Natalya Shevchik[1]

The Performance of Kazakhstani Industrial Enterprises by Location

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[1] The Centre for Euro-Asian Studies, University of Reading, UK.
e-mail: n.p.shevchik@reading.ac.uk

Abstract:

The paper analyses data from a survey of Kazakhstani industrial enterprises in order to examine the relationship between industrial enterprises performance and the interregional structure of the economy. The paper employs the production function of the enterprise, which captures the relationship between an enterprise production performance and its industrial and regional characteristics, with further transformation of the production function into the multinomial logit framework. Estimations of the logit model were made on the basis of more than 4000 observations of Kazakhstani industrial enterprises, in total, for the period between 1997 and 2001 on the quarterly basis. The data employed in the research consists of mixture of the national statistics and questionnaires data from a survey on individual Kazakhstani industrial enterprises. The dependent variable of the estimated model is a qualitative measure of the production performance of individual Kazakhstani industrial enterprises, while independent variables include individual, industry-specific and location-specific characteristics of performed industrial enterprises. Model estimations for 20 chronological quarters of the transition economy presented the instability picture of industrial enterprises recovery from the shock effect of the Soviet Union collapse. Results of the paper found support for the argument that the process of economic transition engenders significant spatial industrial restructuring, and that in addition to individual enterprises characteristics, the spatial aspects of this restructuring are key determinants of firm performance. Moreover, these effects of spatial restructuring appeared to dominate both industry-specific and location-specific characteristics.

Introduction

This research attempts to investigate the patterns of the dependence of industrial production performance of individual enterprises and whole regions with industrial enterprises' characteristics of individual, industrial and location nature. In addition, the research attempts to identify reasons of regional inequalities in terms of industrial sectors performance in Kazakhstan under conditions of transition process. The vast territory of Kazakhstan (2.7 million km^2) requires the fundamental co-operation between regions in order to provide and to maintain the steady growth of the economy. However, there were few studies on the regional development and even fewer studies on causes of the unequal regional development of Kazakhstan.

In order to investigate patterns of industrial enterprises behaviour by regions, the database on Kazakhstani industrial enterprises performance was created for the estimations. These enterprises were divided into groups according to their industrial sectors, regional location, employment size and ownership type and analyses how the production behaviour of industrial enterprises is related to their individual, industrial and location characteristics.

Kazakhstan[2] is in the process of a fundamental transformation in the nature of its economy and radical changes in its industrial structure. A number of researches discuss the overall economic structural changes of Kazakhstan (Peck, A. (2003), Kalyuzhnova, Y. (1998), Pomfret, R. (1995, 1996), Kaser, M. (1997), Olcott, M. (1995, 2002), Amrekulov, M. and Masanov, N. (1994) and others), but only few highlight regional industrial perspectives (Masanov, N (1995), Koshanov, A., Isaeva, M. and Yesentugelov, A. (1993), Kenzheguzin, M., Isaeva M. (1998) and others). A focus on regional issue is important, since Kazakhstan has a very

[2] The current study uses different terminology for the Kazakhstani economy, where *Kazakh SSR* and *Kazakh SSR economy* refer to the country's analysis prior to 1991, while *Kazakhstan* and *Kazakhstani economy* refers to the country prior to 1920 (the entrance to the Soviet Union) and after 1991. Being a part of the Soviet Union, Kazakhstan was called the Kazakh Soviet Socialistic Republic (Kazakh SSR), and after gaining its independence from the Soviet Union in 1991, the country took its current name of *Kazakhstan*.

centralized growth where industrial activities are concentrated. In terms of income, employment, education and other economic opportunities, the disparity between the capital and the rest of the country has persisted over the decade of transition. This raises the question of how to decentralize the growth and to achieve more balanced development within the country.

The Soviet economic system was a basis for a formation of the contemporary Kazakh SSR economy for many years (1917-1991), where the most important issue was to develop Kazakh SSR industries for Soviet Union needs, with no consideration of any iner-regional balance. Kazakhstan is landlocked country, which makes it difficult for the country to develop local industries for the external trade. However, it is unique by its endowment with a wide variety of mineral resources. Being a part of the Soviet Union, the Kazakh SSR happened to be one of the few republics escaping the German occupation during the Second World War (1941-1945), which played the crucial role in reallocation of industrial factories from occupied Soviet republics, such as Russia, Ukraine and Belarus. Factories were moved to distant republics, such as the Kazakh SSR and Central Asia[3] from occupied republics, in order to continue the production process of important goods for the population and military consumption and were allocated in regions close to raw material sources with easy access to USSR occupied republics. Regions located on railways connecting the Kazakh SSR with Soviet occupied republics, had mostly benefited from reallocation of factories. The industrial development in the Kazakh SSR increased the inflow of the qualified human capital for the maintenance of new factories, which significantly increased the qualification level of the local labour. Industrial enterprises, which moved to the Kazakh SSR not only recovered its production, but also created additional branches for satisfaction of the growing demand in occupied republics. After the war ended in 1945 many industrial enterprises were left in the Kazakh SSR together with labour previously evacuated. As such, the Kazakh SSR gained intensive industrial development not only during the war but also after the war, when the Kazakh SSR industries were appealed for help with the recovery of

[3] In the Soviet Union terminology Central Asia included Kyrgyz SSR, Uzbek SSR, Turkmen SSR and Tajik SSR, while Kazakh SSR was considered separately.

destroyed industrial enterprises in occupied republics. This significantly increased the development and production level of the Kazakh SSR industries.

Thus, economy of the Kazakh SSR was specifically created on the basis of political decisions, based on satisfaction of the accelerating needs of the growing Soviet Union and military decisions, based on response to wartime crisis and movements of production activities to the Kazakh SSR. After the wartime crisis, stabilisation of industrial enterprises was not motivated to move to other regions of the Kazakh SSR as economic decisions were centralised and administratively governed by the Central Government of the Soviet Union. Therefore, the efficient pattern of industries allocation was considered from the point of Soviet Union needs and not from the point of internal efficient development of the Kazakh SSR. Besides centralised decisions, industries did not have an opportunity for reallocation for the reason of infrastructure underdevelopment in regions, which did not have strategic location and resources for the Soviet economy development. As a result, the industrial development of the Kazakh SSR is polarised and clustered in few locations, which were determined by important resources for the Soviet Union production and easy access to Russia. The development of agricultural regions of the Kazakh SSR at the beginning of the 1950s was also based on the growing needs of the Soviet Union. However, only southern regions of the Kazakh SSR faced intensive development due to their proximity to the Russian border. The Russian republic was one of the main transit territories for the easy transportation of agricultural output to other Soviet republics, while latter had other comparative advantages for the total production of the Soviet Union.

On the edge of the transition the Kazakh SSR economy was the product of the Soviet planned economy needs based on political and military decisions of industrial allocation, where the Kazakh SSR regions and its industrial clusters were connected to other Soviet republics, rather than having internal links. Consequently, the inherited system left Kazakhstan in the disharmony of regional development, which pulled down the whole economy after the collapse of the Soviet Union.

Transition brought uncertainty and unpredictability, which affected all spheres of the economic development of Kazakhstan. Since transition started, industrial links with former Soviet republics have been broken and the location of Kazakhstani industrial enterprises was discovered to be inefficient for the Kazakhstani development due to the lack of internal inter-regional industrial links. Consequently, following the fall in demand at the republican level, all industries of Kazakhstan faced a decline in production.

After 74 years of central planning, economies of the newly independent states were unfamiliar to the type of self-sustaining economy. The Kazakhstani economy faced enormous structural changes during the transition period, where prices, and as a consequence high inflation, were raised following a fall in industrial production. The whole economy deteriorated, where the share of goods production in Kazakhstani GDP declined from 65.9% in 1991 to 43.3% in 2002. However, the service sector increased from 34.8% to 50.9% for the same period. Nevertheless, at the end of the first transition decade the Kazakhstani economy started to develop new internal as well as external markets, where many of them were based on an infrastructure developed by the Soviet system, connecting the Kazakh SSR to other republics. Only industries based on mineral resources had intensive recovery and development during transition, due to its value on the external market. Manufacturing industries, however, continued to fall due to the out of date equipment and inefficient production, which raised its costs and reduced the quality compared to competitors. Consequently, during the last ten years the Kazakhstani economy started to become more affected by world prices of commodities due to the low industrial diversification.

To date, production and business activities are highly concentrated in three areas of Kazakhstan: the Western Kazakhstan regions, Almaty and Astana cities[4]. Western Kazakhstan is purely based on the endowment of mineral resources, which attracted 74.4% of all foreign direct investments in 2001 (*Kazakhstan: 1991-2002*). However, the concentration of activities in Almaty city is mainly based on highly qualified human capital, where the negotiation skills of

[4] Almaty is the former capital of Kazakhstan and since 1997, Astana became the new capital of the country.

government members, and their easy access to powerful connections of authorities, turned them and their children into successful businessmen, whilst the city has benefited from the improvement of production activities. The concentration of highly qualified human capital in Almaty can be explained by the historic factor, where all intelligentsia and qualified workers were based in the capital in order to increase the returns from their educational level. However, the educational level in Astana was lower than in Almaty and, as a result, in order to maintain the high quality level of government institutions, the new capital faced a high inflow of highly educated human capital. Generally, the human capital of the high quality is likely to migrate in order to increase returns on high-level education and entrepreneurial characteristics. As a result, a new inflow of human capital to Astana possesses the necessary skills for successful businesses. Access to the high quality labour pool is one of the important elements which attracts new businesses to the new capital, gradually increasing their concentration level.

Making the choice of transition towards the market economy, rather than maintaining the socialist system, ex-soviet countries entered into the stage of economic transformation under conditions of uncertainty and the lack of information. The transition process of ex-soviet countries is unique and there is no exact experience in the world due to different initial conditions.

The Data

In order to test the industrial enterprises production behaviour in transition economy in the example of Kazakhstan it is necessary to find a model framework, which would test production behaviour of individual industrial enterprises relative to their characteristics. Hypothesis of the study put forward the suggestion that the performance of industrial enterprises depends on the set of their individual, industrial and location characteristics. The *hypothesis* tested in the study examines the dependence of an enterprise's performance on its individual characteristics, which include location, industrial and individual specific characteristics.

The methodology of the current research is to employ the production function where the profit maximisation changes would reflect changes of enterprises characteristics on the individual, industrial and location levels. Empirical results presented in this paper are conducted by multinomial logit model, which refer to equation 13 and deducted from the production function.

The characteristics of regional performance, which appear to be common to large-area transition economies, seem to be a result of both different interregional industry compositions and different regional geographies. Yet, to determine which (if any) of these influences are dominant, requires us to disaggregate both the structural and locational aspects of industry, and to distinguish between the relative contributions of these two influences on the performance of individual firms. This is exactly what is proposed to do in the current study. The database allows to integrate micro-level firm data with aggregate regional and industry data of both a spatial and a non-spatial nature. Given the data available to the study, the most direct econometric technique which can be used to do this is multinomial logit modelling, where the response variable is taken as categorical data, while explanatory variables include different types of data, including categorical, continuous and dummy variables.

The data for empirical tests combine both national and survey statistics, where the survey statistics consists of a unique micro-level database of 1041 Kazakhstani firms, which combines over 4000 observation, and based on the questionnaire on Kazakhstani industrial enterprises and their qualitative production activity performance conducted in Kazakhstan on the quarterly basis since 1997. Test of the hypothesise includes 20 quarterly cross-sectional estimations between 1997 and 2001. Panel data estimations are impossible in our case due to the possession of different sets of enterprises for every observational quarter, even though they belong to the same set of industries and regions. The cross-sectional estimations of heterogeneous sample of industrial enterprises over time periods are employed in order to distinguish between the sectoral and regional influences on firm performance.

The Model

Modern theories of regional development (Krugman 1991; Porter 1990; Gaspar and Glaeser 1998; McCann 2001) assume that in a market economy, the geographical distance of the firm from specific locations is an essential determinant of its performance. In particular, the relative proximity and accessibility of the firm to specific urban locations, is assumed to be fundamental to the behaviour and performance of the firm. If this assumption is correct, the effects of this should also be observable in the case of a transition economy, which is moving towards a market-based system. In this section, we therefore develop a simple theoretical framework, which is partly based on this assumption, in order to allow the microeconomic effects of geographical location on transition behaviour to be tested, in addition to the effects of non-spatial firm characteristics. To my knowledge, in the case of a central Asian transition economy, this is the first piece of microeconometric research, which has explicitly attempted to disentangle the geographical from the non-spatial characteristics of the firm.

The theoretical model which is employed in the study is based on the approach initially set out by Lee (1982, 1990). It studied the location behaviour of the manufacturing firm in developing countries, Colombia and Korea by considering the production function of the firm, which captures the relationship between a firm performance and its industrial and regional characteristics, with further transformation of the production function into the multinomial logit framework[5]. This type of theoretical model is used in order to provide the justification for the multinomial modelling approach, in the case where firm performance indicators are introduced by qualitative response variables[6].

[5] The similar approach was also used in Kittiprapas and McCann (1999) for the viewing the location choice of individual firms in Thailand as being the result of the firm having considered the set of characteristics.

[6] Although, researches have drawn attention to Kazakhstani economy, however, there are only few highlights of regional industrial perspectives in transition economies and particular Kazakhstan. There is an unattended gap in the area of modeling for industrial enterprises location behavior in the worldwide literature. Particularly, there is a lack in empirical research for the location behavior of industrial enterprises in transition economies. The model employed in the current research was applied previously in the literature to such developing countries as Colombia, Korea and Thailand. While, these type of model are extensively used in economic geography all over other economies in order to extinguish between geographical aspects of enterprises performance and non-geographical characteristics.

Following the Lee's approach, in general terms the production function of a representative firm can be written as:

$$Q = Q[X; A] \tag{1}$$

where Q presents the firm's output, X is a vector of inputs used, and A is the technology embodied in the firm. The firm technology embodied in A will be comprised of vector of the individual firm's characteristics, some of which are firm specific, some of which are industry specific, and some of which will be location specific. Within an explicitly spatial setting, the profit function of the firm located in region j can be written as (Kittiprapas and McCann 1999):

$$\pi_j = \left(P_o - t_o d_{oj}\right) Q(X; A) - \sum_{i=1}^{n} \left(p_i + t_{ij} d_{ij}\right) x_i - \sum_{i=m+1}^{n} (p_{ij} x_i) \tag{2}$$

where: $(x_1, x_2, \ldots x_m, x_{m+1}, \ldots x_n)$ represents a vector X of inputs, where $(x_1, x_2, \ldots x_m)$ are transported inputs such as intermediate or imported goods, and $(x_{m+1}, \ldots x_n)$ are the location –specific inputs such as labour, land, local services and local raw materials. P_o is the market price of the output good, p_i is the mill price of each transported unit of input i at region j, and t_{ij} and t_{oj} are the unit transaction cost per km of the transported inputs and outputs, respectively, to and from the regional location j. The unit input cost of each location-specific input at regional location j is given as p_{ij}, and finally the distance from regional location j to the each market or input source point is given as d_{oj}, and d_{ij}, respectively. Rearranging the profit function (2) we have:

$$\pi_j = P_o Q(X; A) - \sum_{i=1}^{m} (p_i x_i) - \sum_{i=m+1}^{n} (p_{ij} x_i) - T \tag{3}$$

where:

$$T = t_o d_{oj} Q + \sum_{i=1}^{m} t_{ij} d_{ij} x_i \tag{4}$$

In other words, in equation (3) the total profit of the firm is defined as the total output value, minus the total inputs costs and minus the total transactions costs *T,* which includes the sum of output and imported input transaction costs. The profitability of a firm is therefore the result of both spatial and aspatial cost and revenue considerations.

In order to understand how the profit model (3) can be accommodated within a real-world spatial economic framework we can begin by using a stylised example employed by Krugman (1991). We can imagine a hypothetical situation in which all input and output markets are located in the same place, such as a dominant urban centre denoted as *U*. In this case both d_{oj} and d_{ij} can be rewritten as d_{Uj}, and t_{oj} and t_{ij} can be rewritten as t_{Uj}. If local factor prices p_{ij} are invariant across space, the firm will have no incentive to be located elsewhere other than at *U* because its profitability will always be lower than at *U*. The reason for this is that at *U* the value of *T* will be zero, whereas for any other location, the value of *T* will be positive. Therefore, in order for a firm to make equivalent profits at *j*, where *j* is any location different to *U*, the local input factor prices p_{ij} at *j* must be lower than the local factor prices p_{iU} at *U*, by an amount which exactly compensates for the greater transactions costs *T* associated with being located at *j*. In this situation where the variation in local factor input prices p_{ij} with respect to p_{iU} is just sufficient to ensure that a firm is equally profitable at all locations, the spatial economy can be perceived to be in equilibrium. If the spatial variations in local factor input prices p_{ij} with respect to p_{iU} are less than the required equilibrium values, locations distant from *U* will be less profitable than *U*. On the other hand, if the spatial variations in local factor input prices p_{ij} with respect to p_{iU} are greater than the required equilibrium values, locations distant from *U* will be more profitable than *U*. As such, the profitability per unit of output of the representative firm depends on the interrelationship between the local factor prices and the distance-transactions costs associated with production at any particular location.

For a cross estimations of firms of different types and different sectors which produce a range of different outputs, the unit distance-transactions costs t_{Uj} will be different for each firm type. As such, the equilibrium local factor input prices p_{ij} at

any region j at a distance d_{Uj} from U will be different for different firms. For any given aggregate spatial variation of local factor prices, the spatial distribution of activities will therefore be different for different types of firms, reflecting differences in the relative importance of accessibility to U for different types of firms (Fujita 1989; McCann 2001). Firms, whose spatial transactions costs are significant, will have a higher preference for proximity to U than firms whose spatial transactions costs are relatively lower.[7] Such transactions costs will also include the opportunity costs (McCann 1995; Gaspar and Glaeser 1998) associated with distance, time and the need for face to face contact, as well as the actual transportation financial outlays. However, many of these opportunity costs are unobservable in reality, because they depend on the technology characteristics A of the firm. Similarly, for different types of firms, the required optimum input quantities x_i will differ according to the firm's technology characteristics A, and without additional specific information, these are unknown to us a priori. Consequently, in order to undertake an empirical analysis of a heterogeneous cross-sectional sample of firms, even in situations where we do have detailed geographical distance measures such as d_{Uj}., it is still usually necessary to employ additional indirect approaches, in order to capture the relationship between distance-transactions costs, technology and firm performance. One way of circumventing these problems of unobservable characteristics is to employ a probabilistic framework, in which the performance of a firm is specified as being a function of both observable and unobservable characteristics. The simplest and most direct method of doing this is to transform our profit function (3) into a multinomial logit framework.

Suppose there are J regions (j =1,….J) and the distance between the major urban centre U to each region varies according to the geographical location of the region. If we assume that the market prices for inputs and outputs in the dominant urban location U are independent of the distance-transactions costs of transported goods within each individual region, at the optimum output level, then the profit function (3) can be rewritten as:

[7] These transactions costs will also include the opportunity costs associated with distance as well as the actual financial outlays (McCann 1995).

$$\pi_j^* = g_j\left[X^*\left(A, p_{ij}, d_{Uj}\right)\right] \tag{5}$$

where X^* represents the optimum input mix, and d_{Uj} represents the distance from each region to the major national urban centre. Assuming that enterprises are operating at or close to their optimum input mix, the general profit maximization condition for the firm can therefore be written as:

$$\pi_j^{\max} = g_j\left(A, p_{ij}, d_{Uj}\right) \tag{6}$$

Introducing a random error of unexplained firm and location variables given as e_j, which are assumed to be Weibull distributed, the profit maximization function now becomes:

$$\pi_j^{\max} = g_j\left(A, p_{ij}, d_{Uj}\right) + e_j \qquad j \in J \tag{7}$$

The expected profit function now contains a deterministic portion of observable enterprise and location characteristics and a random portion containing the unobservable attributes of the alternatives. Therefore, the probability that a firm will earn a higher profit in region *j* rather than any alternative region *j'* is:

$$P(j/j') = prob\left\{\left[g_j\left(A, p_{ij}, d_{Uj}\right) + e_j\right] > \left[g_{j'}\left(A, p_{ij}, d_{Uj}\right) + e_{j'}\right]\right\} \tag{8}$$

where *j'* is any alternative region and $j' \neq j$; where $j, j' \in J$. This now allows for a logistic estimation of the probability of the firm achieving higher profits in region *j* to any alternative region *j'*, according to (Judge 1985) approach:

$$P(j/j') = \frac{\exp\left[g_j\left(A, p_o, p_{ij}, d_{jj'}\right)\right]}{\sum_{j' \in J} \exp\left[g_{j'}\left(A, p_o, p_{ij}, d_{jj'}\right)\right]} \tag{9}$$

Assuming all parameters are linear, and assuming that we can decompose *A* into a vector of constituent characteristics defined as $a_1 \ldots a_z$, which represent the firm's

individual, industry or location-specific characteristics, we can write equation (9) as a mixed logit function of the firm, industrial and regional location attributes as:

$$P(j/j') = \frac{\exp(\alpha_1 + \beta_1 a_1 + \ldots \beta_z a_z + \beta_{ij} p_{ij} + \beta_{uj} d_{Uj})}{\sum_{j' \in J} \exp(\alpha_1 + \beta_1 a_1 + \ldots \beta_z a_z + \beta_{ij'} p_{ij'} + \beta_{uj'} d_{Uj'})} \quad (10)$$

where d_{Uj} represents the distance from the location of observable enterprise to the major national urban market centre. With a standard logit transformation (Wrigley 1985) it therefore now becomes possible to estimate the log-likelihood of an individual firm achieving a superior profit at location j relative to location j', in terms of:

(i) the firm-specific or industry-specific characteristics of the firm, defined as $a_1 \ldots a_z$,
(ii) the regional location-specific characteristics, defined as p_{ij}, where j=1,….J.
(iii) the distance between the regional location of the enterprises and the major urban market, defined as d_{Uj}.

Within the logit transformation of the profit maximisation function, it is now possible to estimate the likelihood of an enterprise located in the region j experiencing the production growth in connection with individual enterprise's characteristics.

Thus, the above theoretical model will be used in for two hypothesises test, where the *first* hypothesis examines the dependence performance of industrial enterprises in transition economies on its individual characteristics, which include region, industrial and individual specific characteristics.

The Model Variables

The employed data in the study is both of a primary and secondary nature, which are collected and analysed on the quarterly basis. The primary data comes from the questionnaire, introduced above. The secondary data is taken from the

Kazakhstani published statistics, which is collected on the quarterly and annual basis. Thus, model estimations combine the firm-level survey information with secondary data from the Kazakhstani published statistics, which provide information on the structure and performance of each of the respective industries at both national and regional scale.

The data we have at our disposal can be characterised in terms variables of equation (10). For the variables defined above as $a_1 \ldots a_z$, there is a range of enterprise-specific, industry-specific and region-specific data. Firm-specific characteristics, *statusid* and *npeid* presents the employment size of an establishment.

In addition to two firm-specific variables, the model, employs two non-spatial industry-specific variables and two spatial industry-specific variables. The first of the non-spatial industry-specific variables is the percentage change in national employment in the particular industry on the basis of a year-to-year comparison and is represented by the variable *empind*Y_1Y_2, where Y_1 and Y_2 represent comparison years. The second of the non-spatial industry-specific variables is *gdpsec* Y_1Y_2 is the percentage change in Kazakhstani GDP by industries on a year-to-year basis.

Besides of the firm specific and the non-spatial industry-specific variables, the model also employs two spatial industry-specific variables, which are designed to capture the effects of an industry's spatial structure and geographical specialization on a firm's, or an industry's performance. The first of the industry-specific spatial variables used, is the Hirschmann-Herfindahl index (Ellison and Glaeser 1997), denoted here as *HH* and calculated by using the formula:

$$HH = \sum_{j=1}^{J} (s_{Ij} - x_j)^2 \qquad (11)$$

where s_{Ij} is the share of national GDP by *I*'s industry in each region *j*, and x_j is the share of aggregate national GDP in each region *j*. The *HH* index, which varies

between zero and two, captures the extent to which an individual industry is unevenly distributed across an economy, and indicates the extent to which localization economies may be significant for the industry as a whole. A higher value represents a more spatially concentrated industry. In the model, the *HH* index is represented by the variable $hhindexind Y_1$, which shows that the index is calculated for the year Y_1 on the annual basis. Another measure of *HH* index is included in the model as well - hhY_1Y_2, which represents the percentage change in the *HH* index during the period between the beginning of year Y_1 and the beginning of year Y_2.

The second of the industry-specific spatial variables, which is employed in the first model, is the standard regional industrial Location Quotient Index and given as:

$$LQ_{Ij} = \frac{GDP_{Ij} / GDP_j}{GDP_{IN} / GDP_N} \tag{12}$$

where LQ_{Ij} is the location quotient for a particular industry I in region j, the subscripts I, j and N represent industry, region and country, respectively. The location quotient is used in order to capture any additional region-specific effects on a firm's performance associated with a particular region's specialization in any certain industry. As such, this index reflects the extent to which a particular region benefits from any spatial industrial concentration, as captured by the *HH* index and whether the region is the importer or exporter of goods and input factors (Ellison and Glaeser 1997). The location quotient is represented by variable $lq\ Y_1$, and as with *HH* index, the model also includes an additional variable $lq\ Y_1Y_2$ that captures the percentage change in a region's location quotient index on a year-to-year comparison.

The reason for including two regional spatial industrial variables $lq\ Y_1$ and $hhindexind Y_1$, defined in levels terms, as well as the two variables $lq\ Y_1Y_2$ and hhY_1Y_2, defined in terms of current rates of change, is very specific. The rationale for this is to distinguish the extent to which current firm performance is

determined primarily by the (initial or current) inherited spatial industrial structure, or whether it is actually determined primarily by current changes in these spatial industrial structures. In other words, we are seeking to identify whether it is the historical patterns or the current developments in the spatial industrial structure of Kazakhstan, which are dominant. If the inherited planned system is currently close to a market optimal spatial pattern, we would expect the levels variables to dominate, whereas if the inherited system is not close to a market optimum, we would expect the change variables to dominate.

In terms of region-specific variables, the economic performance characteristics of a region which are independent of any particular industry or firm, but which may additionally affect the performance of an individual firm, are captured by a single variable. This variable is defined here as $emplY_1Y_2$, and represents the percentage growth of total employment across all industries in a region between Y_1 and Y_2 years. This variable indicates the extent to which the region as a whole is currently economically buoyant.

Direct regional and industry-specific data on Kazakhstani input costs is not available from published statistical sources, therefore, it is necessary to use an indirect indicator to capture the effects of the location-specific input cost variables defined in equation (10) as $p_{(m+1)j}\ldots.p_{nj}$. This variable is the regional GDP per capita for the observable year and is represented in the model by $gdpperheadY_1$. The logics of employing this variable can be understood from the spatial interregional equilibrium, where the local nominal factor input prices must vary in order to compensate for the distance-transactions costs associated with geographic peripherality. For equilibrium profit levels, the GDP per head will therefore tend to vary directly with local nominal input costs. Moreover, if spatial variations in local nominal factor prices also lead to substitution between capital and non-capital inputs, this index adjusts in the correct direction. As such, in the absence of detailed region-specific industry wage and land price data, the regional GDP per head index can be used as an approximation of the nominal level of local labour and land prices, adjusted for regional factor mixes.

The next variable is the mixture of region and industrial specific characteristics of the firm, which comes from the national statistics as a continuous variable - *industrprod* and represents the Kazakhstani industrial production in monetary terms by regions on the quarterly basis. The categorical variable, which is created from the described continuous variable, is introduced in the second hypothesis test as the dependant variable.

Finally, the model employs a purely spatial distance measure of the geographic peripherality of a firm's regional location. The measure is given as the distance in kilometres from the major population centre of each region to the nationally dominant urban centre represented by Almaty region. Each of the regions is given an ordinal ranking on this basis. In the model this is represented by *almrank* and has 14 ranks, where the closest region to Almaty has rank 1, which represents the Almaty region itself and the region, which is located on the furthest distance has rank 14. However, in order to allow for the fact that the spatial centre of gravity of the Kazakhstani economy may have moved with the recent relocation of the capital to Astana, we also include an equivalent distance measure to the new capital city of Astana, which is represented in the model by *astrank*.

In the case of cross-sectional data from a transition economy such as Kazakhstan, however, the model specification described by equation (10) must be slightly adapted in terms of the independent response variable employed. The reason for this is that in economic environments undergoing fundamental restructuring and which are not yet close to achieving interregional equilibria (Borts and Stein 1964), the current profits of a firm are not necessarily the best indicator of the medium or long-run profitability or viability of the firm. This is particularly true in the case of transition economies whereby monopoly enterprises are being restructured, and contracts and prices are slowly being established in markets that were previously missing (Hahn 1971). Moreover, such data may often be simply unavailable or at best very unreliable. As such, in these types of changing economic environments, the most appropriate dependent variable to employ for the first hypothesis as an indicator of medium or long-run firm performance may be an alternative indicator such as a firm's current growth. In this case, the current growth performance would be interpreted as the 'best guess' as to the overall

future profit performance of the individual firm. Given the absence of any more sophisticated microeconometric data, this is exactly the approach we adopt here.

On the left hand of our cross-sectional data the side response variable is the current output change of the firm, and within the logit modelling technique we estimate the likelihood of a Kazakhstani firm experiencing current output growth as a function of a range of firm, industry and regional variables, as described above by equation (10). We interpret this likelihood of an individual firm's current growth as the best guess of its future performance. Although it is possible that for some firms long-run profit maximisation will be associated with reductions in current output, nevertheless we can assume that this is not the usual case, and that for the vast majority of firms, current output growth will generally be associated with a movement towards long-run profit maximisation. In other words, we assume that the firms which are currently successful (i.e. displaying growing output revenues) are successful precisely because their current production and location characteristics are closer to their particular optimum conditions than those of firms which display current output declines.

The dependent variable of the hypothesis test comes directly from the survey of Kazakhstani industrial enterprises, representing the categorical variable, which indicates whether a firm's output in real terms had *Growth* (1), stayed *Unchanged* (2), or *Decreased* (3) on the quarterly basis. These response categories are treated as being independent of each other, so there are no problems associated with the independence of irrelevant alternatives assumptions.

On the basis of these explanatory and response data, the most appropriate technique is to construct a multinomial logit model with three categories in the response variable. Therefore, the following logit equation is going to be estimated:

$$\begin{aligned} L = {} & \alpha + \beta_1(stausid) + + \beta_2(npeid) + \beta_3(hhindexind) + \beta_4(hhY_1Y_2) + \beta_5(lqY_1) \\ & + \beta_6(lqY_1Y_2) + \beta_7(almrank) + \beta_8(astrank) + \beta_9(emplY_1Y_2) \\ & + \beta_{10}(empindY_1Y_2) + \beta_{11}(gdp\sec Y_1Y_2) + \beta_{12}(gdpheadY_1) + \beta_{13}(industprod) \end{aligned} \tag{13}$$

whereby L is the estimated (logit) likelihood of an enterprise experiencing current output growth as a function of firm, industry and regional variables. The hypothesis being tested here is that the current performance of a firm is a function of the characteristics of the firm, its industry and location.

The Results

Estimation results of the first hypothesis test were made with the full set of variables introduced in the previous section. However these results cannot be explained due to the statistical complications that were found in the data set, which caused the multicollinearity problem in the model. Three variables were found highly correlated with other variables that could affect the overall estimations results. These variables are:

- $gdpsecY_1Y_2$ – percentage changes in the volume of the industrial production in monetary terms by industries over the year period, where Y_2 is the year of observation and Y_1 is the comparison year.
- hhY_1Y_2 – percentage changes in the Hirschmann-Herfindahl index by industries over the year period.
- lqY_1Y_2 – percentage changes in the Location Quotient Index by regions over the year period.

Due to the multicolinearity problem, it was necessary to omit these variables from the model in order to obtain reliable results from the logit estimation. The omitting of these variables did not eliminate the model definition. After omitting the $gdpsecY_1Y_2$ variable from model, another alternative variable of this kind stays in the model and is presented by $empindY_1Y_2$ variable, which is the industry specific characteristics and defines the percentage change in national employment by industries on the basis of a year-to-year comparison and is represented by the variable, where Y_1 and Y_2 are comparison years. This variable keeps in the model an effect of relationships between enterprises performance and its industrial specific characteristic.

Indexes hhY_1Y_2 and lqY_1Y_2 represent alternatives to indexes *hh* and *lq,* which are presented in the model and capture the spatial industry-specific effect of the enterprises' behaviour on the comparison basis to previous year.

In order to explain effect of chosen variables on the probability of enterprises production performance, it is necessary to analyse estimations of variables marginal effects, which are presented in Table 1. The table is horizontally divided into three parts, which present measures of variables marginal effects on the probability of each category of dependent variable, which are: G*rowth* (1), *No changes* (2) and *Decline* (3) in the production of industrial enterprises on the quarterly basis. Each cell of the table contains a coefficient of the estimated variable marginal effect, standard error and z-statistics with significance levels (* for 1%, ** for 5% and *** for 10%).

Table 1 Marginal effect estimations of the first model

Year-Quarter	1997-I	1997-II	1997-III	1997-IV	1998-I	1998-II	1998-III	1998-IV	1999-I	1999-II	1999-III	1999-IV	2000-I	2000-II	2000-III	2000-IV	2001-I	2001-II	2001-III	2001-IV
Probability (1)	**0.197801**	**0.293112**	**0.281618**	**0.267015**	**0.332612**	**0.392337**	**0.387444**	**0.306559**	**0.308999**	**0.36299**	**0.484967**	**0.369798**	**0.462138**	**0.508368**	**0.482731**	**0.488688**	**0.348159**	**0.588557**	**0.474186**	**0.523533**
statusid	-.0112325	.0619544	.0232533	-.0421868	.0143885	-.0196798	.0526745	-.0496782	-.000459	.0662398	-.0020393	-.0534875	-.1524097	.1173399	.1277677	-.0920091	-.0497678	.0048666	.0017981	-.0484741
	.02433	.03353	.02953	.0314	.03282	.03888	.03627	.04013	.04706	.05413	.05106	.04564	.06519	.07917	.05891	.07328	.0723	.07835	.05542	.06713
	-0.46	1.85***	0.79	-1.34	0.44	-0.51	1.45	-1.24	-0.01	1.22	-0.04	-1.17	-2.34**	1.48	2.17**	-1.26	-0.69	0.06	0.03	-0.72
npeid	.0389345	.0101283	.0794267	.0869495	.0430562	.0308589	.0013483	.0855789	.0271825	.0495643	.0244259	.0517793	-.0285068	-.0293374	.0240821	.1056494	.0245587	-.0246257	.0249039	.0472136
	.01999	.02042	.01996	.02049	.02908	.0303	.02185	.02405	.02535	.02441	.031	.02568	.03587	.03527	.03328	.04451	.03917	.03502	.03375	.03869
	1.95***	0.50	3.98*	4.24*	1.48	1.02	0.06	3.56*	1.07	2.03**	0.79	2.02**	-0.79	-0.83	0.72	2.37**	0.63	-0.70	0.74	1.22
hhindexind Y_1	-2.894419	-6.953166	2.910238	-5.281684	-16.92664	7.867186	-5.480075	-9.846168	2.68159	-.5374057	-1.822428	-13.43785	-7.402284	.6336385	-3.657403	4.287052	3.958362	4.585223	-8.703645	2.757074
	4.22766	4.13493	4.13836	3.97312	4.91256	5.77031	4.87127	4.93094	5.56843	5.1672	5.83954	5.46062	4.21523	3.70417	3.85104	4.16827	8.10829	7.05327	8.8658	8.18061
	-0.68	-1.68***	0.70	-1.33	-3.45*	1.36	-1.12	-2.00**	0.48	-0.10	-0.31	-2.46**	-1.76***	0.17	-0.95	1.03	0.49	0.65	-0.98	0.34
lq Y_1	-.1389172	-.5627257	.0861324	-.0766724	-.4036495	.0825886	.0254695	-.1367928	-.1446007	-.0151789	.1490125	-.1110397	-.1101026	-.0377092	.1241232	.0504888	-.0973653	.0917658	-.0306224	.3203237
	.20632	.22052	.16831	.12604	.16885	.18344	.13073	.1246	.13989	.12147	.16716	.13076	.19751	.17069	.17712	.2104	.17601	.15294	.17188	.19028
	-0.67	-2.55 **	0.51	-0.61	-2.39**	0.45	0.19	-1.10	-1.03	-0.12	0.89	-0.85	-0.56	-0.22	0.70	0.24	-0.55	0.60	-0.18	1.68***
almrank	.0117782	.0340669	-.011493	.01178	.0390817	.0255517	.0231879	-.0083209	.023527	.0208553	-.0150623	-.0080924	.0665773	.0279855	-.0282881	.0174694	.0220435	-.0316236	.0008131	-.0600435
	.0164	.01859	.01346	.01527	.01311	.02165	.01134	.01465	.02072	.01301	.01536	.01196	.02655	.02248	.01981	.02434	.02405	.02429	.02624	.03304
	0.72	1.83***	-0.85	0.77	2.98*	1.18	2.04**	-0.57	1.14	1.60	-0.98	-0.68	2.51**	1.24	-1.43	0.72	0.92	-1.30	0.03	-1.82***
astrank	.0051571	-.0141797	.000961	-.0029427	.0045902	.0106759	.0229521	-.0121904	-.0116637	.0188469	-.0085032	.0030775	.0210245	.0054163	.0007405	.0025589	.0193515	-.0017592	-.0199836	-.0026215
	.01701	.01511	.01651	.01418	.01721	.01647	.01198	.01533	.01251	.01396	.0149	.01285	.02381	.02154	.01974	.02342	.01815	.01362	.01382	.0176
	0.30	-0.94	0.06	-0.21	0.27	0.65	1.92***	-0.80	-0.93	1.35	-0.57	0.24	0.88	0.25	0.04	0.11	1.07	-0.13	-1.45	-0.15
empl Y_1Y_2	-.0199228	-.0333652	.0009683	.0020469	.0126464	-.0000562	.0007027	-.0045391	.048694	-.0177672	.0181118	.0250888	-.0066526	.0030919	.0132965	-.0364382	-.0155276	-.000866	-.0032432	.0244741
	.01848	.01568	.01181	.01287	.01206	.01458	.00264	.00307	.0363	.02388	.03121	.02328	.05982	.04954	.04167	.05157	.01324	.01207	.01178	.01413
	-1.08	-2.13**	0.08	0.16	1.05	-0.00	0.27	-1.48	1.34	-0.74	0.58	1.08	-0.11	0.06	0.32	-0.71	-1.17	-0.07	-0.28	1.73***
emplind Y_1Y_2	.0106928	.0243159	-.003456	.0022876	-.0200488	.0102646	-.0078518	.0047628	-.0010141	.0027972	-.0006965	-.0050995	-.0367261	-.0173549	.000035	-.0232618	-.0072955	.0105512	-.0034484	.0076202
	.00998	.01038	.0087	.00776	.01196	.00882	.00707	.00843	.00294	.00316	.00381	.00353	.01801	.01259	.01173	.01585	.01192	.01051	.01258	.01403
	1.07	2.34**	-0.40	0.29	-1.68***	1.16	-1.11	0.56	-0.34	0.88	-0.18	-1.44	-2.04**	-1.38	0.00	-1.47	-0.61	1.00	-0.27	0.54
gdpperhead Y_1	-.0028462	-.0022448	.0020286	-.0013221	-.0023635	-.0030055	-.0014661	.0013358	-.0002027	-.0021668	-.0006361	.0025464	-.0006978	-.0007055	.0010387	.0014304	.0002533	.0008705	.0006327	.0023547
	.00199	.00193	.00144	.0015	.00142	.00172	.00111	.00109	.00175	.00147	.0017	.00146	.0011	.00111	.00124	.00162	.0009	.00078	.00093	.001
	-1.43	-1.16	1.41	-0.88	-1.67***	-1.75 ***	-1.32	1.23	-0.12	-1.47	-0.37	1.74***	-0.63	-0.64	0.84	0.89	0.28	1.11	0.68	2.35**
IndustProd	5.23e-06	.0000266	-.0000115	-1.52e-06	.00002	3.01e-07	6.55e-06	-9.15e-06	.0000175	-2.66e-07	-2.82e-06	7.05e-08	.0000104	1.83e-06	-7.31e-06	1.41e-06	-4.16e-06	-8.62e-06	-3.50e-06	-8.57e-06
	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00001	.00001
	0.47	2.17**	-1.34	-0.18	1.77***	0.03	1.05	-1.17	1.19	-0.04	-0.51	0.02	2.18**	0.37	-1.52	0.23	-0.76	-2.02**	-0.67	-1.44

Continuation of Table 1

Year-Quarter	1997-I	1997-II	1997-III	1997-IV	1998-I	1998-II	1998-III	1998-IV	1999-I	1999-II	1999-III	1999-IV	2000-I	2000-II	2000-III	2000-IV	2001-I	2001-II	2001-III	2001-IV
Probability (2)	**0.353325**	**0.353761**	**0.386209**	**0.326372**	**0.332358**	**0.373454**	**0.385413**	**0.387207**	**0.373328**	**0.304533**	**0.283722**	**0.270532**	**0.284865**	**0.287884**	**0.295734**	**0.322357**	**0.347323**	**0.1901**	**0.307921**	**0.294205**
statusid	.0097398	-.0286929	-.0343306	.0016483	-.0317408	.0070339	-.033693	-.0476618	-.0069163	.0305004	-.0361464	-.0029328	.0802216	-.0624475	-.152722	-.0357307	.1507515	-.0892095	.0080323	.0397954
	.03479	.03257	.03359	.03774	.03432	.03909	.03696	.04601	.05375	.05125	.04511	.03923	.06095	.0647	.04488	.06642	.07695	.0466	.04973	.06286
	0.28	-0.88	-1.02	0.04	-0.92	0.18	-0.91	-1.04	-0.13	0.60	-0.80	-0.07	1.32	-0.97	-3.40*	-0.54	1.96**	-1.91***	0.16	0.63
npeid	-.000137	.0279817	-.0899145	-.0611885	-.0375585	-.0351053	-.0136144	-.0030335	.014199	-.0284118	-.0561704	-.025536	-.004507	-.0243574	-.0684253	-.0629177	-.0225131	.0154057	-.0282404	-.0683625
	.02402	.02074	.02228	.02197	.0256	.02814	.02226	.02777	.02931	.02262	.02767	.02483	.03002	.03075	.0304	.04352	.04996	.02963	.03227	.0322
	-0.01	1.35	-4.04*	-2.78*	-1.47	-1.25	-0.61	-0.11	0.48	-1.26	-2.03**	-1.03	-0.15	-0.79	-2.25**	-1.45	-0.45	0.52	-0.88	-2.12**
hhindexind Y_1	2.604263	9.415999	1.937333	-2.249845	1.113283	1.344457	6.037769	-2.071491	.1898015	-.5472141	3.150365	6.542354	-2.409876	-3.919621	-1.804232	-5.441134	-18.52638	-.9826031	-.3928405	-3.645747
	5.16584	4.34853	4.40983	4.43089	4.95092	5.38777	4.78383	5.32804	6.33474	5.02266	5.68031	4.91594	3.70629	3.96586	3.47733	3.56298	9.86792	5.95154	7.39765	7.12952
	0.50	2.17**	0.44	-0.51	0.22	0.25	1.26	-0.39	0.03	-0.11	0.55	1.33	-0.65	-0.99	-0.52	-1.53	-1.88***	-0.17	-0.05	-0.51
lq Y_1	-.4253307	.0247292	.3562428	.348746	.2375944	-.0344412	.0749465	-.1211155	-.04624	-.3481566	-.1298233	.1841869	.3321656	-.0218529	-.2665116	.0429363	-.2511952	.032472	.1573912	.0156643
	.28499	.22696	.19057	.13634	.1375	.20696	.1292	.13626	.11487	.10792	.13457	.12136	.21591	.16309	.18678	.17283	.19707	.1083	.16009	.17286
	-1.49	0.11	1.87***	2.56**	1.73***	-0.17	0.58	-0.89	-0.40	-3.23*	-0.96	1.52	1.54	-0.13	-1.43	0.25	-1.27	0.30	0.98	0.09
almrank	.0133178	.001654	-.0175751	-.0357094	-.0146535	-.0219169	-.0185762	.0028883	-.0177523	.003094	.0175226	-.0082442	-.0567714	-.007657	.0049516	.0030013	.0602668	-.0106607	.0092157	.0047998
	.02211	.01989	.01462	.01577	.01168	.02224	.01111	.01383	.01722	.01284	.01312	.01168	.03059	.0217	.01691	.0226	.02841	.01673	.02406	.02832
	0.60	0.08	-1.20	-2.26**	-1.25	-0.99	-1.67***	0.21	-1.03	0.24	1.34	-0.71	-1.86***	-0.35	0.29	0.13	2.12**	-0.64	0.38	0.17
astrank	.0284254	.0265997	.0359856	.0317191	-.0130356	-.0088495	-.0044743	.0117034	.0094659	-.0051992	.0140415	-.0065242	-.0238279	.0064368	.0364064	-.0187674	.0286083	.0171658	.0205919	-.00056
	.02239	.0167	.01969	.01635	.01667	.01757	.01296	.01535	.01333	.01357	.01284	.01128	.02695	.02206	.02029	.02036	.01846	.01116	.01309	.01568
	1.27	1.59	1.83***	1.94***	-0.78	-0.50	-0.35	0.76	0.71	-0.38	1.09	-0.58	-0.88	0.29	1.79***	-0.92	1.55	1.54	1.57	-0.04
empl Y_1Y_2	-.0275502	-.0035697	-.0052083	-.0010281	-.0049088	.0043736	.0001569	.00525	-.0372092	.0157597	-.003661	.0251488	.0276071	-.0283246	.0514009	-.0311672	-.0172644	.0019775	.0054593	-.004942
	.025	.01847	.0123	.01356	.00969	.01589	.0028	.00334	.03016	.02319	.02829	.02005	.05132	.046	.04388	.04401	.01453	.00976	.01074	.01324
	-1.10	-0.19	-0.42	-0.08	-0.51	0.28	0.06	1.57	-1.23	0.68	-0.13	1.25	0.54	-0.62	1.17	-0.71	-1.19	0.20	0.51	-0.37
emplind Y_1Y_2	.0148258	-.0053956	-.0150143	-.0244913	.0107657	-.0105256	.0048532	-.0078116	.003658	.0009054	-.0015332	-.0016065	.0224137	.0114222	-.0011911	.0129172	-.0095623	-.0108887	-.0104275	-.0053189
	.0133	.01167	.0097	.00903	.00799	.00989	.00694	.00867	.00316	.00301	.00315	.00265	.0152	.01139	.01184	.01455	.01264	.00797	.01052	.01257
	1.11	-0.46	-1.55	-2.71*	1.35	-1.06	0.70	-0.90	1.16	0.30	-0.49	-0.61	1.47	1.00	-0.10	0.89	-0.76	-1.37	-0.99	-0.42
gdpperhead Y_1	-.004192	-.0007223	.0009583	.001898	.0003291	.0013829	.0007111	.0005381	-.0003344	-.0010554	.0001508	-.0001019	.0016461	-.0001322	-.0022971	.0020712	-.0016643	-.000172	-.0005278	.0003465
	.00282	.00202	.00154	.00184	.00134	.00162	.00103	.00109	.00167	.00126	.0014	.0014	.00116	.00103	.00124	.00138	.00091	.00058	.00079	.00085
	-1.49	-0.36	0.62	1.03	0.25	0.86	0.69	0.49	-0.20	-0.83	0.11	-0.07	1.41	-0.13	-1.86***	1.50	-1.83***	-0.30	-0.66	0.41
IndustProd	.0000338	1.89e-06	-1.95e-06	-7.93e-06	-.0000144	6.05e-06	-2.98e-06	4.52e-06	-2.07e-06	.0000139	8.34e-06	-1.55e-06	-.00001	1.81e-06	8.54e-06	-7.14e-06	.0000105	3.00e-06	3.55e-06	3.55e-06
	.00002	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00000	.00000	.00001	.00000	.00001	.00001	.00000	.00001	.00001
	2.14**	0.16	-0.22	-0.87	-1.75***	0.58	-0.51	0.62	-0.20	2.11**	1.84***	-0.40	-2.04**	0.33	1.90***	-1.28	2.04**	0.90	0.69	0.64

Continuation of Table 1

Year-Quarter	1997-I	1997-II	1997-III	1997-IV	1998-I	1998-II	1998-III	1998-IV	1999-I	1999-II	1999-III	1999-IV	2000-I	2000-II	2000-III	2000-IV	2001-I	2001-II	2001-III	2001-IV
Probability (3)	**0.448874**	**0.353127**	**0.332173**	**0.406613**	**0.33503**	**0.234209**	**0.227143**	**0.306234**	**0.317674**	**0.332477**	**0.231311**	**0.359669**	**0.252997**	**0.203748**	**0.221536**	**0.188955**	**0.304518**	**0.221343**	**0.217894**	**0.182262**
statusid	.0014927	-.0332615	.0110773	.0405385	.0173524	.0126459	-.0189815	.09734	.0073752	-.0967403	.0381858	.0564203	.0721881	-.0548924	.0249543	.1277398	-.1009836	.0843429	-.0098304	.0086786
	.03522	.0315	.03275	.03784	.03225	.03524	.0309	.04755	.05393	.04877	.04371	.04839	.06592	.04807	.053	.06791	.07667	.08717	.04124	.03966
	0.04	-1.06	0.34	1.07	0.54	0.36	-0.61	2.05**	0.14	-1.98**	0.87	1.17	1.10	-1.14	0.47	1.88***	-1.32	0.97	-0.24	0.22
npeid	-.0387975	-.03811	.0104879	-.025761	-.0054977	.0042465	.0122661	-.0825455	-.0413815	-.0211525	.0317445	-.0262433	.0330139	.0536948	.0443432	-.0427317	-.0020456	.0092201	.0033366	.0211489
	.0243	.02089	.02082	.02259	.02613	.02546	.0193	.02627	.02967	.02442	.02486	.02455	.02896	.03287	.03104	.02791	.04098	.02708	.03022	.02663
	-1.60	-1.82***	0.50	-1.14	-0.21	0.17	0.64	-3.14*	-1.39	-0.87	1.28	-1.07	1.14	1.63	1.43	-1.53	-0.05	0.34	0.11	0.79
hhindexind Y_1	.2901564	-2.462834	-4.847571	7.531529	15.81336	-9.211643	-.5576939	11.91766	-2.871392	1.08462	-1.327937	6.895494	9.812159	3.285983	5.461635	1.154082	14.56802	-3.60262	9.096486	.8886731
	5.27568	4.25328	4.10444	4.72533	5.02416	4.96704	4.38963	5.36384	6.11607	4.94178	4.29505	5.4195	4.17222	3.64511	3.15432	2.81378	8.89599	5.66027	6.11719	6.04384
	0.05	-0.58	-1.18	1.59	3.15*	-1.85***	-0.13	2.22**	-0.47	0.22	-0.31	1.27	2.35**	0.90	1.73***	0.41	1.64	-0.64	1.49	0.15
lq Y_1	.5642479	.5379965	-.4423752	-.2720737	.1660552	-.0481474	-.100416	.2579083	.1908407	.3633355	-.0191892	-.0731473	-.222063	.0595621	.1423883	-.0934251	.3485605	-.1242378	-.1267688	-.335988
	.29451	.21548	.19154	.18128	.13239	.14828	.10777	.12948	.11177	.10874	.11985	.13757	.19141	.14199	.12277	.21023	.22127	.13539	.1681	.13265
	1.92***	2.50**	-2.31**	-1.50	1.25	-0.32	-0.93	1.99	1.71	3.34*	-0.16	-0.53	-1.16	0.42	1.16	-0.44	1.58	-0.92	-0.75	-2.53**
almrank	-.025096	-.0357209	.0290682	.0239294	-.0244282	-.0036349	-.0046117	.0054326	-.0057747	-.0239494	-.0024603	.0163366	-.0098059	-.0203285	.0233365	-.0204706	-.0823103	.0422843	-.0100288	.0552437
	.02382	.01864	.01384	.01845	.0137	.01874	.01127	.0133	.01618	.01302	.01247	.0122	.01846	.01988	.01613	.01779	.03404	.02139	.0271	.02057
	-1.05	-1.92***	2.10**	1.30	-1.78***	-0.19	-0.41	0.41	-0.36	-1.84***	-0.20	1.34	-0.53	-1.02	1.45	-1.15	-2.42**	1.98**	-0.37	2.69*
astrank	-.0335825	-.01242	-.0369466	-.0287764	.0084454	-.0018264	-.0184778	.0004869	.0021977	-.0136478	-.0055382	.0034467	.0028034	-.0118532	-.037147	.0162084	-.0479598	-.0154066	-.0006084	.0031815
	.02285	.01682	.01792	.01713	.01677	.01479	.01096	.01502	.01227	.01314	.01226	.01235	.02414	.01631	.01487	.02058	.0173	.01136	.01154	.01151
	-1.47	-0.74	-2.06**	-1.68***	0.50	-0.12	-1.69***	0.03	0.18	-1.04	-0.45	0.28	0.12	-0.73	-2.50**	0.79	-2.77*	-1.36	-0.05	0.28
empl Y_1Y_2	.047473	.036935	.0042399	-.0010188	-.0077376	-.0043175	-.0008596	-.0007108	-.0114848	.0020075	-.0144508	-.0502376	-.0209545	.0252327	-.0646974	.0676054	.032792	-.0011114	-.0022161	-.0195321
	.02591	.01613	.01225	.01456	.01076	.01328	.00218	.00334	.02877	.02329	.02722	.02317	.05536	.03523	.03225	.04178	.01286	.00944	.00972	.00944
	1.83 ***	2.29**	0.35	-0.07	-0.72	-0.33	-0.39	-0.21	-0.40	0.09	-0.53	-2.17**	-0.38	0.72	-2.01**	1.62	2.55**	-0.12	-0.23	-2.07**
emplind Y_1Y_2	-.0255185	-.0189203	.0184703	.0222037	.0092831	.0002611	.0029986	.0030489	-.0026439	-.0037027	.0022297	.006706	.0143124	.0059327	.0011561	.0103446	.0168577	.0003374	.0138758	-.0023013
	.01512	.01092	.00934	.01057	.00817	.00682	.00626	.00921	.00274	.0031	.00303	.0032	.01596	.01119	.00966	.01055	.01725	.00889	.01157	.00845
	-1.69***	-1.73***	1.98**	2.10**	1.14	0.04	0.48	0.33	-0.96	-1.19	0.74	2.09**	0.90	0.53	0.12	0.98	0.98	0.04	1.20	-0.27
gdpperhead Y_1	.0070382	.002967	-.0029869	-.0005759	.0020343	.0016226	.0007551	-.0018738	.000537	.0032222	.0004853	-.0024445	-.0009483	.0008376	.0012585	-.0035016	.001411	-.0006985	-.0001049	-.0027012
	.00329	.00189	.00142	.00186	.00126	.00125	.0008	.00129	.00147	.00129	.00129	.0016	.00117	.00083	.0009	.00169	.0011	.00063	.00077	.0008
	2.14**	1.57	-2.11**	-0.31	1.61	1.30	0.95	-1.46	0.36	2.50**	0.38	-1.53	-0.81	1.00	1.39	-2.07**	1.29	-1.11	-0.14	-3.36*
IndustProd	-.0000391	-.0000284	.0000134	9.45e-06	-5.59e-06	-6.35e-06	-3.57e-06	4.63e-06	-.0000154	-.0000136	-5.52e-06	1.48e-06	-3.79e-07	-3.64e-06	-1.23e-06	5.73e-06	-6.36e-06	5.62e-06	-4.62e-08	5.01e-06
	.00002	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00000	.00000
	-2.22**	-2.50**	1.66***	0.95	-0.61	-0.80	-0.63	0.64	-1.44	-2.18**	-1.25	0.31	-0.08	-0.91	-0.35	1.04	-1.08	1.47	-0.01	1.31

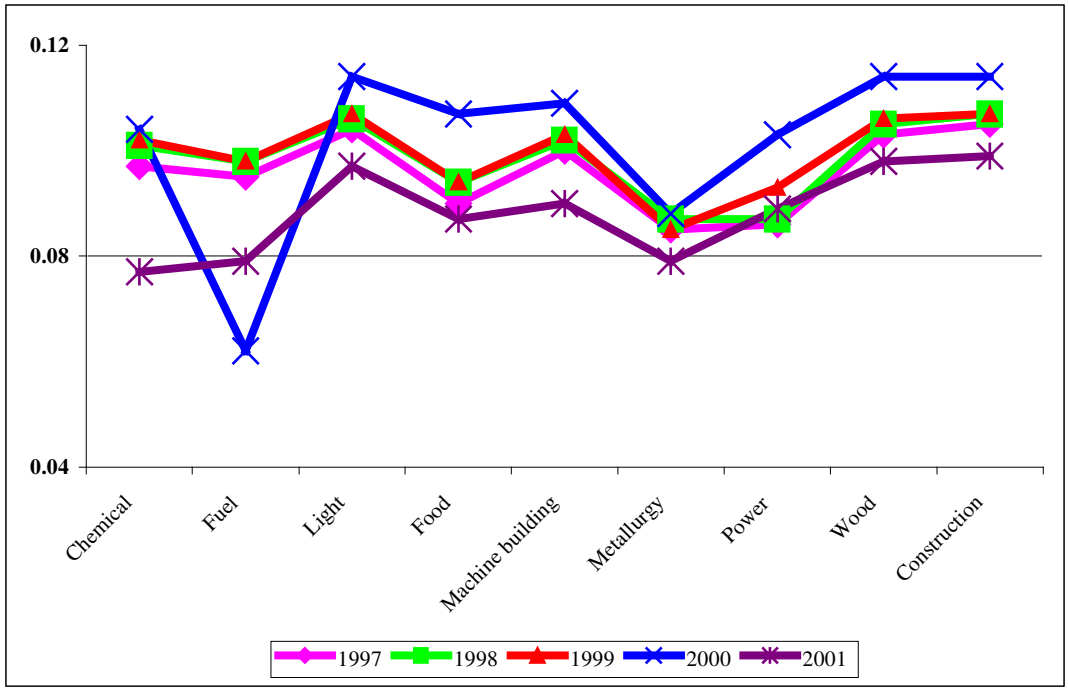
Hereby, industrial enterprises with ownership of higher order of market orientation and liberalisation were found to be unsteady in their production performance. These enterprises performed lower probability of rise in their production in the beginning of 2000 and the higher probability for its rise at the end of the same year, while the probability of stable level of industrial production declined for the reason of the higher likelihood of the production growth. At the same time the probability of decline in the output production of industrial enterprises increased with growth of the market orientation order of ownership types at the end of 1998 during the Russian crisis. However, in the second quarter of 1999 the recovery after the Russian crisis lead the probability of decline in the output production of industrial enterprises to go down with the increase of the market orientation of their ownership types. As a result, Kazakhstani industrial enterprises tend to benefit from the private ownership type, which lead to the growth of their production. However at the same time private ownership allocate industrial enterprises into more vulnerable situation under the effect of external crisis, compared to enterprises of lower degree of the market orientation.

Estimations results for all industrial enterprises of the Kazakhstani survey show that industrial enterprises of the larger employment size (*npeid* variable) tend to have higher probability of an increase in their output production and lower probability of being stable or experiencing decline in the production. This indicates that Kazakhstani industrial enterprises of larger employment size could be less sensitive to other external and internal factors in their production activity compared to firms with smaller employment size. Latter could find it more difficult to increase their level of production due to the smaller share on the market, where the probability of being stable is high compared to growth in the production, while the decline tendency for smaller enterprises was significant only over one quarter compared to the growth of output production. Thus, industrial enterprises of the larger employment size are appeared to be more stable on the market, and less vulnerable to economy changes, which affect the production performance.

The *HH* index (*Hhindexind* Y_1 *variable*), which represents the non-spatial industrial specific characteristic, was found to be strongly significant in relation with enterprises production level. Estimations results show that industrial enterprises, which belong to

higher spatially concentrated industries, have higher likelihood that their production volume will stay at the same level or will have decline in the consequent quarter, compared to the growth in their production. Industries, based on mineral resources would be expected to have higher level of the industrial concentration, such as fuel or metallurgy, however Kazakhstan, as mineral-resources endowed country has different picture. *HH* index (Figure 1) of the Kazakhstani industrial concentration shows that the lowest level of industrial concentration is observed exactly in fuel and metallurgical industries, which are more evenly distributed across regions than other industries, which is explained by the high dispersion of mineral sources in Kazakhstan. However, such industries as light, wood and construction materials were found to be highly concentrated in Kazakhstan across years of the survey, which had the production collapse during the transition decade in many regions, due to the demand fall at internal and external markets, and high level of competitiveness from imported goods. Therefore the conclusion of *HH* index estimations denotes that industrial enterprises that belong to industries of the lowest level of industrial concentration, such as fuel or metallurgy (Figure 1) do tend to have higher probability of their production growth, rather than being stable or facing the decline. Estimations results of the *HH* index coincide with the real situation in Kazakhstan, where the high interest from foreign investors is observed towards industries based on mineral resources, which is increases level of investment and as a result lifts the production level. Therefore, such uneven distribution of investments increases disparities between production levels of different industries, where minerals intensive industries progress ahead of other industries, which are mainly based on the local consumption.

Figure 1. HH Index of the Kazakhstani industrial concentration



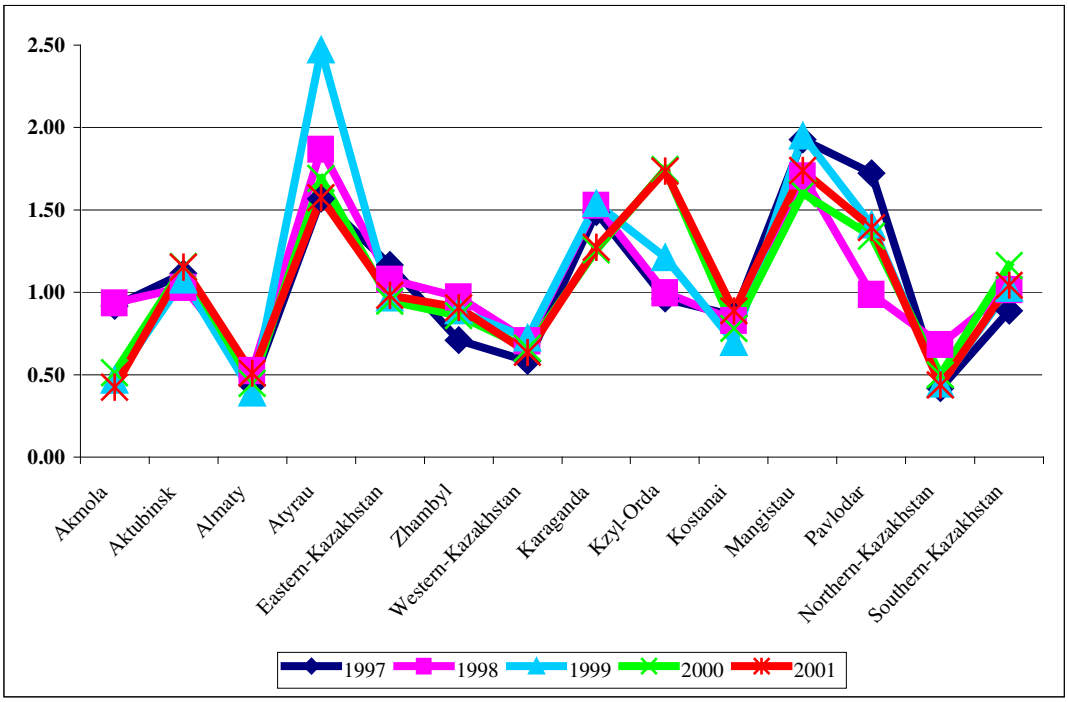
Source: Data are measured from:

1. Regional Statistical Yearbook 1996-1999. National Statistical Agency of Kazakhstan. Almaty, 2000.
2. Regional Statistical Yearbook 1997-2000. National Statistical Agency of Kazakhstan. Almaty, 2001.
3. Regional Statistical Yearbook of Kazakhstan. National Statistical Agency of Kazakhstan. Almaty 1998.
4. Kazakhstan: 1991-2002 years. National Statistical Agency of Kazakhstan. Almaty 2002.

Another industrial specific spatial variable – LQ index (*Lq Y_1 variable*) was found to be negatively significant for the group of the production growth, which means that Kazakhstani industrial enterprises located in highly specialised regions, tend to have lower probability of their production growth than industrial enterprises located in other regions and higher likelihood of the decline or the stable position of their production level. Figure 2 presents *LQ index* of Kazakhstani regions over years of the survey, where index lower than 1 means that the region is the net importer of industrial goods, while the region with the LQ index higher than 1, exports the output of the specialised industry inside of the country as well as it could be outside. It can be seen from the Figure 2, that Atyrau, Mangistau, Kzyl-Orda and Karaganda regions are highly specialised in particular industry, which is the fuel. However, since 1997

the fuel industry had constant growth. Therefore industrial enterprises located in regions of the higher specialisation, and which do not belong to the specialised industry of a region, tend to face decline of their production compared to enterprises located in regions with lower specialisation. As the high level of specialisation observed only in regions rich with mineral resources, which are profitable commodity for export, these regions put a lot of efforts to increase the production of these commodities, which would increase the income level. At the same time, other industries, such as food or light, of these regions, face the lack of investment, where labour of the low qualification level prefer to go to industries of specialisation with higher level of income and young generation prefers the specialised industries qualifications to others for the reason of income. Consequently, the production level of industrial enterprises of non-regional specialisation falls down, increasing the cost of production. As a result, it becomes cheaper to import goods of these industries from other regions or countries, while local industries, which do not belong to the regional specialisation, deteriorate with higher speed.

Figure 2. LQ Index of the regional specialisation



Source: Data are measured from:

1. Regional Statistical Yearbook 1996-1999. National Statistical Agency of Kazakhstan. Almaty, 2000.
2. Regional Statistical Yearbook 1997-2000. National Statistical Agency of Kazakhstan.

Almaty, 2001.
3. Regional Statistical Yearbook of Kazakhstan. National Statistical Agency of Kazakhstan. Almaty 1998.
4. Kazakhstan: 1991-2002. National Statistical Agency of Kazakhstan. Almaty 2002.

Purely distance measures in the model, which introduced by *almrank* and *astrank* variables and presented as the distance from regions to the capitals Almaty and Astana respectively on the basis of the ordinally ranking, appeared to be significant in different estimations groups. Thus, industrial enterprises located closely to Almaty region were found to have low likelihood of growth in their production and at the same time they have low likelihood of having decline in their production, compared to industrial enterprises located in distant regions from ex-capital Almaty. Therefore, it can be concluded that industrial enterprises located at the proximity to ex-capital city do tend to have higher stability in their production, than enterprises of other regions. This fact could be explained by time lags of the privatisation process between Kazakhstani regions. By the middle of the first transition decade, 1996, the privatisation of enterprises had higher level of activity in economically developed regions, such as Almaty, Southern Kazakhstan, Karaganda, while less developed regions like Northern Kazakhstan and others had the lower speed of the privatisation process (Kalyuzhnova 1998). Therefore, the majority of industrial enterprises were privatised in economically developed regions by the period of study estimations, 1997. The production level relatively stabilised in those regions compared to other less developed regions, which mainly appeared to be distant located from ex-capital city and had late privatisation accomplishment due to the lack of development and lack of information from the authorities centre. As a result their production activity is found relatively live during the period of estimations, compared to industrial enterprises located in economically developed regions and proximate to Almaty region.

Astana city became the new capital of Kazakhstan in 1997, therefore there would be expected the high inflow of investment into the development of the whole Akmola region. However, estimations results of the *astrank* variable oppose this hypothesis and show that industrial enterprises, which are proximate located to Akmola region, have higher likelihood of their production decline, than industrial enterprises located

in distant regions from Akmola region. The phenomena could be explained by high investment into the new capital development, which involves the demand of high quality goods use, which are imported from the neighbouring Russian market or other countries. At the same time, local industries do not meet sufficient demand of their goods due to their higher production costs and lower quality.

Estimation results of industrial enterprises sample show that the employment growth on the regional (*$emplY_1Y_2$ variable*) and industrial level (*$emplindY_1Y_2$ variable*), respectively, negatively affects the production growth of enterprises. Considering data more precisely, on the basis of distributions of variables means, it is necessary to explain results from the point of decline in the fall of industrial employment rather than its growth. Thus, industrial enterprises located in regions with lower decline in industrial employment were found to have higher likelihood of decline in their production. Apparently, the decline in the fall of industrial employment does not necessary mean its growth, even opposite, it indicates the worsening of the situation where industrial employment was going down for quarters and there was depletion of labour input, where the high probability of decline in the production is the natural way of response to the depletion of sources.

The growth of total regional employment, *$emplY_1Y_2$*, was not found to be positive characteristic for the production growth of industrial enterprises, however the strength of the decline likelihood was changing over the whole period of estimations. The reason of decline in the production of industrial enterprises in regions with high growth of total employment could be in the reorientation of labour from low-income and declining industries, mainly food and light, into trade business of importing goods from Russia or other countries to Kazakhstan.

The GDP per capita index (*Gdpperhead Y_1 variable*) was used to capture the effects of the location-specific input cost variables and was found to have positive effect on the production growth of industrial enterprises. However, surprisingly higher level of regional GDP per head increased the probability of decline in the output production of industrial enterprises in the beginning of 1997 and 1999. This could be explained by negative effect on Kazakhstani industrial enterprises of Russian crisis at the end of 1998. Nevertheless, the tendency was changed at the end of 2000 and 2001 where the

higher level of the regional GDP declined the probability of industrial enterprises experiencing decline in their output production, as a result of the total economy recovery.

However, the higher level of GDP per head in the region does not give an advantage for all industries located in this region. The location specific characteristic (*LQ Y_1*) of industrial enterprises was found to negatively affect the production growth of industrial enterprises in highly specialised regions. Highly specialised regions tend to be regions rich with energy sources as coal, oil and gas, which give high percentage of the Kazakhstani GDP. Therefore, the value of GDP per head in these regions is high[8] as a result of economic forces concentration on energy industries. Estimation results of the (*Gdpperhead Y_1 variable*) give additional evidence in prove of the argument discussed in the analysis of the LQ variable estimations. Thus, that location specific characteristics captures the decline of production of industrial enterprises, which do not belong to the regional specialisation, such as food industry in the fuel-specialised region. The higher GDP per head is an advantage for enterprises of the region's specialisation industry, however their dominance negatively affects industries of non-specialisation. The exception case of the high level of GDP per head with low level of regional specialisation is Almaty city, where high concentration of financial sources gives a higher opportunity for all industrial enterprises to progress their production level.

The measure of the purely industrial production volume of regions (*IndustProd variable*) indicates the direct positive significant effect to the probability of increase in industrial enterprises' output production through taken quarters and the negative effect on the probability of decline in their output production. Thus, industrial enterprises located in regions with high level of industrial production tend to have higher likelihood of a rise in their output production and lower likelihood of its decline. However, in the second quarter of 2001 the high level of industrial production was appeared in estimations to have negative effect on the production growth of industrial enterprises. This could be explained by the slowdown and decline of industrial production in regions of the high production level. Thus, Western

[8] In transition, hydrocarbon rich regions, Atyrau, Western Kazakhstan, Mangistau had highest level of GDP per head incluing Almaty city.

Kazakhstan and Pavlodar regions had decline by 17% and 7% respectively in the second quarter of 2001 as a result of oil and other mineral commodities prices decline in 2000. Besides of the effect of world commodity prices falls, the level of industrial production in Kazakhstani regions was found to be highly dependent on growth of industrial enterprises production.

The hypothesis that the performance of industrial enterprises of Kazakhstan depends on the set of spatial, industrial and individual specific characteristics can be accepted considering estimated results. However, these results also show that the performance of Kazakhstani industrial enterprises changes over the taken period of years staying at the strong relationships with spatial, industrial and individual specific characteristics but having signs of changes in some of them. As such, the results indicate the unstable behaviour of industrial enterprises, which could be the result of transitional transformations in the country. Such transformations are found to be the most sensitive for production behaviour of industrial enterprises on the regional level, where such variables as LQY_1, $EmplindY_1Y_2$, $EmplY_1Y_2$, $GdpperheadY_1$, which perform the location quotient, regional industrial employment growth, total regional employment growth and the regional GDP per head respectively affect the sign fluctuations of significant z-statistics. This shows that regional economies are still in the process of the foundation and economically active. At the same time the ownership type was found to have sign fluctuations, which indicate the weak level yet of establishment of the new system of ownership types in the economy where enterprises were still customizing with new system of operating at the management level.

In some cases the instability of the transition process in Kazakhstan affected the stability of production activities of industrial enterprises. As a result, the sign of marginal effects fluctuates through quarters, which were specified with most strong changes in the economy. Thus, distributions variables means do not have frequent changes, while the marginal effect of every single variable fluctuates over the whole period of the survey with changes in signs.

Summary

The model used in the study estimates the probability of industrial enterprises being dependent on its individual, industrial and regional specific characteristics in terms of the short-term production. Results of econometric estimations present the high volatility of signs of variables coefficients. One of explanation of such signs instability could be that the sample of industrial enterprises is somewhat different for every quarter, where industrial enterprises are different. However, their general properties are the same, and the distribution of enterprises by their individual specific characteristics, such as region and industrial sector, is mainly keeping the same structure over all quarters of observation.

Observing the sample of industrial enterprises we have, it can be seen that, enterprises, which are repeated in the questionnaire over quarters, have continuous changes in their industrial production on the qualitative level. The continuous changes in growth and decline of enterprises' output production across all quarters of the survey are not distinctive characteristics of a particular enterprise and independent on the regional or industrial specific characteristics of enterprises, but are applied to all surveyed industrial enterprises. Therefore, the much more plausible reason of high signs instability of variables coefficients may be explained by the enterprises' inherent behavioural instability over the successive quarters of the uncertain transition period. The transition process is defined by the restructuring of the whole economy from the Soviet planning system towards the market economy, where former Soviet republics became independent from the central management. The transition appears to be a highly unstable rather than a smooth process. Where changes are made on the random level due to the lack of information for supporting the right way of the economy restructuring, which would lead to the continuous production growth.

In the transition economy, industrial enterprises adopt the leader following behaviour, copying industrial enterprises, which perform the production growth. However, the performance of industrial enterprises on the basis of the following market leader behaviour, does not always brings expected results. Other determinants play important role in their performance, such as individual specific, regional specific and industrial

specific characteristics, which are estimated in the current study. Therefore, due to uncertainty conditions in the transition economy, industrial enterprises face constant and unpredictable changes.

Nearly every firm of the survey is exhibiting huge instability in terms of the short-term production from quarter to quarter, where continuous changes affect the general performance of industrial enterprises on regional and sectoral levels. Therefore, on the basis of curried estimations the conclusion can be made that the transition process is characterized by high instability on the microeconomic level, where the U-shape of the growth theory is not defined by the smooth process in transition economies, but is defined by continuous fluctuations. The transition process in Kazakhstan moves the economy from central planning towards the market. However, this process cannot be finished in the short term due to conditions of uncertainty, while the long-term process is defined by constant search of the successive way for the growth performance. The lack of information brings many firms to use the "trial and error" behaviour, while other firms are following leader of the market. Therefore, many enterprises are successive in their production, however, many of other enterprises face failures, which are defined by the transition economy uncertainty and unpredictability. Estimations results show that the transition developing market is not strictly divided into constantly succeeding or failing industrial enterprises. However, it indicates that industrial enterprises, which maintain their production process, continuously face production fluctuations, which determine the nature of the transition process.

Conclusion

The chosen multinomial logit framework of the production function allows to examine relationships between the industrial enterprises' production behaviour and their individual, industrial and location characteristics, where the hypothesis tested the dependence of industrial enterprises' production performance on the set of their given characteristics. The research faced with tendency of many estimated independent variables to the volatility of its signs over quarters, which is not related to econometric estimations problems, as they were corrected over estimations.

This paper confirms that performance of Kazakhstani industrial enterprises varies relative to their location, where industrial and individual characteristics also affect their production performance, while many of them are regionally divided. The model attempted to capture the relationships between production performance of Kazakhstani industrial enterprises and their specific characteristics. The production performance was introduced by three possible outcomes: *Growth* of production volume, *No changes* and *Decline*.

Results of model estimations demonstrate that the *growth* in production is more likely to be observed in industrial enterprises, which do present following comparative characteristics: the larger employment size, if industrial enterprises belong to industry of the low industrial concentration, and if they locate in regions of low industrial specialisation, with low growth of regional employment and which locate on the distance from the ex-capital Almaty city. The production with *no changes* is most likely to occur in industrial enterprises with the state type of the ownership or it's partly share and favourable lower employment size of enterprises with low growth of the regional industrial employment. However the concentration of the particular industries is most likely to be higher than industries where enterprises face instability in the production. Finally, the *decline* in production was mostly detected in industrial enterprises of smaller employment size, but with high industrial regional employment growth, commonly in regions located closer to the new capital with high industrial concentration, but with low level of industrial production compared to other regions.

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