Labour adjustment in agriculture: Assessing the heterogeneity across transition countries

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ABSTRACT

A standard model of labour adjustment in times of economic transition assumes a constant impact of variables like sectoral income differences, unemployment or the relative size of the agricultural sector. This paper shows for a panel of 29 European and Asian transition countries that the standard model fails to take the heterogeneity of determinants of sectoral labour adjustment properly into account. A random coefficients model reveals quite heterogeneous influences of the intersectoral income ratio, the relative size of agricultural employment, the unemployment rate, and the general level of economic development on a measure of sectoral labour adjustment across transition countries. Moreover, for selected determinants the estimated coefficients show opposing signs.

INTRODUCTION

Former socialist economies underwent tremendous changes since the start of the economic reforms. In most of these countries, agriculture was collectivized and intersectoral movement of labour was more or less restricted before the break-up of the economic planning system. Economic reforms implied decollectivization, privatization of land and productive assets, adjustment of relative prices and liberalization of labour markets. However, the speed and degree of reforms' implementation varied widely between the different countries. Rozelle and Swinnen (2004) provide a comparison of the reform process and its outcome across several transition countries' agricultural sector.

One striking observation is the significant divergence in agricultural labour productivity and agricultural labour use over the post-reform period. Whereas most Central European and East Asian countries experienced an increase of labour productivity after the first reforms, the drop in productivity is highest for Transcaucasian and Central Asian countries. The adjustment if agricultural labour to new economic conditions seems to take different paths and to proceed at different speeds.

Determinants of intersectoral labour adjustment from a macro-economic perspective are extensively discussed and summarized by Larson and Mundlak (1997) as well as Bojnec and Dries (2005). In line with traditional theories of migration, like Todaro's (1969) seminal work, the authors mentioned highlight the differences in (expected future) incomes as the dominating force of labour adjustment away from agriculture. A number of empirical findings support these hypotheses. Butzer et al. (2002, 2003) show empirically that the income ratio between agricultural and non-agricultural sectors, the growth of non-agricultural employment, and the unutilized capacity in non-agriculture are the main determinants of sectoral labour adjustment away from agriculture.

Focusing less on outside conditions and more on factors inside the agricultural sector, Swinnen et al. (2005) show that important drivers of labour outflow from agriculture are decreasing agricultural prices and any development which will increase the reservation wage of agricultural workers. Using the case of Polish macro-regions, Dries and Swinnen (2002) observe a highly significant reduction of agriculture's share in employment in relatively more developed regions. This effect is found to be even stronger in regions with a better infrastructure as well as for younger and better educated farm populations.

Although the importance of institutions like property rights on land, hard budget constraints, the framework for contract enforcement and access to capital is widely acknowledged in the theoretical literature, its quantitative assessment in econometric studies is still quite limited. Overarching and effective property rights on land are seen as necessary requirement to raise efficiency of agricultural production (Lerman et al., 2004, Swinnen, 1999). Applying a more formalized theoretical framework, Swinnen et al. (2005) conclude that an effective privatization of old-style corporate farms and the break-up into profit-maximizing private family farms will reduce the employed labour in agriculture. Furthermore, the reorganisation is expected to lower wages up to the equality with the value marginal product of labour. However, increasing labour efficiency might partially offset the latter effect.

Previous analyses implicitly assumed a homogenous impact of the various determinants mentioned above across the different countries. However, Swinnen et al. (2005) discover three patterns of agricultural labour adjustment based on the organizational transformation of agriculture:

1) A fast decline of agriculture's share in total employment together with a moderate increase in the share of individual farms in total agricultural land applies to the development in Estonia, Hungary and the Czech Republic.
2) Agricultural employment decreases slowly or even increases together with a high prevalence if individual farms applies to Poland, Romania, Lithuania, Latvia and Slovenia.
3) A limited change in agricultural employment combined with a minor share of individual farming, which characterises the situation in Russia and Ukraine.

A fourth pattern needs to be added: Mainly Central Asian countries show a fast and significant increase in agricultural employment since the onset of economic reforms.

The aim of this paper is to analyse the heterogeneity in determinants of the use of agricultural labour over the transition period. We quantify the change in agricultural labour use for transition countries in Central and Eastern Europe (CEE) as well as South East Asia. This measure is regressed on macroeconomic variables and indicators of the institutional environment. The paper's contribution to the literature is twofold. First, it goes beyond previous literature by including all European and Asian countries in transition. It compares, second, the different impact of the determinants of labour reallocation across the transition countries.

METHODOLOGY AND DESCRIPTION OF DATA

In pursuing the theoretical base introduced by Mundlak (1978) and developed further by Barkley (1990), sectoral labour adjustments can be analysed within a framework of occupational choice. Each individual is assumed to maximize an indirect utility function depending on personal characteristics, realised income or expected income in any other occupation, prices of consumption goods and costs of migration. The remaining life time utility of any individual can be derived by discounting the stream of utility for each occupation up to his retirement age. Usually expected earnings and switching costs enter the maximization as most important determinants of life time utility (Mundlak, 2000). At

a positive difference of the discounted indirect utility in any other occupation and the discounted indirect utility in agriculture a shift of occupation is expected to take place. Aggregating over individual decisions yields sectoral changes in labour force.

Under the assumption of an economy with two sectors, agriculture and non-agriculture, and a mutually exclusive character of occupations, aggregated shifts between sectors are defined as sectoral labour adjustment. The sectoral labour adjustment is calculated as the difference between growth rates of total labour and agricultural labour:

$$m = \frac{L_t - L_{t-1}}{L_{t-1}} - \frac{L_{At} - L_{At-1}}{L_{At-1}} = n - n_A \tag{1}$$

where n is the growth rate of total labour (L) and n_A designates the growth rate of agricultural labour (L_A). In the absence of migration, the natural growth rates of agricultural labour and total employment are assumed to be equal. A negative measure of labour adjustment represents a relatively higher growth of agricultural employment and vice versa. The measure has been suggested first by Mundlak (1978).

To calculate the measures of occupational migration, annual sectoral labour data are taken from World Bank (2010), FAO (2010), ILO (2010), and United Nations Economic Commission for Europe (2010) and are completed with information from national statistical yearbooks. Data are available for 30 transition countries from Europe and Asia.[1] Employment in agriculture refers to people who have their principle activity within agriculture, hunting, forestry and fishing.[2] The data covers up to 28 years with most of the countries starting in 1990. The following analysis concentrates on labour adjustment after the start of the first economic reforms up to 2008. Obviously, due to a different start of the transition period in China, Vietnam, and Europe, the resulting panel is unbalanced.

The main explanatory variable of sectoral labour adjustment is the income ratio between non-agricultural sectors and agriculture (*IR*). A measure of this income ratio is derived as the ratio of respective sectoral value-added per worker. The ratio of agricultural to non-agricultural labour force (*LR*) controls for the impact of the labour pool in agriculture as the sending sector. To approximate for a change of relative prices the ratio between the GDP deflators for agriculture and for the aggregated non-agricultural sector is interpreted as Terms of Trade (*TOT*). The unemployment rate (*Unemp*) reflects the uncertainty with respect to finding a new employment outside agriculture. However, as the national unemployment rate does not reflect sector-differentiated developments we further control for the unutilized capacity of the non-agricultural sector (*Uncap*). The highest real sectoral value added for each country is defined as the maximum capacity. Accordingly,

[1] The countries are: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, China, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Mongolia, Poland, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and Vietnam. Rozelle and Swinnen (2004) include additionally Laos and Myanmar, but explanatory data for them are lacking.

[2] The categories correspond to the major divisions A and B in the third revised version of the International Standard Industrial Classification (ISIC) and major division 1 in the second revision of the ISIC. Processing of agricultural products beyond levels required for primary markets, marketing through cooperatives and field preparation involving construction work like terracing are excluded from agricultural activities in the ISIC nomenclature.

the unutilized capacity is calculated as current output relative to the maximum. All sectoral production data are from the National Accounts Main Aggregates Database of the United Nations (2010). Finally, structural change in employment is expected to take place naturally induced by economic development (e.g. Chenery and Taylor, 1968; Raiser et al., 2004). Therefore, GDP per capita is included as explanatory variable (*GDPpc*) and expected to lead to a higher migration out of agriculture. Furthermore, this variable is thought to cover remaining unobserved characteristics that might affect sectoral labour adjustment.

Panel data estimators are applied to explain labour adjustment, y_{it}, explained by a vector of explanatory variables X_{it}, the unobserved country-specific variable υ_i and an error term ε:

$$y_{it} = \beta X_{it-1} + \upsilon_i + \varepsilon_{it} \quad (2)$$

To take a possible delay in individual occupational decision following changes of macroeconomic conditions into account, all explanatory variables enter the econometric model with their one-year lagged values (X_{it-1}). The so-called fixed-effects estimator (FEM) bases on the assumption of υ_i as a time-invariant country-specific constant. Parameters of the fixed-effects estimator are identified from within-country variation. Thus, parameters of variables of initial and institutional conditions without any variation over time could not be estimated in this framework (Baltagi, 2008). To sum up, the fixed-effects panel data estimator allows the constants to vary between the transition countries.[3]

The hypothesis of a constant coefficient β will be tested econometrically. In the case the hypothesis need to be rejected, a random-coefficient model will be estimated. Such a model allows the coefficient to vary across countries β_i.

RESULTS AND DISCUSSION

Table 1 displays the estimated coefficients of the two estimators. As suggested by theory, a growing sectoral income difference leads to a higher labour adjustment. Similarly, a higher ratio of agricultural to non-agricultural employment is associated with a higher rate of adjustment. However, both determinants together exert a counter balancing effect. The interaction term between the income ratio and labour ratio suggests a decreasing labour adjustment as one of the two variables is increasing. The net marginal effect evaluated at the respective sample means is 0.023 for the income ratio and 0.127 for the labour ratio. That is, a one standard deviation increase of the income ratio yields a 42 per cent of the standard deviation change of the dependent variable. The labour ratio is predicted to exert a stronger impact, a change by one standard deviation yields a 92 per cent change of the standard deviation change of the labour adjustment rate.

Furthermore, labour adjustment is predicted to slow down if unemployment is increasing. Quantitatively, the impact is with 62 per cent of the standard deviation in between the effect of the other two statistically significant variables. According to the results of the

[3] Alternatively, a random-effects estimator (REM) treats the variable υ_i as an additional country-specific error term. However, the Hausman test clearly favours the FEM.

fixed-effects model the terms of trade, the unutilized capacity and the GDP per capita have no statistically significant influence on the labour adjustment rate.

Table 1: Determinants of sectoral labour adjustment

	Fixed-effects model	Random coefficients model
Income ratio	0.04***	0.24
	(0.01)	(0.15)
Labour ratio	0.19***	1.83
	(0.05)	(1.72)
Income ratio x Labour ratio	-0.03***	-0.82
	(0.01)	(0.86)
Terms of trade	-0.05	-100.75
	(0.03)	(1646.10)
Unemployment rate	-0.62***	-0.25
	(0.19)	(0.70)
Unutilized capacity	0.003	-0.53
	(0.005)	(1.32)
GDP per capita	0.007	0.41
	(0.007)	(0.58)
Constant	0.98***	100.31
	(0.04)	(1646.11)
Observations/ Countries	442/ 29	463/ 28
R^2_{within}/ χ^2	0.12/ 8.07***	./ 6.90

Note: Standard errors in parentheses. FEM is estimated using the estimator suggested by Baltagi and Wu (1999) taking autocorrelation into account. Both estimators apply different transformations. Therefore, the number of observations and countries differs slightly. *** $p < 0.01$.

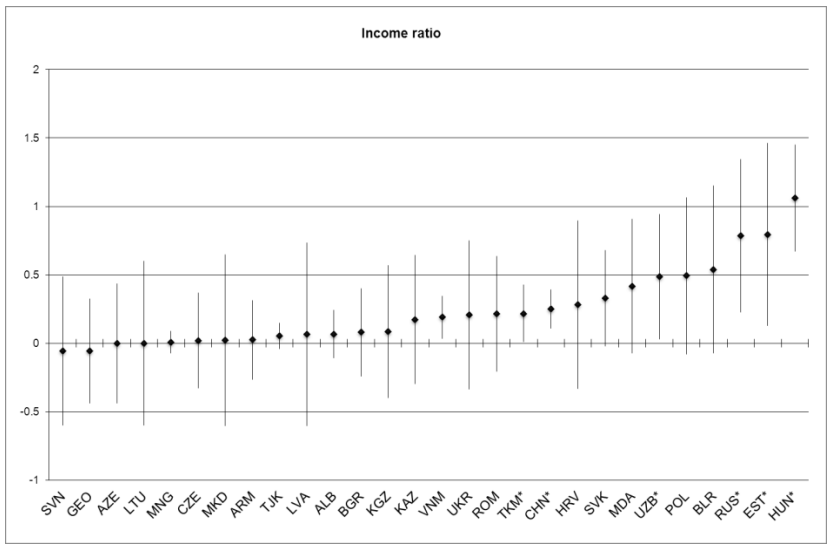
However, testing the assumption of homogeneous parameters results in a clear rejection of the hypothesis. That is, the impact of the determinants differs significantly across the sample of transition countries. The third column of Table 1 presents the estimated coefficients of the random coefficients model. Almost all coefficients are higher than those from the FEM, but statistically insignificant at conventional levels. To gain more insights into the heterogeneity the country-specific coefficients of selected explanatory variables are displayed together with the 95 per cent confidence interval in the following Figure 1.

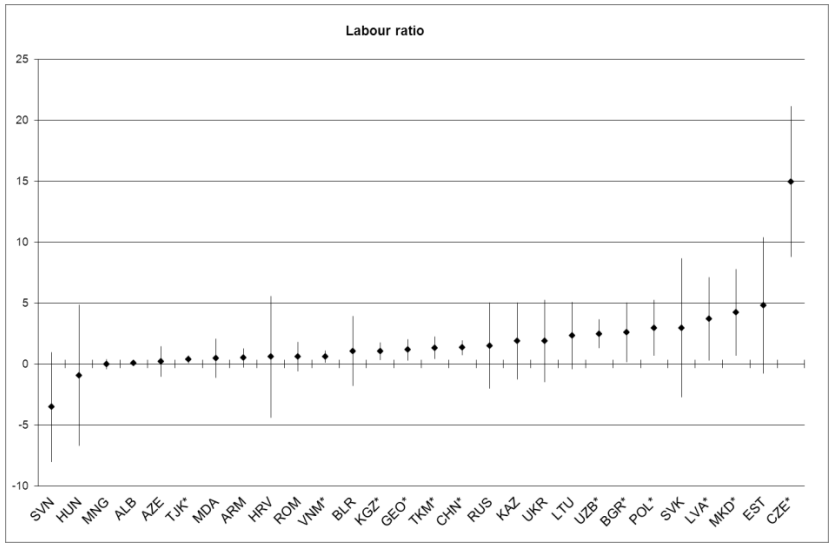
Clearly, the estimated coefficients vary over a wide range. Less than half of the countries in the sample show statistically significant coefficients. To take a few examples, in the case of China almost all estimated coefficients are statistically significant and point to a similar impact as the coefficients of the "average" model. A similar observation applies to Uzbekistan. For countries like Czech Republic, Estonia, Hungary, Kyrgyz Republic, Latvia, Poland, Russia, and Vietnam at least some of the estimated coefficients are statistically significant.

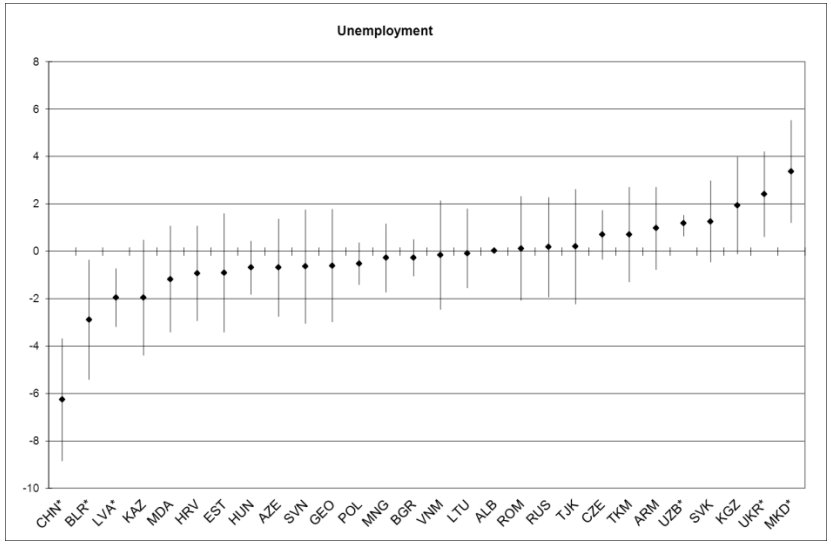
Surprisingly, the variables unemployment rate and GDP per capita seem to yield different effects depending on the country of analysis. Whereas sectoral labour adjustment is predicted to slow down with increasing unemployment in China, Belarus, and Latvia, the opposite conclusion can be derived for Uzbekistan, Ukraine and Macedonia. Putting it differently, in China, Belarus, and Latvia the agricultural sector functions as a labour buffer in times of increasing unemployment. This observation is in line with findings by Sorm and Terrell (2000) as well as Bernabè and Stampini (2009). A positive relation between agricultural labour adjustment and unemployment is less intuitive. The three countries, Macedonia, Ukraine, and Uzbekistan, are not explicit examples of a fast restructuring of the agricultural sector and dismantling of former collectives.

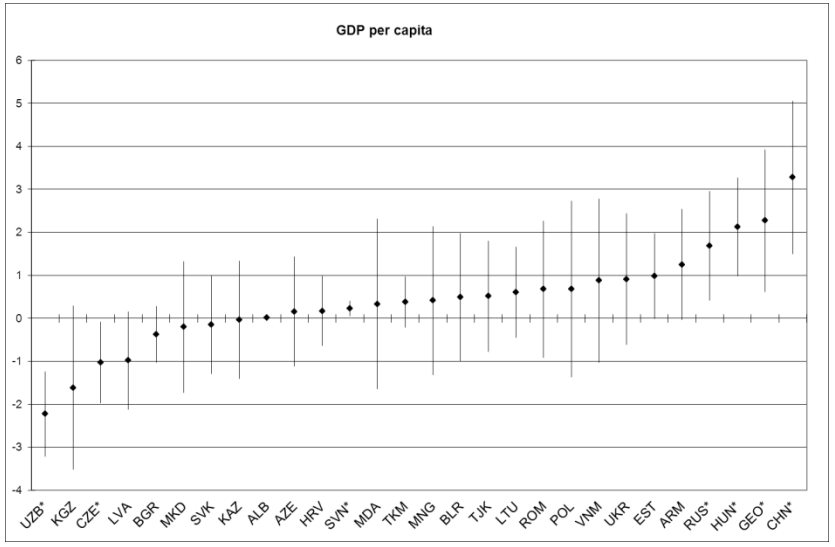
Turning to the impact of the level of economic development, the observed positive relation between GDP per capita and labour adjustment for countries like China, Georgia, Hungary, Russia , and Slovenia is in line with findings by Chenery and Taylor (1968) as well as Raiser et al. (2004). Nevertheless, for at least two countries, Uzbekistan and Czech Republic, the relation between GDP and labour adjustment is predicted to be negative. That is, at higher levels of GDP per capita employment in agriculture should increase. Due to a GDP per capita in Czech Republic which is almost six times higher than that of Uzbekistan, it is highly probable to find two different mechanisms at work here. A comparative assessment of the development within the two countries illustrates this. Whereas agriculture's share on GDP in nominal terms heavily fluctuates in Uzbekistan over the 1990s and even increased, it continuously decreased in the Czech Republic. At the same time, Czech agricultural employment dropped drastically over the very first years of economic transition and later on stabilised around an adjustment rate of 4 per cent of agricultural employment per year. The Uzbek agricultural sector experienced even an increase of agricultural labour over the first half of the 1990s.

Figure 1: Estimated group-specific coefficients and 95% confidence intervals of the random coefficients model









Note: * indicates statistical significance with a probability of at least 95%.

Conclusions

Estimating a fixed-effects panel data model using a sample of 29 transition countries over their post-reform period suggests a faster labour adjustment away from agriculture if the income ratio between non-agricultural and agricultural sectors is growing or the ratio of agricultural labour to non-agricultural labour is higher. Furthermore, a growing unemployment is predicted to slow down sectoral labour adjustment. However, an estimation of random coefficients model reveals a strong heterogeneity of the determinants of sectoral labour adjustment and rejects the hypothesis of constant slopes across transition countries. The majority of country-specific coefficients are not statistically significant. For some determinants the statistically significant coefficients show opposing signs, indicating a co-existence of different relationships for selected countries.

Our results challenge previous theories by Swinnen et al. (2005) which suggest common paths of labour adjustment for groups formed by the countries Czech Republic, Estonia, and Hungary as well as Romania, Lithuania, and Latvia and, finally, Russia and Ukraine. Following the determinants used in our analysis, we are not able to derive similar groups. We rather find very different countries sharing common slopes, which makes it difficult to derive common patterns.

Further research aims at elaborating more the characteristics of countries where the theoretical model holds and were not.

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