obtain 6 location/industry variables: *Y1*, *Y2*, *Z1*, *Z2*, *H1* and *H2*.

The productivity of the firms is measured as a sum of value added per employee. Value added has been calculated as a difference between the firm's revenue and non-labour costs. Values of *Y1*, *Y2*, *Z1*, *Z2*, *H1* and *H2* are given as means of the productivity measures of the firms within the respective groups. However, if the first closest location unit is the firm *i*'s own village/town/city then we exclude firm *i* from *Y* group in calculating the group's average productivity. This is done to obtain the average productivity for other firms, "neighbours" only. For the same reason we exclude group *Y* from group *Z*, and group *Y* and *Z* from *H*.

Since we try to estimate the effect of the firm *i*'s productivity and those of its "neighbours" we suggest the following specification for empirical test:

$$w_i = \beta_0 + \beta_1 OWN_i + \beta_2 Y1_i + \beta_3 Y2_i + \beta_4 Z1_i + \beta_5 Z2_i + \beta_6 H1_i + \beta_7 H2_i + controls + \varepsilon_i$$

The dependent variable  $w_i$  is an average yearly wage, obtained as a ratio of sum of labour costs (wages, salaries and benefits) on total number of employees for a given financial year, 2004 in our case. The variable  $OWN_i$  represents the firm's own productivity. Following the predictions of the theoretical model by Bhaskar and To (2003) that firm *i*'s own productivity and productivity levels of "neighbour" firms have positive impact on the firm *i*'s wage and the size of impact reduces as the "distance" between the firm *i* and its "neighbour" grows, we make several hypotheses:

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<sup>9</sup> It is very general grouping, where mining and quarrying, manufacturing and construction are united into one production group, while all service sectors are united into another services group. *H* group is formed mainly for completeness purposes.

- a) all slope coefficients of the productivity variables will be positive;
- b) largest value will be attained to  $\beta_1$ ;
- c)  $\beta_2 > \beta_4 > \beta_6$ ;
- d)  $\beta_2 > \beta_3$ ;  $\beta_4 > \beta_5$ ;  $\beta_6 > \beta_7$ .

The given specification allows separating the effects of geographical distance and industrial proximity and we avoid the impossible task of combining location and industry characteristics and identifying the “location” of a firm on the hypothetical characteristics space.

Another adjustment we need to undertake is to include so-called geographical distance deflator. Since the geographical distances between the firm  $i$ 's location unit and those of each of 6 location/industry variables  $Y1$ ,  $Y2$ ,  $Z1$ ,  $Z2$ ,  $H1$  and  $H2$  vary per observation we should expect to obtain different values of slope coefficients for each observation. This conclusion is based on the prediction of Bhaskar and To (2003) that the impact of the “neighbours” productivities decline with increase of distances between them and the firm  $i$ . As an example, instead of  $\frac{\partial w}{\partial Y1} = \beta_2$  we

have  $\left(\frac{\partial w}{\partial Y1}\right)_i = \beta_2 \cdot q_i$ , where  $q_i$  is a distance deflator. For the functional form, we

adopt the distance deflator that is widely used in spatial econometrics studies (Anselin,

1988). As a result, we obtain  $q_i = \frac{1}{1 + \frac{d_i}{100}}$ , where  $d_i$  is the distance, measured in

kilometres, between the firm  $i$ 's location unit and that of respective group of firms taken as first or second closest<sup>10</sup>. Consequently, the empirical specification changes into

$$w_i = \beta_0 + \beta_1 OWN_i + \beta_2 q_i^{Y1} Y1_i + \beta_3 q_i^{Y2} Y2_i + \beta_4 q_i^{Z1} Z1_i + \beta_5 q_i^{Z2} Z2_i + \beta_6 q_i^{H1} H1_i + \beta_7 q_i^{H2} H2_i + controls + \varepsilon_i$$

As it is suggested by the empirical specification, original values of  $Y1$ ,  $Y2$ ,  $Z1$ ,  $Z2$ ,  $H1$  and  $H2$  are multiplied by the respective  $q_i$  deflator.

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<sup>10</sup> The to-be-reported estimation results are robust to changes of the functional form of the distance

deflator, e.g.  $q_i = e^{-\frac{d_i}{100}}$ . The actual distances,  $d_i$ , are divided by 100 to avoid the problem of multicollinearity, which arises given to large average distances between the villages, towns and cities covered in the sample.

Control variables include industry dummy variables at 2 digit NACE code level in order to control for wage differentials arising due to vertical differentiation of the jobs. Differing quality of the labour force is controlled through inclusion of the percentage measure of employees with university education and higher. Another group of control variables are regional dummy variables, which are included to control for regional variation in wage levels given to differing costs of living.

## **Section 6. Estimation and Results**

Estimation procedures employed in this work are based on Baum et al. (2003) and Baum et al. (2007). Table 1 contains the estimation outcomes. OLS results are given for comparison only. Main conclusions have been derived from instrumental variables (IV) estimation, given to the possible endogeneity of the firm's own productivity. Endogeneity of the firm's productivity may arise due to simultaneity problem, when the firm's wage is not only affected by the firm's productivity, but also has own positive impact on its productivity through influencing employees' incentives and efforts.

Another problem is heteroskedasticity, which arises frequently in cross-sectional studies. Common tests of heteroskedasticity, like Breusch-Pagan or White's tests are valid in IV estimation only if heteroskedasticity is present in the main equation and nowhere else in the system (corresponding first-stage regressions). Following the advice of Baum et al. (2003) we employ Pagan-Hall test, where this restriction is relaxed. Under the null hypothesis of homoskedasticity in the IV regression, Pagan-Hall statistic follows  $\chi^2$  distribution, irrespective of the presence of heteroskedasticity elsewhere in the system. In our data Pagan-Hall statistic is equal to 193.4 with P-value=0.0000, indicating the presence of strong evidence rejecting the null hypothesis.

As a standard remedy to the heteroskedasticity problem we employ 2SLS estimator with Eicker-White "sandwich" heteroskedasticity-robust standard errors. The estimates are given in the third column of the table 1.

Although 2SLS estimates with robust errors are consistent and correct inferences are possible, 2SLS estimator is not efficient. Since, in the presence of heteroskedasticity, 2-step GMM is the most efficient estimator we consider its estimates as the main ones, although there is no much decrease in standard errors indicating that efficiency gains are not large. 2-step GMM estimates are given in the last column of the table 1.

Table 1			
Variable	OLS	2SLS with robust errors	2-step GMM
own	.068587*** (.0057584)	.0902947*** (.0241836)	.0897207*** (.0232428)
Y1	.0301946*** (.0086038)	.0298811*** (.0094631)	.029987*** (.0094558)
Y2	-.0042372 (.0095892)	-.0027293 (.0110865)	-.0018883 (.0108063)
Z1	.0141649** (.0066093)	.0140132** (.0066999)	.014103** (.0066802)
Z2	-.0202112 (.0123013)	-.0229413 (.0131998)	-.0234476 (.0131862)
H1	.0030907 (.0106851)	.0038841 (.0143047)	.0038053 (.0142631)
H2	.0164472 (.0138672)	.0158173 (.0166288)	.0154557 (.0166068)
Uni	.0034309*** (.0009098)	.0033076*** (.0010182)	.0033342*** (.0010158)
Regional dummies	Yes	Yes	Yes
Industrial dummies	Yes	Yes	Yes
Hansen's <i>J</i> stat		0.734	0.734
P-value		0.6929	0.6929
<i>N</i>	1225	1225	1225

(\*\*\* indicates significance at 1%)

(\*\* indicates significance at 5%)

(Excluded instruments are advertising expenditures per employee; dummy variable for foreign ownership; dummy variable for positive answer to the question of whether the firm had increase in sales during the last 3 years)

Hansen's *J* statistics refers to the joint test of correct model specification and orthogonality conditions for the full set of instruments. High P-value indicates the lack of evidence, which could call either or both of these hypotheses into question.

Another problem with validity of the given results may arise due to the problems with dataset used, namely, low number of observations for each country<sup>11</sup>. As a result, we have very low number of observations for each industry group per one location unit. Since the sampling was designed to be self-weighted, large cities contain more observations than smaller ones. Nevertheless the largest number is as low as 21 independent retails trade firms for Tashkent city, while the whole population of them can be thousands. Obviously, the mean productivity measures used in our study estimate population mean with low precision. For this reason, it seems sensible to us to treat values of  $Y1$ ,  $Y2$ ,  $Z1$ ,  $Z2$ ,  $H1$ , and  $H2$  as the ones with measurement errors. Another problem posed with the low number of observations per country is the large average distance between the location units included into the sample. As a result we are not able to observe the firms, which could be located closer than the ones in the sample and we are not able to control their effects. In other words, we have a problem of variable omission. It is well known that the problem of variable omission is aggravated if the included and omitted variables are correlated. In our case we suspect that average productivity levels of two groups of firms belonging to the same industry but located in different, however close to each other, towns may be correlated due to the effect of common regional factors.

Since the problems of measurement errors and variable omission may lead to endogeneity problem of  $Y1$ ,  $Y2$ ,  $Z1$ ,  $Z2$ ,  $H1$ , and  $H2$  we calculate GMM distance or C statistic, which tests orthogonality conditions for a subset of instruments. The P-values of the C statistics for each variable are given in the table 2:

<b>Table 2</b>	
Y1	0.3969
Y2	0.5707
Z1	0.4212
Z2	0.4005
H1	0.3922
H2	0.6133

High P-values indicate the lack of evidence that could reject the null hypothesis that these variables may be treated as exogenous.

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<sup>11</sup> 390 observations for Kazakhstan; 134 – Kyrgyzstan; 320 – Russia; 174 – Tajikistan; 207 – Uzbekistan.

The results presented in Table 1 indicate that there is statistically significant positive relationship between the firm's wage and its productivity levels. Moreover, the results demonstrate that the larger is the productivity of the firm's "neighbours" the higher its wage. Signs and values of *OWN*, *Y1* and *Z1* confirm the hypotheses a), b) and c). Insignificant results of *Y2*, *Z2* and *H2* are probably can be explained by large distances between the firm's location unit and its second closest. *H1* also has insignificant coefficient, which could be the result of too wide grouping, where firms were divided only into two groups – manufacturing and services.

The biggest problem of IV estimation is weak instruments, when correlation between the endogenous variable and excluded instruments is non-zero, but low. Bound et al. (1995) demonstrate that use of weak instruments produced biased estimates reducing the benefit from using IV estimation. Widely cited rule of thumb of Staiger and Stock (1997) suggest that F statistic of the first-stage regression should be larger than 10 to ensure that maximal bias in IV estimation is no more than 10% that of OLS. In our case,  $F = 6.91$ , which indicates that IV bias is between 10 and 20% of OLS. To examine the effect of weak instruments we use limited information maximum likelihood (LIML) estimator and GMM – "continuously updated estimator" (GMM-CUE), which may be more robust in the presence of weak instruments than 2SLS and 2-step GMM. The estimates of LIML and GMM-CUE are given in the Table 3.

Table 3			
Variable	2-step GMM	LIML with robust errors	CUE-GMM
own	.0897207*** (.0232428)	.0904375*** (.0243458)	.0900992*** (.023207)
Y1	.029987*** (.0094558)	.0298791*** (.0094638)	.0299936*** (.0094696)
Y2	-.0018883 (.0108063)	-.0027194 (.0110902)	-.0018888 (.0107526)
Z1	.014103** (.0066802)	.0140122** (.0067008)	.0141043** (.0066728)
Z2	-.0234476 (.0131862)	-.0229592 (.0132053)	-.0234649 (.0132192)
H1	.0038053 (.0142631)	.0038893 (.014307)	.0038415 (.0142608)
H2	.0154557 (.0166068)	.0158131 (.0166288)	.0154062 (.0165501)
Uni	.0033342*** (.0010158)	.0033068*** (.0010185)	.0033307*** (.0010145)
Regional dummies	Yes	Yes	Yes
Industrial dummies	Yes	Yes	Yes
Hansen's <i>J</i> stat	0.734 0.6929	0.733 0.6930	0.733 0.6930
<i>N</i>	1225	1225	1225

(\*\*\* indicates significance at 1%

(\*\* indicates significance at 5%)

It is obvious from the Table 3 that use of estimators with superior finite sample performance did not change the results significantly, from which we may conclude that they are not affected substantially by poor finite sample properties of 2-step GMM estimator,

## **Conclusion**

In this work we discussed the reasons of why labour markets should not be considered as competitive. ‘Modern monopsony’ models suggest that market imperfections may cause non-negligible market power for employers. In our work we attempted to empirically test one of ‘modern monopsony’ models – oligopsonistic labour market, where a firm’s wage is determined jointly by its own productivity and those of its “neighbours” on characteristics space. Our results suggest existence of at least some evidence, which supports the productions of the oligopsonistic labour market.

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