ELASTICITY OF AGRICULTURAL LABOUR MARKET – THE CASE OF ZRENJANIN DISTRICT[1]

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Abstract

Agriculture in Serbia is the economic branch which has best coped with the long-term recession as of 2008. However, number of persons being employed in it was stagnating, or even diminishing. In this paper the authors have set a goal to find out if it is possible to determine how, and in what extent the elasticity in labour market in district of Zrenjanin has had an impact on shifts in its labour market. By the means of using all available statistical data, and its interpretation they are giving the overview of the resources for agriculture in Zrenjanin. Moreover by using the regression we have shown how the equilibrium in labour market was shifting in all quartiles in the period 2010-2012. We have found that agricultural labour market in Zrenjanin is inelastic in short term, but in the long run it is getting elastic, as well as that demand side is more elastic and flexible to changes in the environment.

Key words: *agricultural sector, employment elasticity, labour market*

Introduction

Modern agricultural business needs to adapt to changes on the global market in order to become more competitive. According to Zubović et al. (2009) "Efforts to increase productivity include innovations on four levels which are policy, institutional, program and household… At institutional level, it is necessary to provide better fit between the supply of trained workforce and a demand that is constantly changing". Rivera and Alex (2002) note that it is flexible approach that is needed for occupational profile of trainees in agriculture. At the same Marshall (2011) points out

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that time firms and individuals have only two basic choices in increasing competitiveness: lower costs, mainly wages; or increased value added over increased human capital. As noted in previous section, low cost of wages is already available, so it is necessary to focus on increase of human capital value. Moreover, increase of productivity based on low wages, is not sustainable in the long term.

Improved productivity and increased levels of production in agriculture is a tool to overcome the challenging effects of the economic crisis. At the same time greater liberalization dictate a need for greater capacity on the part of the agriculture workforce and rapid increase of productivity.

In this paper authors aim to determine what capacity for agricultural development of Zrenjanin district exist, by focusing on elasticity of labour market, and its capability to adapt to new market trends. The paper is divided in five sections. After introduction the research methodology will be presented. It is followed by the overview of Zrenjanin district and its capacities for rural development. Further on we present descriptive statistics on the labour market trends in the district. Discussion on the findings is the next section which is followed by conclusions and recommendations.

Methodological aspects

In our analysis we are using several basic economic models. At first we will try to discover what the market trends are in respect to equilibrium on the labour market in Zrenjanin. Further on, it is necessary to decompose those trends and to find what the elasticity of supply and demand side is. A key question in respect to elastic for any market is how the level of demand for its product will change in response to a price change. Labour markets are also under the impact of the same economic law. A 5 per cent decrease in wages should attract more job openings from farmers, but, this increase in number of jobs may or may not be followed by sufficient aggregate income growth to compensate for decreased wages. Total revenue could either rise or fall depending on how big the increase in demand on the market is in relation to the size of the price. The impact of such circumstances reflects promptly on the labour market. A wage cut will increase revenue only if demand is elastic and a wage rise can only raise total revenue if demand is inelastic. The elasticity of demand may be presented by the formula:

$$e = \frac{\Delta Q}{\Delta P} \qquad 1)$$

The price elasticity of supply is the percentage change in the quantity of labour supplied divided by the percentage change in its cost. However, the question arises as to whether price and demand changes ought to be measured as a percentage of their initial value or as a percentage of their final value. To avoid confusion, and inconsistency in measuring elasticity, the average of the initial and final price or quantity demanded can be used as the basis for calculating the degree of price elasticity of demand. The formula is:

$$e = \frac{\Delta Q}{(Q1+Q2)/2} \Big/ \frac{\Delta P}{(P1+P2)/2} \qquad 2)$$

where P1 and Q1 denote the old cost and quantity and where P2 and Q2 represent the new cost and quantity.

When the elasticity of demand, or supply, is greater than 1.0, that demand or supply is said to be elastic. A ratio of less than 1 indicates that demand, or supply, is inelastic. Elasticity will be zero if the quantity demanded or supplied does not change at all when price changes. The greater the elasticity, the bigger the percentage change in quantity demanded for a given percentage change in price. A summary of price elasticity patterns is given in Table 1.

Table 1. *Degrees of own-price elasticity of demand*

Value Of Elasticity	Interpretation	Type
e = 0	Quantity demanded does not change at all in response to price changes.	Perfectly inelastic
0>e>(-)1	Quantity changes by a smaller amount than price.	Relatively inelastic
e = (-)1	Quantity changes by the same amount as price.	Unitary elasticity
(-)1>e>(-)∞	Quantity changes by a larger amount than price.	Relatively elastic
e = (-)∞	Consumers will purchase all they can at a particular price but none at higher price.	Perfectly elastic

By using the formula for elasticity, in our research we will determine the level of elasticity of the labour market equilibriums in Zrenjanin in order to determine its impact on the level of unemployment. Moreover we will explore on the impact of demand and supply side in the agricultural labour market on estimated elasticity.

Agricultural resources

Zrenjanin belongs to Central Banat County, which is covering an area of 1,326 km^2 which is the second largest local government in the Republic of Serbia. It includes 4 districts, namely Zrenjanin, Zitiste, Nova Crnja and Novi Becej. Area of Zrenjanin is extremely flat area with mostly agricultural land which occupies 83.56% of its territory. Average elevation of Zrenjanin is 80 meters, with no significant variations.

Human Resources

Population trends in the period 1948-1981, indicate a tendency of slight increase in the total population. In the census of 1948 there were 100,371 inhabitants. From this period until the eighties, the population had risen to 139,300. In the city of Zrenjanin today there is 122,714 inhabitants (11.91% less than in 1981), with three consecutive last decades of drop in population size (Table 2).

Table 2. *Trends in population of Zrenjanin (1971-2011)*

Year	Population	Change in population %
1953	102.844	2,46
1961	115.692	12,49
1971	129.837	12,23
1981	139.300	7,29
1991	134.252	-3,62
2002	132.051	-1,64
2011	122.714	-7,07

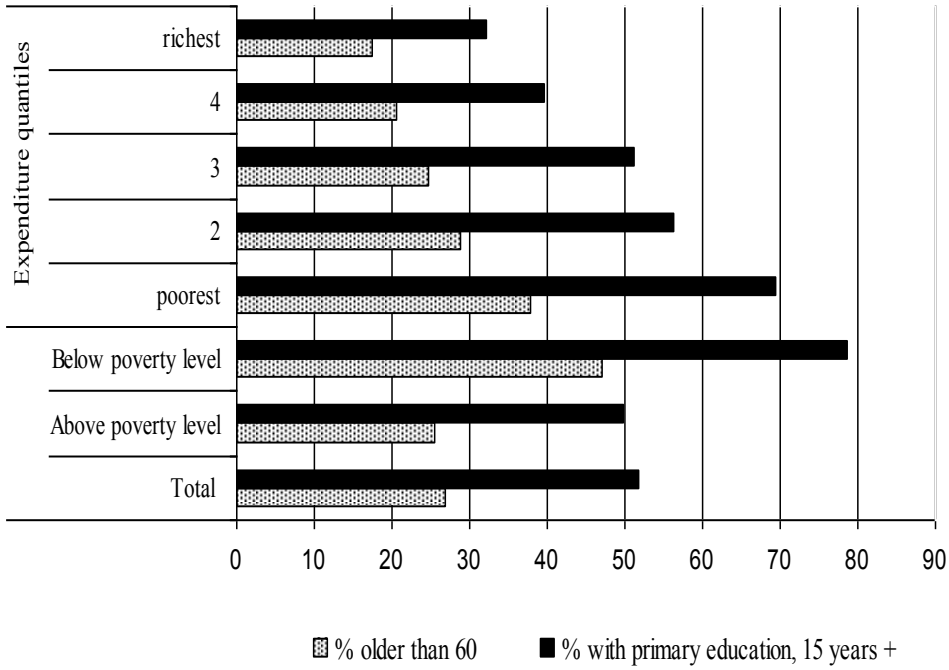
Source: *Statistical office of Republic of Serbia*

Trend of the demographic development in the period 1991-2002 was negative, and the natural growth rate was at the rate of -5.08 ‰. Natural shifts of the population according to the data is negative - characterized by low birth rate of 9.52 ‰ and a high rate of overall mortality of 14.61 ‰. The average life expectancy for men is 68 and for women 74.

As recorder in 2011 census of population, nearly half of Serbian population is living in rural areas. Compared to previous censuses younger population is moving from rural to urban areas. In graph 1 we can see the level of human capital amongst rural population.

It is visible that population belonging to lower level expenditure quintiles are mostly older than 60 years of age and have only primary education or less. This proves the necessity of making efforts to increase education level, especially training and lifelong learning for adult population.

Graph 1. *Human potential of rural families, by expenditure quintiles*



Source: *Serbian Statistical Office (2008, pg. 145)*

Migrations

After World War II, Zrenjanin has experienced an economic boom and became one of the most developed urban centres in the former Yugoslavia. Until the eighties, it recorded strong inflow of population from rural areas to the city, which led to significant changes in the social, educational and ethnic composition of the population.

However, after the eighties, there came a gradual decrease in the population, especially in rural areas. Derelict network of local and regional roads, water supply problems, rising unemployment, weak economic activity and many other factors have brought natural decrease in the population and the migration of rural population to urban areas.

Age and gender structure

According to the data of 2002 census, the population of the city was elderly, with only 15.12% of the population under the age of 15, and 35.07% of the population older than 50. Male population was 63,788 and female 68,263 which comprised 52% of the total population. In all age cohorts up to 39, male are dominant. In the cohort of 49-59 there is equal number, as long in all other age groups, women's participation is greater. The largest population is in the age cohort 45-49 (8.6%).

According to the official statistics in 2010, the declining trend continues, with population under 15 representing only 14.78% of total. Working age population 15-64 included a total of 86,473 people (70.5%). Only 22.9% of the population is fertile (15-49 years old). According to 2002 census, most of the active population was engaged in manufacturing and agriculture which represented 47.6% of total active population

Rural resources

The most important natural resource in Zrenjanin is agricultural land which covers an area of 110,881 hectares, occupying 83.56% of the territory of the city. In addition to arable land, the city has other resources necessary for rural development which include: desirable natural and climatic conditions for the production of a fertile soil, favourable geographical location, tradition, skilled and non-expensive labour force, developed scientific research institutions and the existence of processing capacity and substantial agricultural budget at the local level. Area of the city of Zrenjanin is very plain and the most densely river and canal hub in Europe, where within 30 kilometres of city centre there exist four rivers - Bega, Tamis, Tisa and Danube as well as canal network DTD.

Agricultural production is intensive by the land use (a little participation orchards and vineyards), and by the structure of agricultural production (high share of cereals and industrial crops). According to the RAH (2011) 47.97% of the total area was used for agriculture (Table 3) most of which is devoted for production of cereals - 67.28% of the total arable land. Second largest share was in production of industrial crops (20.51%), while the share of orchards and vineyards is at a very low level (0.27%) as well as and the production of vegetables (1.20%).

Given the very low share of fruits and vegetables in agriculture of Zrenjanin, the development could be aimed at creating the conditions for better use of natural resources (especially water resources), which would encourage the intensification of the production structure by better use of human resources.

Table 3. *Use of arable land by family farms in Zrenjanin (2011)*

Area (ha)	132,698.00
Land used (ha)	60,815.54
Cereals (ha)	40,445.05
Industrial crops (ha)	12,633.30
Fodder crops (ha)	1,694.24
Vegetables (ha)	762.59
Fruits and Grapes (ha)	174.26
Aromatic and Medicinal Plants (ha)	21.99
Planting material and horticulture (ha)	20.17
Fallow land (ha)	2,333.00
Other land	2,748.52

Source: *RAH (2011)*

According to the RAH (2011) the city of Zrenjanin in the Registry employs a total of 6,676 farms (6,621 family farms, 55 companies and cooperatives) with a total registered area of 86,612 hectares, out of which 60,816 hectares were cultivated in family farms and 25.796 by companies and cooperatives. Average size of agricultural holdings is 12.97 ha, which is three times more than the Serbian average of 4.34 ha.

Having all the above in mind it is certain that Zrenjanin district has all necessary resources for sustainable agricultural production. It is necessary to have an overview on the shifts in the labour market in order to foresee what might happen in the future.

Empirical data on Zrenjanin labour market

In spite of decreasing population of the Zrenjanin district it was to expect that there might by present a trend of diminishing unemployment. However, the size of decrease of over 20% (Table 4) is significantly above the volume of depopulation which equalled just above 7% (Table 2) in the period of ten years. Decrease in unemployment is even more emphasized for female population which was reduced by 28% in the period of three years.

Table 4. *Quarterly distribution of unemployed persons by level of education and gender (2010-2012)*

Edu.	G.	mar.10	jun.10	sep.10	dec.10	mar.11	jun.11	sep.11	dec.11	mar.12	jun.12	sep.12	dec.12
All	T	13143	12364	11247	11717	12673	12462	12018	11078	11034	10393	10106	10130
	F	6830	6340	5880	6061	6266	6186	6106	5696	5577	5251	4951	4871
I	T	4418	4082	3752	3928	4192	4094	3901	3536	3469	3279	3085	2998
	F	2373	2183	1980	2070	2153	2080	2005	1813	1739	1635	1545	1440
II	T	209	192	169	169	182	177	170	152	145	143	142	172
	F	83	60	55	56	55	54	60	48	46	48	43	54
III	T	3759	3577	3105	3158	3583	3443	3242	2914	2950	2830	2765	2785
	F	1467	1363	1257	1210	1244	1227	1174	1095	1070	1014	914	908
IV	T	3323	3120	2886	2947	3146	3182	3151	2880	2858	2626	2612	2594
	F	2090	1962	1838	1876	1934	1930	1943	1795	1761	1657	1574	1548
V	T	113	107	91	95	98	97	83	72	78	69	65	60
	F	24	27	28	25	24	29	26	19	21	19	14	16
VI	T	663	623	575	659	684	695	681	680	691	621	606	639
	F	402	364	350	399	413	433	442	428	435	382	367	397
VII-1	T	645	648	656	741	768	758	776	831	826	814	820	873
	F	387	376	367	417	435	427	451	495	497	490	488	504
VII-2	T	13	14	13	20	20	16	14	13	15	10	10	8
	F	4	4	5	8	8	6	5	3	8	6	6	4
VIII	T	0	1	0	0	0	0	0	0	2	1	1	1
	F	0	1	0	0	0	0	0	0	0	0	0	0

Source: *National employment service, district of Zrenjanin*

If we look at different levels of education of unemployed persons, it is to see that there are significant differences in the trends among them. Only one cohort had increase in unemployment level, namely persons with tertiary education, which are mostly not involved with agriculture. Focusing on agriculture, table 5 presents data on unemployed persons registered at local NES during the period of 2010-2012, by occupations groups important for agriculture and food processing.

Table 5. *Quarterly unemployment in the occupation group Agriculture, food production and processing by gender (2010-2012)*

Occupation	G.	mar.10	jun.10	sep.10	dec.10	mar.11	jun.11	sep.11	dec.11	mar.12	jun.12	sep.12	dec.12
Total	T	1.236	1.138	1.043	1.044	1.118	1.150	1.128	1.002	999	963	969	995
	F	780	697	636	640	657	672	665	602	585	573	550	546
Production of plants	T	419	409	395	381	420	436	415	359	399	371	348	371
	F	188	172	166	165	179	183	167	151	170	166	151	154
Livestock and poultry breeding	T	36	35	37	39	45	45	41	40	36	31	36	34
	F	21	18	19	20	22	24	22	22	19	14	17	16
Fishing and breeding of other animals	T	6	8	7	6	5	8	6	5	7	7	7	7
	F	2	3	3	2	1	3	3	4	4	4	3	3
Veterinaries	T	70	68	60	65	68	66	66	68	68	57	58	61
	F	38	35	29	33	31	32	32	31	32	29	28	21
Food and beverage processing	T	705	618	544	553	580	595	600	530	489	497	520	522
	F	531	469	419	420	424	430	441	394	360	360	351	352

Source: *NES, Zrenjanin*

From table 5 it is notable that decreasing trend explained in table 4 is also applicable for agricultural occupations. Moreover, there are emphasized positive trends for female population. However, if we look specifically on the trends of occupations directly related to agriculture, where we could exclude a subgroup of food and beverage processing, which belong to secondary sector, it is visible that decrease in unemployment is flatter and it accounts for around 15%. Therefore the supply curve on the labour market has a constant trend of shifting leftwards. In accordance to general economic laws it was to expect that the result would be increased cost of work, with a new equilibrium which would provide fewer jobs.

To complete the story of the labour market we need to give insight into employment data for the observed period in Zrenjanin (Table 6).

Table 6. *Population, employment and earnings trends in Zrenjanin (2010-2012)*

	mar.10	jun.10	sep.10	dec.10	mar.11	jun.11	sep.11	dec.11	mar.12	jun.12	sep.12	dec.12
Population	124.501	124.112	123.536	123.215	122.920	122.714	122.115	122.156	121.516	120.930	120.256	119.356
Total employment	29.372	29.115	28.818	28.923	29.184	29.012	28.534	28.346	28.654	29.011	29.012	28.954
Employment in agriculture	1.346	1.312	1.315	1.254	1.298	1.113	1.030	1.050	1.029	1.070	1.113	1.122
Real wage (RSD Dec.2009)	35904,9	31551,5	33215,8	35900,4	29171	31263,6	31713,1	36220	32010,5	30094,4	30346,2	32870,9
Wage in €	366,23	318,27	337,22	377,47	329,86	364,97	368,49	423,62	347,45	319,62	337,92	382,14

Source*: Own calculations based on data from Serbian Statistical office*

Having in mind that population in Zrenjanin is decreasing for over three decades, it is to expect growing number of elderly population, followed by increased share of pensioners. However in the observed period 2010-2012 there is only slight drop in overall employment by 2%, but in agricultural employment there has been registered significant decrease until 2012, with slow recovery afterwards. The real wages were decreasing over the whole observed period.

Table 7. *Average wages in Serbia (RSD, 2010-2012)*

	mar.10	jun.10	sep.10	dec.10	mar.11	jun.11	sep.11	dec.11	mar.12	jun.12	sep.12	dec.12
Total	33508	34161	34570	39580	35777	39322	38763	43887	40562	42335	40258	46923
Agri.	28978	29769	31444	34757	28912	31621	32603	36467	34252	36705	34979	40619
%	86,5%	87,1%	91,0%	87,8%	80,8%	80,4%	84,1%	83,1%	84,4%	86,7%	86,9%	86,6%

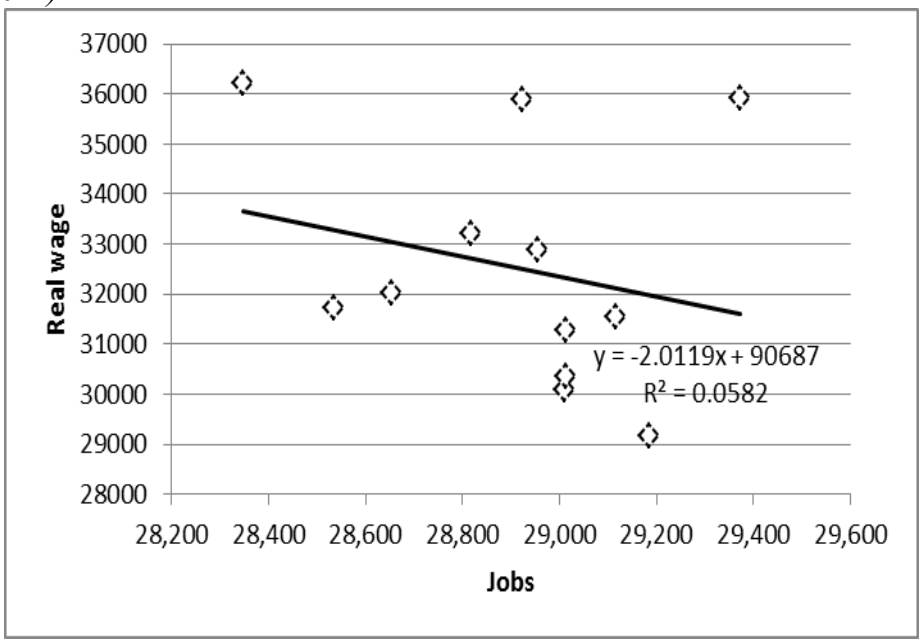
Source: *Serbian Statistical office, ZP11 report, several issues*

Since there is no data on the levels of wages in Zrenjanin district for persons being employed in Agricultural sectors, we may make estimation on its trends based on the relationship between wages in Serbia for total population and agricultural population (Table 7).

Discussion and conclusions

Having in mind the goal of the research, at first it is required to analyse supply and demand trends in labour market of Zrenjanin. Shifts in equilibrium on Zrenjanin Labour market in the observed period 2010-2012 are presented in graph 2.

Graph 2. *Equilibriums on Zrenjanin labour market (real RSD, 2010-2012)*



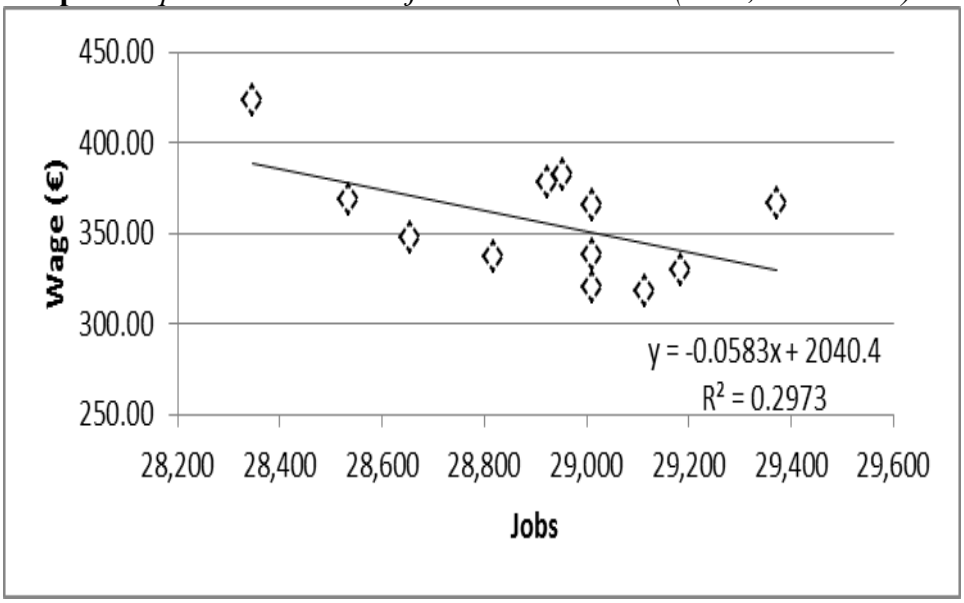
Source: *Authors calculations*

This graph shows that there might be possible extensive elasticity effects in the labour market of Zrenjanin, since the regression line shows very strong negative slope of the equilibrium curve for the observed period. This means that equilibrium real wage is strongly changing with the change of the number of employed persons. However R^2 is very low, and therefore we must not draw final conclusions from that observation. At the same time from table 6 we have seen that real average wage is decreasing in the district during the same period, which is unusual economic trend in the environment with decrease in employment and unemployment. Knowing that agricultural product are mostly sold on the prices set on the world markets, it is to conclude that it might be better to observer wages in € instead of local currency.

In that case, we have somewhat different trends (graph 3). Graph 3 shows that if we analyse the equilibrium by using wages values in euros, we will get more reliable regression formula, with R^2 being significantly higher. In this graph we have the expected slope of the curve, which is again negatively sloped, but with a milder angle.

This may be explained with the fact that unlike with real wages expressed in RSD, when using euro levels, the wages are not decreasing, but the opposite, the have upward trends as seen in table 6. From the economic point of view, that is quite expected knowing that equilibrium number of jobs has been reduced.

Graph 3. *Equilibriums on Zrenjanin labour market (Euro, 2010-2012)*



Source: *Authors calculations*

From this point on we may focus on agriculture. By using data from table 6 and 7 we are able to estimate wages in agriculture in Zrenjanin district, as well as to resemble the number of employed and unemployed persons in that occupation (Table 8).

Data from NES Zrenjanin is telling that there are only few unoccupied job openings for the whole observed period, and therefore we may summarize total supply on the labour market as unemployed plus employed persons, and demand may be equalled to employed persons.

Table 8. *Agricultural labour market in Zrenjanin (2010-2012)*

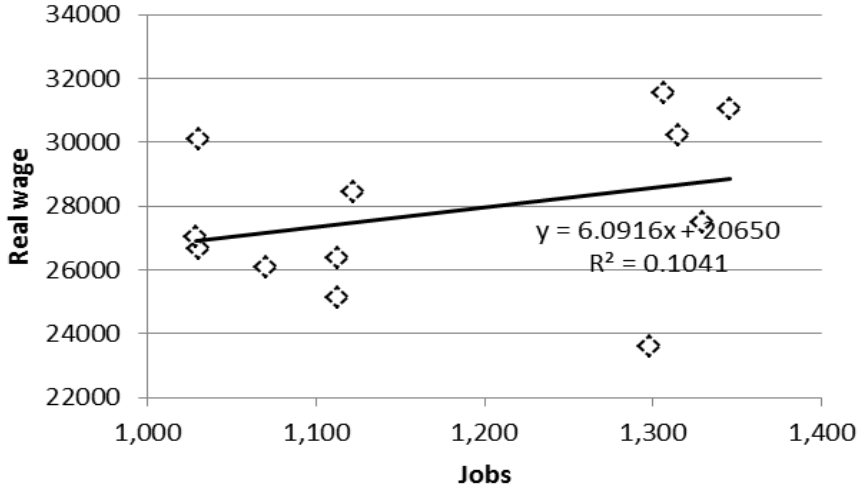
	mar.10	jun.10	sep.10	dec.10	mar.11	jun.11	sep.11	dec.11	mar.12	jun.12	sep.12	dec.12
Employed	1.346	1.312	1.315	1.254	1.298	1.113	1.030	1.050	1.029	1.070	1.113	1.122
Unemployed	1.236	1.138	1.043	1.044	1.118	1.150	1.128	1.002	999	963	969	995
Supply	2.582	2.450	2.358	2.298	2.416	2.263	2.158	2.052	2.028	2.033	2.082	2.117
Real wages (Dec.2009)	310509	27495	302122	315257	235735	251408	266735	300963	270308	260923	26367	284548
Wage (€)	316,719	277,352	306,726	331,471	266,569	293,493	309,928	352,001	293,4	277,118	293,611	330,801

Source: *Table 5, 6, 7*

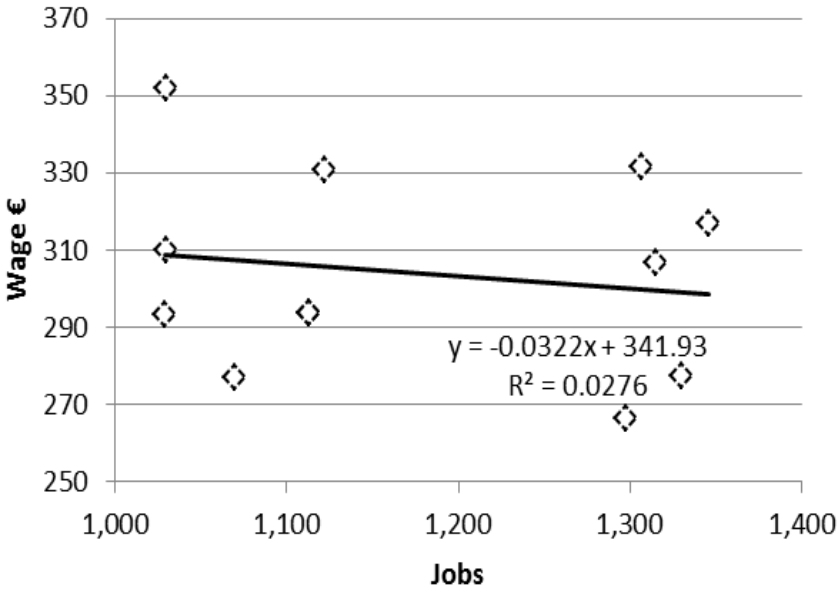
Similarly to the principle used for obtaining graphs 2 and 3, we may generate trends in agricultural labour market in Zrenjanin (Graph 4 and 5).

Unlike in total labour market in Zrenjanin, regression of equilibriums is showing weak R^2 scores. However it is notable that there is large difference in slopes in respect to the currency used for calculations, where RSD is shoing positive and Euro negative direction of relation. Form the basic economic principles, we know that the slope should be negative, therefore for the further calculations we will use wages in Euros as a variable influencing the trends in its labour markets.

Graph 3. *Equilibriums on agricultural labour market (RSD, 2010-2012)*



Graph 4. *Equilibriums on agricultural labour market (Euro, 2010-2012)*



Source: *Own calculations on table 8*

Since the equilibrium prices as well as shifts in supply and demand have shown some aspects which may cause variations in labour markets, we have now to focus on elasticity in order to get more precise justification. By applying formula (2) let us calculate elasticity of the agricultural labour market in Zrenjanin (table 9).

Table 9. *Trends in labour market elasticity for 3 months periods*

Period	apr-jun 10	jul-sep.10	oct-dec.10	jan-mar.11	apr-jun.11	jul-sep.11	oct-dec.11	jan-mar.12	apr-jun.12	jul-sep.12	oct-dec.12
Elasticity	0,13	0,02	-0,41	-0,11	-1,04	-0,94	0,10	0,07	-0,46	0,46	0,05

Elasticity for all but one of the 3 months periods is lower than 1 (in absolute values) which uncovers that the market is inelastic in the short run. However, for the whole period of 3 years elasticity is higher, e = - 2.87 which implies that there exists long term elasticity in the market. That means that market is still underdeveloped and inflexible in the short run, but over the period of 3 years it is able to cope with changes in the environment.

Finally it is necessary to try to determine which side in the labour market is more elastic. From table 8, it is clear that both supply and demand are decreasing in average over the observed period, but showing slight recovery in 2012. Supply side has shown much stronger negative trends. Therefore, in accordance to general economic principle, we may note that both supply and demand curve are shifting leftwards until 2012, and then shifting rightwards thereof after. In table 10 we present changes in demand and supply, as well as elasticity for all quartiles of the observed period. It is to note that wherever changes in demand are higher than changes in supply, elasticity is higher. That means that elasticity of demand curve is greater than the elasticity of supply curve.

Table 10. *Changes in elasticity, demand and supply for 3 months periods*

	apr-jun 10	**jul-sep.10**	**oct-dec.10**	**jan-mar.11**	**apr-jun.11**	**jul-sep.11**	**oct-dec.11**	**jan-mar.12**	**apr-jun.12**	**jul-sep.12**	**oct-dec.12**	**Total**
Elasticity	0,13	0,02	-0,41	-0,11	-1,04	-0,94	0,10	0,07	-0,46	0,46	0,05	-2,87
Change in demand	-1,2%	-1,1%	-0,6%	-0,7%	-14,3%	-7,5%	0,0%	-0,1%	4,0%	4,0%	0,8%	-16,6%
Change in supply	-4,4%	-4,5%	-0,3%	2,8%	-6,3%	-4,6%	-5,8%	-0,2%	1,3%	1,3%	1,7%	-19,5%

Having in mind all of the above, we have concluded that demand side in agricultural labour market in Zrenjanin is more elastic, which means that it is reacting more to changes in the wages, as well as to some other variables that might be affecting shifts in the market. Moreover it is to say that smaller elasticity of supply implies to possible under-education of participants in the labour market, and their no flexibility to accept changes in the wider economy.

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