Labour Market Model — Focused on Final Products

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Abstract
This paper studied history of development of commodity and cash flows balancing models. Keynesian model , monetary model and Mundell-Fleming model are investigated, the issues of mutual consistency of indicators of economic growth is studied. At the same time , the mathematical formulation of market equilibrium of levels of production, employment, incomes and prices is gives. A new model of labour market focusing economy on the final product is established.
Keywords Labour market; Gross output; Labour-intensity of products; Interindustry balance; Final product

1 Market Imbalance Theory is an Instrument to Identify Macroeconomic Imbalances

This section studied history of development of commodity and cash flows balancing models. There are assumptions that adequately reflected development of market forces of economic development. Relationship between indicators of economic growth in both sectors of the economy was established. If Keynesian model developed a balance between real economy and financial economics by using only one indicator, then monetary model used two, and Mundell-Fleming model used three indicators of economic growth. It also studied the issues of mutual consistency of indicators of economic growth.

Historically, analysis of production repeatability since 40-ies of the last century was conducted based on Keynesian model, which assesses the market equilibrium between commodity and cash flows. Using this model as an anti-crisis tool to eliminate the consequences of the Great Depression of the US economy in the 1930s is associated with the name of the US President F. Roosevelt. Circuit diagram of the replenishment cycle of this model is shown in Figure 1.

According to Keynesian model we may admit the constancy of prices for goods and services, and consider investment growth and increase in other consumption costs as an impetus for economic development by the state. As prices for goods and services are constant, commodity and cash flows balancing based on this model is carried out due to one indicator - nominal GDP. In other words, economic growth indicator is nominal GDP, which serves as an indicator of real

economic growth, as prices are constant, and volumes of real GDP and nominal GDP are the same because of constant prices.

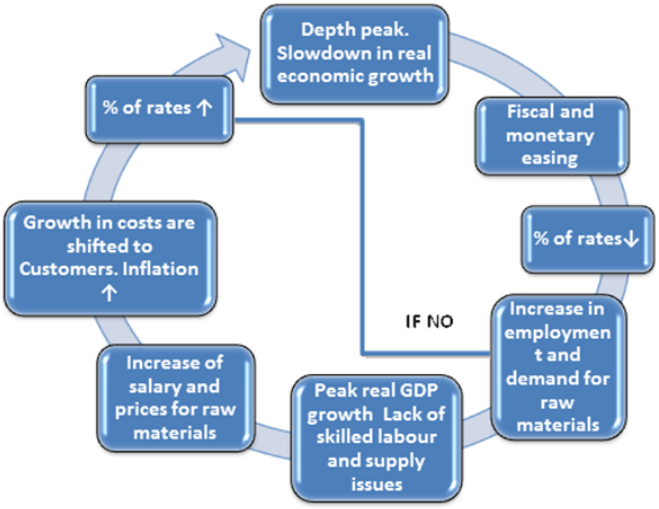

Fig.1 Principle circuit diagram of the replenishment cycle of Keynesian model

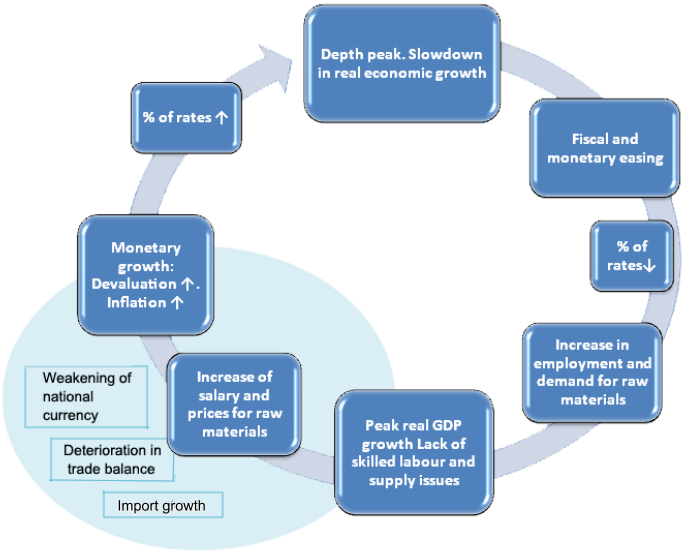

Fig.2 Principle circuit diagram of the replenishment cycle of monetary model

In the mid-80s of the last century a model of economic management has

changed. Keynesian model was replaced by more progressive model - a model of monetary policy. The reason of progressivity of monetary model was that it considered variability of prices of goods and services that was clear in real life and which is a key advantage of the market economy.Conditions of goods and services are rapidly renewed because of the influence of market competition of goods and services, and there will be their new prices, and prices of previous goods and services will change due to scientific and technological progress.

Monetary model in production repeatability analysis started to be actively used since the 1980s. Its appearance on practice of economic management of the country is associated with the name of the President of R. Reagan. Monetary model means constant money velocity and it uses two GDP indicators: nominal and real. A real GDP is defined in prices of basic year and characterizes the dynamics of market forces of real economy. A nominal GDP is defined in prices of the year and characterizes the dynamics of market forces of monetary and financial system. GDP deflator connects their balancing between each other. But later it is turned out that a weak point of the model of monetary policy is assuming the constancy of money velocity, which is considered as a basis for monetary model.

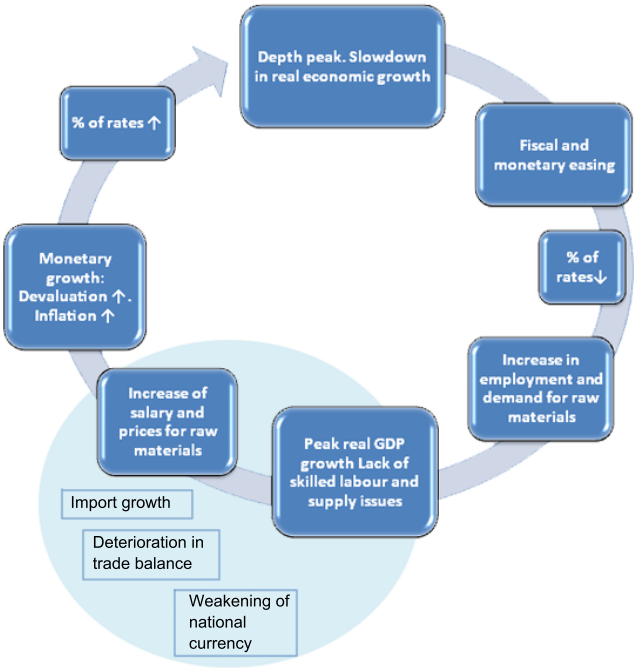

Fig.3 Principle circuit diagram of the replenishment cycle of monetary model

Multinational companies and companies with developed foreign trade relations started to see the narrowness of this model during their economic analysis. In this regard, since the 1990s of the last century Fleming - Mundell model was used, which overcame limitations of the monetary model. The advantage of Fleming - Mundell model is that it admits that money velocity is dynamic. However, this model again assumes the constancy of prices for goods and services.

Production repeatability analysis according to Fleming - Mundell model (since 1990) considers dynamics of exchange rate, which serves as a reliable development instrument of international relations of the world countries. It uses three GDP indicators: nominal, real and GDP based on purchasing power parity; Figure 3 shows a principle circuit diagram based on Fleming - Mundell model.

Firstly, Mundell-Fleming model assumes that prices are constant, and secondly, it links three GDPs to each other. To ensure conceptual relationships of three GDPs and stop assuming that prices for goods and services are constant, market equilibrium of levels of production, employment, incomes and prices was established.

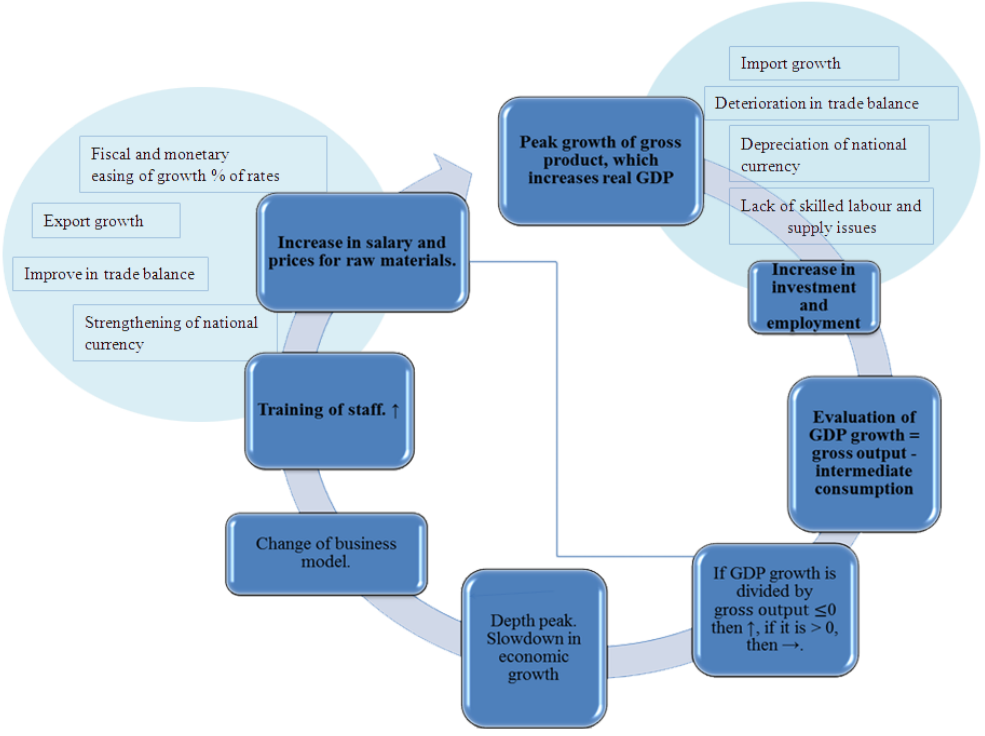

Fig.4 Principle circuit diagram of the replenishment cycle of Kazakhstan model of double regulation

A new model of market equilibrium of levels of production, employment, incomes and prices in employment terms summarizes Keynesian, monetary and Fleming - Mundell models, and do not contradict their structure principles, but develops them.

2 Economic Content of Kazakhstan Model of Double Regulation

This section gives mathematical formulation of market equilibrium of levels of production, employment, incomes and prices.. A new model of labour market focusing economy on the final product is established, which is shown in the example of the Republic of Kazakhstan. It explains why the market forces of labour and capital are developing according to the laws of free competition despite wishes of entrepreneurs to increase competitiveness of their companies.

An article of American Scientists was published in the column "New World Order" in magazine "Foreign Affairs" about "labour, capital and ideas in economy of power laws", which states that the future belongs not to those who provide cheap labour or owns capital (they will be driven out by automation), but to those who are willing to introduce innovations and create products, services and business models based on them. New technologies do not only integrate existing sources of labour and capital, but also generate products that replace both labour and capital.

According to the authors of the article, innovations in the nearest future, will lead to great changes, associated with distribution of incomes, as profit sources will be represented by high technology and globalization, in which this process is usually demonstrated as power laws. In this case, an employee in the USA will receive the same salary as employees working in the industrial sector in China or India. This is good news for developing countries, and problem for the United States and Europe, where there are no possibilities of reducing production costs and monetary growth.Can Kazakhstan take advantage of the situation in the new world order?

Economic Research Institute (Kazakhstan) applies a system of techniques to do forecasting and analysis. Innovative model of the labour market plays an important role in it, which is focused on the final result. Top modules of balance labour model are coefficients of direct labour intensity of products. To measure labour intensity we can use the unit of man-hours, man-years or jobs, and for their calculation we can use the table "Input - Output", which are produced in Kazakhstan every year:

$$t_i = \frac{L_i}{X_i}\,, \quad i = \overline{1,n} \tag{1}$$

where t_i - coefficients of direct labour intensity of products; L_i - number of people employed in the economy; X_i - gross output.

To measure labour intensity we can use the unit of man-hours, man-years or jobs.

Full coefficients of labour intensity per unit of production are calculated by coefficients of direct labour intensity:

$$T_j = \sum_{i=1}^{n} a_{ij} T_i + t_j \ , \quad i, j = \overline{1, n} \tag{2}$$

where a_{ij} - input-output coefficient i type of economic activity for issue j type of economic activity; T_i, T_j - full labour intensity coefficients for production of Y_i or Y_j - component of final product - Y;

If we consider that coefficients of direct $t = (t_1, t_2, \ldots, t_n)$ and full $T = (T_1, T_2, \ldots, T_n)$ labour intensities are raw vectors, then the ratio (2) can be written in matrix form:

$$T = TA + t \tag{3}$$

or

$$T = t(E - A)^{-1} \tag{4}$$

where E is identity matrix, A is matrix coefficient, representing production process technology of this year. $(E - A)^{-1}$ - input coefficient matrix of production processes represented by full material costs in the table of interindustry balance. Labour intensity turns into full material costs in accordance with duality principle of Koopmans and Kantorovich.

If we introduce a notation = $(E - A)^{-1}$ then formula (4) can be rewritten as follows:

$$T = tB \tag{5}$$

As it is seen from the formula, the only link between direct and full labour intensity indicators of products is still input coefficient matrix of production processes. It means that coefficients of of full labour intensity of each goods and services provided are very important, which reflect the influence of production processes.

If we consider L as a number of jobs in all sectors of national economy and apply module (1), we will get the following formula to calculate a number of people employed in the economy:

$$\mathrm{L} = \sum_{\mathrm{j}=1}^{\mathrm{n}} \mathrm{L_j} = \sum_{\mathrm{j}=1}^{\mathrm{n}} t_j \mathrm{X_j} = \mathrm{tX} \tag{6}$$

where X is gross output of goods and services.

If in formula (1) we marked a number of people employed in the economy by the components of raw vector Li, then we can have the record shown in formula

(6) by representing the same number of people employed in the economy as that of components of raw vector j.

If we multiply both sides of (5) by Y-final vector of production, we can have the following model of the labour market:= tBY. And if we take into account the formula (6), then balancing model will have a complete form, where the basic law of labour market and capital is reflected:

$$tX = TY \tag{7}$$

On the other hand, a similar assessment on the level of national economy of the country represents the average value formed by the ratio of nominal GDP to gross output:

$$c = \frac{t}{T} = \frac{Y}{X}$$

Left side (7) is equal to TY where T according to formula (5) is full labour intensity of products, nd Y is the final product. And the cost of the final product is considered to be equal to nominal GDP. Right side (7) is equal to tX where t according to the module (1) is direct labour intensity of products, nd is gross output of goods and services provided. Based on this simple formula the yield of GDP (CDP (t)) is estimated as per turnover unit - $X(t)$.

In fact, the gross output value $X(t)$, which was correctly identified by famous American scientist Harrington Emerson in his main work "Twelve principles of productivity" (1911), at business level it is "total expenditure = material costs + labour costs + capital costs.

Or:

total expenditure =QP+TW+TR;

> where compensation for intermediate materials, and other current material resources, used during production of goods is QP; remuneration of labour costs of employees is TW; remuneration of fixed capital is TR.

Thus, there is relationship between the final product and overall costs to create it - X. So, by putting in place of t in the formula (7) its value from the formula (1) we will have $t = L/X$. Then we will have $L = TY$. It means that a number of people employed in the economy is equal to multiplication of full labour intensity of products by nominal GDP. And full labour intensity of products is T, which in turn, is determined by multiplication of direct labour intensity of products - t to full costs matrix.$B = (E - A)^{-1}$.

Multiplicationt X according to (6) alsomeans number of working time fund used or number of jobs on economic activity, which are required to produce gross output (X), necessarry for production of the final product (Y).

On the one hand, development model of the labour market (7) defines the

marginal valuation of the ratio of direct and full labour intensity of products for every type of economic activity, on the other - a similar assessment at the level of national economy of the country represents the average value, formed by the ratio of nominal GDP to gross output:

$$t/T = Y/X \tag{8}$$

A number of people employed in the economy of state is similar to the total number of employees in all economic activities. Therefore, new interpretation of the main situation of the market in labour terms is calculated by the model (7), which is completed by equation (8). In this case, the share of direct labour intensity of goods and services in their full labour intensity is equal to the level of production of the final product (Y) in the gross output (X).

As a rule, destructive forces of laws of market equilibrium appear in macroeconomic imbalances, which are easily detected by analytical tools built on the basis of the table of interindustry balance. Thus, according to the above formula (5), full material costs matrix allows to turn actual labour used during production of gross output (X) into abstract labour. However, this abstract labour, expressed in full labour intensity of products is needed to evaluate the effectiveness of production of a particular amount of the final product (Y).

As defined in formula (1), direct labour intensity is expressed by the ratio of a number of people employed in every economic activity to the total volume of gross output, issued in this sector. Multiplication of raw vector of direct labour intensity of a particular type of human activity by inverse matrix of material costs expresses a column vector of full labour intensity of production of the final product (Y)). Figure 5 shows a piece of values of direct and full labour intensity of products for certain types of economic activity of Kazakhstan for 2012.

As we can see from the diagram, the first indicator reflects the specific amount of jobs (man-years, man-hours, man-days) required to produce 1 million tenge worth of gross output. For example, in agriculture, hunting and forestry, it amounted for 965 jobs, and in production area of crude oil and natural gas - only 10. Figure 5 also shows that full labour intensity is greater in number than direct labour intensity.

This is due to the fact that the first indicator reflects abstract labour that expresses the social form of unit cost of the final product produced, and the second represents economy of a particular type of human activity. Here, the "black box", which allows you to transfer direct labour intensity (t) into full (T) is represented by inverse matrix of interindustry balance (B), $T = t * B$. It also makes it possible to determine rapid development of technological improvement of production, since it is its dynamics (τ) that is a factor defining the rapidness of this process. That is why the advantages of new Kazakh model, focused on

the final result, are provided on the basis of analytical calculations, conducted using reverse (τ)-matrix. The results are shown in Table 1.

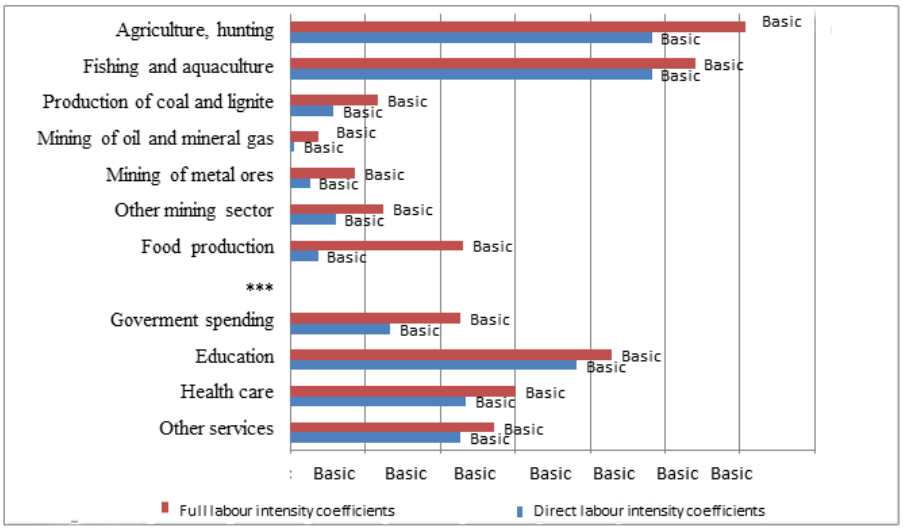

Fig.5 Diagrams of the values of direct and full labour intensity, defined on the basis of the table of interindustry balance of Kazakhstan for 2012.

The first three columns show the components of final demand, translated into jobs, and the fourth column reflects total results. Thus, we see that to cover final consumption, to have gross savings, and to attract export of the national economy we will require 6903.22, 1907.75 and 2227.89 thousand jobs, respectively. In general, the final demand (fourth column) can be satisfied if Kazakhstan will have more than 11 million jobs. Since supply of the country's economy, according to the data of interindustry balance of 2012, is amounted to just $tX = 8507000$ jobs in total, then to cover the final demand of the economy additional capacity will be fully required, which must be repaid by import financing of foreign goods (the fifth column).

In general, as we can see from the sixth column, Kazakhstan's jobs defined on the basis of labour intensity of product in calculation equal to 1 million tenge worth gross output (by economic activity) significantly deviated from the jobs defined on the basis of full labour intensity (Y). However, their ratio (direct labour intensity - 0,177 jobs, full - 0.298) in terms of the national economy is equal to the ratio of scientific and technological excellence of real sector of the country, because we have the equation:

$$c = \frac{t}{T} = \frac{L}{X} + \frac{L}{Y} = \frac{Y}{X} \tag{9}$$

Index value of the level of scientific and technological excellence of real sector of the country for Kazakhstan is 0.587. This equation (9) of market equilibrium of levels of production, employment, incomes and prices in man terms is based on the balance of aggregate demand and aggregate supply.

Final demand in the economy of the country is generally determined by total costs of final consumption of households ($Y1$), general government costs ($Y2$), non-profit organizations ($Y3$), changes in inventories ($Y4$), purchase minus retirement of valuables ($Y5$), gross saving of fixed capital ($Y6$) and export ($Y7$).

$$\text{Final demand} = Y1 + Y2 + Y3 + Y4 + Y5 + Y6 + Y7$$

An aggregate supply, which is used to cover it, is defined as total of final demand and import with a minus sign ($-Y8$):

$$\text{Final product} = \sum Yi - Y8$$

Thus, market equilibrium of levels of production, employment, incomes and prices is carried out by all agents of production, exchange, distribution and consumption. For example, to measure performance of the economy in working time we have the results of final demand in Kazakhstan: 11,005,000 people. (8.505 million of which is covered by human resources within the country, and 2.5 million - beyond the country). Volumes of aggregate demand and aggregate supply are balanced, and they are equal to the work of 11,005,000 people, while direct labour intensity of products for production of 1 million tenge worth gross products in Kazakhstan in 2012 amounted to 177 people, and full labour intensity - 298 people.

This equilibrium in formula (9) is defined in current prices and it expresses a market equilibrium. To assess the level of economic development of the country comparison base in comparable prices or quantum indexes should be determined based on this level. Since nominal GDP (NGDP) is monetary terms of the final product and is defined in prices of this year, then, multiplying both sides of a well-known equation of GDP deflator: $NGDP = b * RGDP$ by purchasing power (pp), real value of the final product (Q) can be defined, which corresponds to the balance of supply and demand in the country:

$$\begin{aligned} &Q = pp * NGDP = c * RGDP, \\ &where \;\; c = pp * pb = \frac{RGDP}{X} * \frac{NGDP}{RGDP} = \frac{RGDP}{X} \end{aligned} \tag{10}$$

The main indicator of equation (10) is an indicator of scientific and technological progress (STP) - c. Its multiplication by real GDP is identical to multiplication of nominal GDP with purchasing power. It turns out that STP's contribution helped to divide GDP deflator into two indicators. One of them

is purchasing power, the other is coefficient of scientific technological progress itself. As a result, the formula (10) balances the final product both in terms of money and terms of commodity. It is developed by generalizing and developing the equation of exchange of monetarists, which do not contradict its structure principles, but there are variables that are also represented by purchasing power and an STP index at real GDP. It means that the cost of the final product is equal to the nominal value of the product, i.e.Q = pp*NGDP. Therefore, multiplying both sides of equation $NGDP = pb * RGDP$ by purchasing power, a balance between nominal and real GDP can be set with weighing coefficient pp and c, respectively:

$$\text{pp} * \text{NGDP} = \text{c} * \text{RGDP} \tag{11}$$

It explains the viability of creative formula of scientific and technological progress:

$$\frac{\dot{c}}{c} = \frac{\dot{Y}}{Y} - \frac{\dot{X}}{X} \tag{12}$$

Rapid change of STP coefficient in equation (12) depends on difference in speed of the final product and gross output.

Let us assume that principle of using direct and full labour intensity to determine technical and technological excellence of the national economy is applied in the countries all over the world, which have developed foreign economic relations. Then value of the dollar, euro, Kazakhstani tenge and other currencies will be established according to the level of economic development within the state itself and its foreign relations. In this case, assessment principle of STP level deviations between the countries can be preserved, and real exchange rates of the national currencies will be set in accordance with rules of SDR design. Such an approach can serve as an effective tool for building a methodology for sustainable development of the global economy: measured economy is managed economy.

In conclusion, it can be summarized that it is possible to construct an analytical model for managing a market economy. It can be built in labour terms using the principle of double regulation and the table “input-output”.

Thus, balances of commodity and cash flows on economic activity in labour terms are formed with imbalances:

$$t_i * X_i - T_i * Y_i = \pm\Theta_i$$

And at the level of the national economy of the state commodity and cash flows are always balanced:

$$\sum t_i * X_i - \sum T_i * Y_i = 0$$

where components of final demand are Y_i defined, and their total value is the final demand, which corresponds to the final product of the country.

Table 1 Balancing model of the labour market of Kazakhstan according to data of the interindustry balance of 2012 (piece).

Type of Activity	End product orientation gross output estimation							
	Final demand components			Final demand determined by quantity of workplaces necessary for final demand coverage, ths.people	Number of employed estimation for import mobilization, ths. people	Final product determined by quantity of workplaces necessary for final demand coverage, ths.people	Check of model (A): TY = tX	Estimation of labour market development through the economy sectors' scientific and technological progress coefficients (%)
	Number of employed estimation necessary for final consumption coverage, ths.people	Number of employed estimation necessary for gross accumulation requirement coverage, ths.people	Number of employed estimation for export mobilization, ths.people					
	T*Y1	T*Y2	T*Y3	T*Y =T*Y1+T*Y2+T*Y3	T*M	TY=TY+T*M	TY-tX	t/T=Y/X
Agriculture, hunting and sylviculture	1643.08	136.93	**297**	2077.47	**-388**	1689.93	-466.6	62.2
Fishery and aquaculture	17.62	0.46	**0.2**	18.3	**-1**	17.75	1.6	98.3
Coal and lignite production	32.16	-0.24	**24**	55.65	**-1**	54.55	16.2	69.7
Crude and natural gas production, technical services in the field of mining industry	0.5	18.79	**534**	553.43	**-34**	519.69	428.5	74.1
Metal ores production	0	14.91	**84**	99.3	**-18**	81.11	3.3	31.9
***								
Activity in the field of administrative and supportive services	49.76	0	**8**	57.4	**-28**	29.87	-144.3	11.9
State management and defense; statutory social security	649.61	0	**24**	674.11	**-18**	656.01	270.2	100
Education	998.41	0	**0**	998.41	**0**	998.41	106.3	99.6
Health care and social services	519.14	0	**0**	519.14	**0**	519.14	105.3	97.8
Other types of services	391.87	9.87	**0**	401.86	**-5**	396.85	44.6	93.8
Total, ths.people	6903.22	1907.75	2227.89	11038.86	-2531.66	8507.2	0	**58.7**

These balance equations fully meet the conditions of globalization of the world economy and can be used to ensure market equilibrium of the levels of production, employment, incomes and prices anywhere in the world. The construction of an analytical model of market forces for development of real sector and financial system based on parity of their autonomous and parallel operation is the final result of this study.

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