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DOES INDIVIDUALIZATION HELP PRODUCTIVITY OF TRANSITION AGRICULTURE?

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Abstract

There are large differences across transition countries with respect to agricultural-sector performance and corresponding scope of farm restructuring and shift to individual farming. In this paper we analyze the impact of individualization on productivity growth within an augmented neo-classical growth model framework. This approach allows us to circumvent criticisms on the grounds of lack of theoretical and objective criteria for inclusion of explanatory variables. Furthermore, in the empirical analysis using a panel data covering 15 transition countries over the period 1990-2001 and applying a GMM-IV estimator we are able to control for the impact of various factors and the potential endogeneity of variables. Our estimation results are robust and support the view that the shift to individual farming, as well as the overall economic reforms, have positively contributed to the productivity growth in agriculture during the first decade of transition.

Key words: agriculture, individual farming, productivity, economic transition, international integration
JEL classification: D20, L23, Q1

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DOES INDIVIDUALIZATION HELP PRODUCTIVITY OF TRANSITION AGRICULTURE?

1 Introduction

A current policy objective of the governments in transition countries is to increase productivity and growth. This objective is motivated by the process of integration into the European Union and the high competition faced in the global markets. Recent country assistance strategies and structural adjustment loans from the World Bank (e.g., World Bank, 2001a and 2001b) have pushed these governments to reduce subsidies and price interventions, and impose hard budget constraints by letting the private sector control production and marketing.

Economic reforms and enterprise restructuring have induced important output and productivity changes in the agricultural sectors of transition countries. However, there are large differences across countries with respect to productivity growth, measured as the growth of agricultural output per worker, and the corresponding scope of farm restructuring and shift to individual farming, defined as the share of country's total agricultural land (TAL) cultivated and/or managed individually.[1] For example, cumulative productivity growth, after ten years of reforms in Czech Republic is 70% with corresponding level of individualization at 26% (see table 1). While in Albania the individualization level is 90% but the cumulative productivity growth is only 10%, for the same period. Furthermore, in many countries there is even decline in agricultural productivity while individualization remained low. In Russia,

[1] The definition of individual farm is by no means uniform and uncontested, however, the individual-farm sectors across transition countries have one important feature in common – the management and use of farm resources is in individual hands. There is evidence that the individual farms are gradually differentiating into two distinct groups: private (family) farms and household plots. The private commercially oriented full-time individual farms may reach substantial size and are mostly responsible for the observed increase of the average size in the individual-farm sectors in transition countries. Alongside the large private farms are the numerous

for example, there is more than 30% cumulative decline of output per worker while the share of individual farming is only 13% and collective farms still dominate.[2] Thus it is not unambiguously clear from the raw statistical numbers if individualization helps productivity growth in agriculture.

- Table 1 -

There are only a few studies related to the impact of individualization on agricultural performance in transition countries. Macours and Swinnen (2000a, 2000b) and Lerman (2000, 2001) in their analyses of output and productivity changes in agriculture during transition find mixed evidence. Furthermore, there is an ongoing institutional debate concerning the effects of individualization as a policy for restructuring former socialist countries' agriculture. On the one hand, consultants and international institutions, such as the World Bank support individualization of agriculture as reform policy that leads to higher productivity by solving incentive and organizational problems of collective farms (e.g., Deininger, 1993, 1995; Lerman et al., 2002). On the other hand, a number of local policy makers are not convinced in the usefulness of the shift to individual farming and blame this policy for fragmentation and disorganization along the supply chain.[3] Therefore contributing to this important for agricultural reforms debate is timely and requires more thorough investigation. Clearly, shifting production from collective to individual farms merits

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household plots. For such households farming is mostly self-supply activity, and it takes place on a tiny scale. Further discussion related to individualization of production in transition agriculture is provided in section 2.

[2] Macours and Swinnen (2002) identify three patterns of transition countries' agricultural performance as measured by gross agricultural output (GAO) and agricultural labor productivity (ALP). Pattern I (CSH): a strong decline in GAO coincides with a strong increase in ALP. This is the pattern followed by Czech Republic, Slovakia and Hungary. Pattern II (RUB): a strong decline in GAO coincides with a strong decline in ALP. Russia, Ukraine and Belarus are typical examples, but also, e.g. Moldova, Kazakhstan, Kyrgyzstan, Azerbaijan and Tajikistan fit within this pattern. Pattern III (CVA): a strong increase in GAO coincides with an, albeit slower, increase in ALP. Examples are China, Viet Nam, and to certain extent, Albania.

[3] There is also a view that individualization of agricultural production leads to subsistence farming, which is seen as a survival strategy and usually associated with low productivity (e.g., Sarris et al., 1999; Kostov and Lingard, 2002).

attention also because it has much wider implications beyond agriculture, specifically for rural development, land use and the environment as a whole.

In this paper we analyze the impact of individualization on agricultural (labor) productivity growth using a neo-classical (Solow) growth model framework to specify tractable estimation equations.[4] The neo-classical growth model is a natural framework for analyzing productivity as it is derived from a production function and links productivity (output per worker) growth with capital accumulation, employment growth, and technological progress - the (Solow) residual of the regression. This approach allows us to circumvent criticisms on the grounds of lack of theoretical and objective criteria for inclusion of various explanatory variables (e.g., Durlauf and Quah, 1999; Brock and Durlauf, 2001). In particular, this criticism seems relevant for the transition growth analyses where the impact of major variables affecting growth such as investment, technological and institutional change is often not estimated or interpreted appropriately.

Furthermore, in the empirical analysis using a generalized method of moments with instrumental variables (GMM-IV) estimator and panel data covering 15 transition countries over the period 1990-2001 we are able to control for unobserved country-specific effects and endogeneity of the variables.[5] The panel data approach allows us to isolate the effect of capital and labor deepening on the one hand and technological and institutional changes on the other, in the process of transition. Our estimation results are robust to various assumptions and support the view that the shift to individual farming, together with

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[4] We use the neo-classical growth model framework, to impose structure and motivate the empirical analysis bearing in mind that the original neo-classical growth model is highly aggregative, at economy rather than sector level. We note, however, that rural sectors of most former socialist countries were quite large and isolated from the rest of the economy (e.g., Johnson and Brooks, 1983; Cook, 1992).

[5] All previous studies of agricultural sector performance apply pooled or cross-section regressions (Macours and Swinnen, 2000a, 2000b; Lerman, 2000, 2001). There are also several studies analyzing technical or total factor productivity across farm types but only in a few transition countries and again using cross-section survey data (e.g., Mathijs and Swinnen, 2001; Davidova et al., 2002; Gorton and Davidova, 2004).

advancement in general economic reforms, has positively contributed to the productivity growth in agriculture during the first decade of transition. This positive effect is a result of both resource reallocation and shift in the efficiency of production.

The reminder of the paper is organized as follows. In the next section an overview of agriculture in former socialist countries is presented and hypothesis for the impact of individualization as a transition policy derived. In section 3, the methodology and testing strategy are developed. Section 4 describes the data while section 5 reports estimation results and offers a discussion in the context of relevant previous research. Section 6 concludes.

2 The heritage of transition agriculture and hypothesis

Land reform and farm restructuring are important components of overall economic reforms because agriculture's share in the economies of the former socialist countries has traditionally been much higher than in the market economies. The former socialist countries were also more agrarian than non-socialist countries with comparable levels of income per capita. In the pre-transition decade of 1980s, the mean share of agriculture in GDP for former socialist countries was 21%, compared with 14% for non-socialist countries with similar per-capita income (Lerman et al., 2002).

A common trend in former socialist countries, pre-reform was that in the 1980s growth rates (of both GDP and agricultural output) were significantly lower compared with similar non-socialist countries. In fact this was a continuation of a trend that began in the 1960s; the annual growth rates of agricultural production in the USSR, for example, dropped from 4% in 1966-1970 to 1% in 1981-1985. This was a particularly alarming trend because investment in agriculture continued at relatively high and increasing levels; Soviet agriculture's share in total investment increased from 21% in 1966-1970 to 24% in 1981-

1985 (Cook, 1992; Lerman et al., 2002). New investments in agriculture were thus producing decreasing marginal returns and failed to sustain sectoral growth.

Economic growth in agriculture, as well as in the whole economy, was accomplished mainly through increasing the use of inputs and capital, and not through productivity increases (Ofer, 1987). Johnson and Brooks (1983) who analyze the technical efficiency of socialist agriculture using data for all fifteen republics of the USSR over 1960-1979 period show that the productivity level of socialist agriculture was substantially lower than that in market economies.[6] The partial productivity of agricultural land in former socialist countries, as measured by the gross output of agricultural products per hectare, was somewhat higher than the partial productivity of land in market economies. However, socialist and market economies' agriculture differed primarily in the productivity of agricultural labor. For instance, labor productivity was lower by a factor of ten or more in the USSR compared with the US and Canada. This low productivity of agricultural labor is clearly a reflection of the very high labor use.

The centrally planned environment was the main cause of inefficiency of socialist agriculture. It insulated the farms from market signals, imposed central targets as a substitute for consumer preferences, and allowed farms to function indefinitely under soft budget constraints without proper profit accountability (Kornai, 1986). Besides, efficiency was never an important objective in socialist agriculture; meeting production targets at any cost was the main priority. Yet the inefficiency of socialist agriculture also can be attributed to two "micro-level" factors, which sharply distinguished socialist agriculture from agriculture in market economies. These are the exceptionally large farm sizes and the collective organization of production (Lerman et al., 2002).

[6] The gap between productivity levels of the Soviet agriculture and agriculture in market economies reached 100%-150% depending on the particular estimation scheme used.

The strategy of agricultural transition in former socialist countries aimed to improve the efficiency and productivity of agriculture by replacing the institutional and organizational features of the command economy with attributes borrowed from the practice of market economies (Lerman, 1999).[7] The transition agenda formulated in the early 1990's envisaged a transformation from collective to more efficient individualized agriculture as the ultimate goal. It was asserted that individual farmers, once established as independent entities, would engage in land-market transactions and optimize the size of the holdings given their managerial skills and availability of resources (e.g., Binswanger et al., 1995; Deininger, 1995; Lerman, 1998; Mathijs and Swinnen, 1998). This process would lead to increase in efficiency and productivity, and ultimately result in growth of incomes.

Market economies are characterized by the predominance of individual (family) farms. The experience of transition countries shows that individualized agriculture is possible without land privatization, and land privatization does not necessarily create individual farms (Brooks, 1993; Rizov, 2001). Yet primarily because of differences in land allocation strategies – paper shares versus physical plots – the extent of individual farming in most of the CIS republics is substantially lower than in the Central and East European transition countries.[8]

The impact of individualization can be seen both at household level and at private (family) farm level. The household plot with average size less than a hectare, after enlargement, is mainly a source of food for the household, but 10%-20% of the output is sold for cash in local markets. The cash revenue from these sales augments the income of rural

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[7] Rizov (2003) offers a comparison of advantages and disadvantages of various production organizations in agriculture and suggests implications for agricultural transition in former socialist countries.

[8] On average, 16% of agricultural land is cultivated individually in household plots and private (family) farms across the CIS republics compared with 63% across the Central and East European transition countries (Lerman et al., 2002).

households and thus individual farming contributes altogether 40%-50% of the household budget (including produce consumed). Some households increase their plots even further by leasing additional land. Other households pool the land resources of the extended family to create relatively large holdings. Surveys show that the larger the plot, the greater is the surplus available for cash sales and the greater the contribution to household income. For example, in CIS republics, although the share of individual farming in land is relatively modest (about 16%), its contribution to agricultural production has been steadily increasing over time and now approaches 50% of total agricultural output (Lerman et al., 2002).

Private (family) farms are much bigger than household plots, often cultivating hundreds of hectares of land, with or without hired labor, and represent the ultimate individualization of agriculture. They, in most cases, are run by former farm-enterprise employees who have decided to leave the collective and face the risks and benefits of large scale individual production. The decision to start up a private farm is affected by individual's traits, which are determined, among other factors, by age, education, and skills as well as capital endowments (e.g., Rizov et al., 2001; Rizov and Swinnen, 2004).

Both the household plots and the private farms are characterized by individual farm operation that entails important incentive, efficiency, and resource allocation changes in agricultural production. These changes due to the individualization of land use and management certainly affect productivity of agricultural sector, in a major way. However, it has to be recognized that there also are potentially important differences in the efficiency of the small household plots and the larger private farms. The existing efficiency studies, at farm level, suggest moderate advantages of large private farms but results by and large are inconclusive with respect to comparisons across countries and vary with the definitions used.[9]

[9] See, e.g., Mathijs and Swinnen (2001), Mathijs and Vranken (2001), Davidova et al. (2002), and Gorton and Davidova (2004).

Our aggregate country-level data do not allow pursuing this issue further and therefore we treat the forms of individualization symmetrically.

The goal of this paper is to analyze the impact of the shift of land to individual farming (measured as a share of TAL) on the aggregate (labor) productivity growth in agriculture. The hypothesis is that individualization would positively influence agricultural productivity due to the higher efficiency of the individual (private) farm organization. Besides, individualization may also have an indirect effect on agricultural productivity growth resulting from more efficient reallocation of resources across farm organizations (and economic sectors). We test empirically this hypothesis in the next section within the augmented neo-classical growth model framework.

3 Theory and estimation methodology

The neo-classical growth model is a natural framework for our analysis given that it is derived from a production function (of a country) such that productivity (output per worker) is determined by the capital and labor growth rates and the parameters of technology.[10] By definition, productivity growth is equal to output growth less employment growth (Solow, 1956).[11] The underlying production function is: $Q=A(t)f(K,L)$, where Q is output and K and L are capital and labor, respectively. The multiplicative factor $A(t)$ measures the cumulative effect of productivity shifts over time. These shifts are generally affected by institutional environment and reforms besides the (exogenous) technological progress.

Solow (1957) defines shifts (technical change) in the production function as neutral if they leave marginal rates of substitution untouched but simply increase or decrease the output

[10] One can equally well consider the production function of an economic sector or a firm to derive a sectoral or firm growth model, respectively (see e.g., Hall, 1988 and Roeger, 1995).

attainable from given inputs. In reality, however, changes in productivity are compounded out of changes in input use, i.e., along the curve representing the production function, and shifts of the curve itself. Problem of distinguishing these two effects arises because not all the factors affecting productivity are observable or measurable. In the framework of cross-section regressions it is not possible to control for such factors. Only a panel data approach can overcome this problem (see further).

Implementation of the neo-classical growth model as a panel-data estimation framework is commonly done by specifying a Cobb-Douglas production function with labor-augmenting technological change: $Q(t)=[A(t)L(t)]^{1-k}K(t)^k$, where k ($0<k<1$) is the share of capital in output (e.g., Mankiw et al., 1992; Islam, 1995). $L(t)$ and $A(t)$ are assumed to grow exogenously at rates l and a so that $L(t)=L(0)e^{lt}$ and $A(t)=A(0)e^{at}$. Further, it is assumed that s is the constant fraction of output that is saved and invested into the stock of capital, which depreciates with a constant rate, d. The output per worker is defined as $q(t)=Q(t)/L(t)$; note that output per effective worker is $q^e(t)=Q(t)/[A(t)L(t)]=Q(t)/[A(0)e^{at}L(t)]$ and $\ln q^e(t)=\ln q(t)-\ln A(0)-at$. Then the steady state output per effective worker, $\ln q^{e}*$ can be specified in the following way:[12]

$$\ln q^{e}* = \frac{k}{1-k}\ln(s) - \frac{k}{1-k}\ln(l+a+d)\,. \tag{1}$$

However, countries may not be at their steady states or departures from steady states may not be random across countries. The equation describing the out-of-steady-state

[11] This formulation of productivity is analogous to the ALP measure commonly used in agricultural sector performance studies (see e.g., Macours and Swinnen, 2000a, 2000b).
[12] At steady state or on the balanced growth path (see Romer, 1996, Ch.1) each variable of the model grows at a constant rate.

behavior is derived by considering the distance between the steady state level of output per effective worker, $q^{e}*$ and its actual value, $q^{e}(t)$ at any point of time in period t (see Islam, 1995). This equation represents a partial adjustment process around the steady state, where $q^{e}*$ is determined by s and l, which are assumed to be constant for the entire period t; $c=(l+a+d)(1-k)$ denotes the rate of convergence to steady state:

$$\ln q(t) - \ln q(0) = (1-e^{-ct})[\ln A(0) + at] - (1-e^{-ct})\ln q(0) + (1-e^{-ct})\frac{k}{1-k}\ln(s) - (1-e^{-ct})\frac{k}{1-k}\ln(l+a+d). \tag{2}$$

Equation (2) represents the standard neo-classical growth model relationships and predicts that a high savings/investment rate will affect growth positively, whereas high labor-use rate (corrected by the rate of technological progress and the rate of depreciation) will have a negative effect on productivity growth.[13] It is clear that especially during transition, reforms and enterprise restructuring will importantly affect savings and employment growth rates. Thus, these rates are likely endogenous to institutional factors.

Apart from the savings and employment growth rates, equation (2) contains the term $\ln A(t)=[\ln A(0)+at]$. In reality, this term reflects not just exogenous technology (shifts) but also resource endowments, institutions, etc. and is affected by reform policies and institutional changes (such as individualization of agriculture, for example). One way to deal with the complex nature of $\ln A(t)$ is to assume that it consists of a time-specific component and a country-specific component (see further).[14] However, for example, the country-specific

[13] In the augmented version of the neo-classical growth model investment in human capital is an additional determinant of growth in output per worker. For discussion on the augmented neo-classical growth model refer to e.g., Mankiw et al. (1992) and Barro and Sala-I-Martin (1995).
[14] For example, Hall (1988) decomposes the Solow residual as a measure of total factor productivity into a firm/industry-specific markup and a time-specific technology factor.

component is likely to be correlated with the savings and employment growth rates, experienced by the respective countries.

Possible estimation techniques for the model are cross-section regressions using averaged data for long periods (e.g., Barro, 1991; Mankiw et al., 1992) or a dynamic panel data approach (e.g., Islam, 1995; Caselli et al., 1996). Single cross-section growth regressions have several disadvantages: (i) the time series are reduced to a single observation means and not all available information is used; (ii) it is very likely that single cross-section regressions suffer from omitted variable bias; (iii) one or more of the regressors may be endogenous. Within a dynamic panel data framework (e.g., Hansen, 1982; Arellano and Bond, 1991) it is possible to account for unobserved country-specific effects and allow for endogeneity of the regressors.

Using the conventional panel data notation, equation (2) can be written as:

$$q_{it} - q_{it-1} = \alpha + \beta q_{it-1} + \gamma x_{it} + w_t + v_i + \varepsilon_{it} , \quad (3)$$

where q_{it}=ln$q(t)$ denotes productivity (output per worker) for country, i (i=1,…I) in time, t (t=2,…T), q_{it-1}=ln$q(0)$ is the level of productivity at the beginning of each period, and x_{it} is a vector of regressors such as investment rate and employment growth. In our empirical analysis we also include, in augmented specifications, as proxies for $A(t)$, variables measuring the impact of reforms and individualization on productivity.[15] All variables are either initial values or average values over each time period. As discussed earlier, the ln$A(t)$

[15] In most (empirical) growth studies (see for a review Sala-I-Martin, 1997) a number of socio-economic variables are often included in x_{it}.

term is further decomposed into a time-invariant, country-specific (unobserved) effect, ν_i, a time-specific effect, w_t, and a constant, α. The random (zero-mean) error term is denoted ε_{it}. Finally, from equation (3) the dynamic panel data model can be rewritten in the following way:

$$q_{it} = \alpha + \beta^* q_{it-1} + \gamma x_{it} + w_t + \nu_i + \varepsilon_{it}, \qquad (4)$$

where $\beta^*=(\beta+1)$.

At this point it is appropriate to emphasize that equation (4) is based on approximation around the steady state and captures the dynamics towards the steady state. Note that in the single cross-section regression, s and l are assumed to be constant for the entire period. Such an approximation is more realistic over shorter periods of time - in our analysis these are one-year intervals. The panel data setup allows us, after controlling for the individual country effects, to integrate the process of transition and (conditional) convergence occurring over several consecutive time intervals.

In order to address inconsistency and endogeneity problems due to (i) omitted unobserved (time-invariant) country effects (Hsiao, 1986), (ii) small number of time-series periods, T (Nickell, 1981), and (iii) correlations between regressors and ν_i and/or ε_{it}, we apply the first differenced GMM-IV estimator. Taking first differences of (4) eliminates the constant and the country specific effects:

$$\Delta q_{it} = \beta^* \Delta q_{it-1} + \gamma \Delta x_{it} + \Delta w_t + \Delta \varepsilon_{it} \,. \qquad (5)$$

Assuming that error terms are independent across countries and serially uncorrelated ($E[\varepsilon_{it}\varepsilon_{ip}]=0$ for $p \neq t$) and that the initial conditions satisfy $E[q_{i,1}\varepsilon_{it}]=0$ for $t \geq 2$, then values of q_{it} lagged two periods or more are valid instruments in the first differenced growth equation. This is so because q_{it-2} and earlier values are generally correlated with Δq_{it-1} but not with $\Delta\varepsilon_{it}$. Thus, q_{it-1} is predetermined with respect to ε_{it}, i.e. shocks to productivity in one time period are not correlated with initial productivity of this time period.

If the regressors, x_{it} are strictly exogenous ($E[x_{it}\varepsilon_{ip}]=0$ for all p,t) then all the past, present and future values of x_{it} are valid instruments in each of the differenced equations, even if the x_{it} are correlated with ν_i. However, it is likely that some of the regressors in our model, e.g. policies and/or policy outcomes (capital and labor reallocation rates as well as shift to individual farming), may not be strictly exogenous. There may be a feedback mechanism where past shocks to productivity are correlated with current policies and/or outcomes. Maintaining the assumption that current shocks to productivity are uncorrelated with current policies would mean that $E[x_{it}\varepsilon_{ip}]\neq 0$ for $p<t$ and $E[x_{it}\varepsilon_{ip}]=0$ for $p \geq t$. Following Arellano and Bond (1991) we can then use values of the predetermined x_{it} lagged one period or more as valid instruments in the first differenced growth equation.

If a regressor is endogenous then we have to allow for correlation between the current value of this regressor and current shocks to productivity, as well as feedback from past shocks to productivity, i.e. $E[x_{it}\varepsilon_{ip}]\neq 0$ for $p \leq t$ and $E[x_{it}\varepsilon_{ip}]=0$ for $p>t$ only. In this case, valid instruments in the differenced equation are values of the endogenous x_{it}, lagged two periods or more.

4 Data and variables

Our empirical analysis focuses on the experience of a selected sample of 15 transition countries,[16] for which comparable agricultural sector annual data are available over the period 1990-2001. [17] However, data is not available for all countries for all years, thus making the panel unbalanced. As the sample covers selected countries of the Balkans, Baltics, Central Europe and the CIS, and includes the most up-to-date information available, we are able to also test whether the main conclusions from previous studies related to agricultural sector performance are still valid after more than ten years of transition.

We measure productivity growth in agriculture in terms of growth in the gross agricultural output per worker (ALP). Contrary to previous empirical studies that focused on average changes in the early years of transition (e.g., Macours and Swinnen 2000a, 2000b; Lerman, 2000), we consider year-on-year changes in ALP. By looking at growth rates in agricultural production per worker in each country at a given point in time we are able to capture the high heterogeneity across countries as it appears from table 1.

ALP is measured in purchasing-power-parity adjusted US dollars and was calculated by using the initial, 1990 level of agricultural GDP obtained from the EBRD database and the FAO annual gross agricultural output (GAO) index over the period 1990-2001.

We explain ALP growth in terms of the main factors identified in equation (2), i.e., the initial level of ALP, the changes in the agricultural labor force (adjusted for the rate of depreciation and the rate of technological progress) and the savings/investment in the sector. In addition, we control for initial conditions and general economic reforms. Thus the impact

[16] The sample includes: Albania, Belarus, Bulgaria, Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia and Ukraine.

[17] The main data sources are the National Statistical Offices, FAO, OECD, EBRD, and the World Bank.

of the factor in the focus of this analysis - the individualization of agricultural production – can be isolated.

Due to lack of any other more appropriate measure, we proxy the savings/investment rate, *s* by an index based on the ratio of output and input agriculture-specific prices as reported by OECD. This (ratio) index is a measure of the gross margin, which is closely related to the availability of internal funds and thus to the investment rate, especially in environments characterized by financial market imperfections. Gross margin also is a good indicator of how profitable the farms and the sector, as a whole, are at the most fundamental level. Farms with higher gross margins will have more money left over to spend on investment.[18] Based on information from IMF country reports and statistical appendixes, we assume 20 percent average investment rate (see also Lerman et al., 2002), which is then normalized to the gross margin index of each country.

Under conditions of imperfect financial market and credit constraints the sensitivity of investment to internal financing is shown to be high (e.g., Fazzari et al., 1988).[19] Moreover, a number of studies emphasize the importance of profitability and cash flow for access to financing and investment in transition agriculture. For example, Pederson et al. (1997) and Csaki et al. (2001) emphasize the importance of profitability and cash flow problems for the perceived "excessive debt burden" of CIS farms and in limiting investment in agriculture. Other examples are 1998 Romanian and 2000 Czech and Slovak surveys, where about 50% of farmers

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[18] Solow (1957) points out that " … ideally what one would like to measure is the annual flow of capital services, however, due to lacking any reliable year-on-year measure of the utilization of capital, one must be content with a less utopian estimate … " such as the savings or investment rate.

[19] In general, financing of investment can come both from internally generated resources and from (formal or informal) loans. Transition has constrained both sources of financing. Own financial sources are constrained because hyperinflation wiped out savings, and low profitability and cash flow problems have complicated generation of funds internally. Access to external credit is severely restricted as financial institutions are less likely to lend to enterprises with low profitability, outstanding debt, and cash flow problems. In addition, institutional problems such as ongoing reforms of the banking system and enterprises, soft budget constraints, lack of credit history, high monitoring costs all contribute to the credit supply problems (see e.g., Swinnen and Gow, 1999; Konings et al., 2003; Rizov, 2004).

identify insufficient income as the key reason for their investment loan applications being rejected (Davis et al, 1998 and EBRD, 2002).

The annual data for agricultural employment is from countries' National Statistics and ILO. The average employment growth rate, l was computed as the difference between the natural logarithms of agricultural employment at the end and beginning of each year.

It is implicitly assumed, as in other panel data studies (e.g., Islam, 1995; Caselli et al., 1996) that the rate of technological progress is common to all countries and allowed for unobserved country-specific differences in technology. Assuming that the (initial) rate of technological progress is common to all countries can be justified for the economies in transition by the fact that there were explicit policies towards equalization of countries within the former COMECOM. Furthermore, the technological-progress component of a reflects primarily the advancement of knowledge, which is not country-specific (Mankiw et al., 1992).

We recognize that the diffusion of new technology is likely to be costly and take a considerable period of time (e.g., Kershenas and Stoneman, 1995). Therefore, if the diffusion of new technology is not costless and instantaneous, we may want to also allow for different rates of technological progress in different countries. However, due to lack of data we have to maintain the standard assumption of a common rate of technical change as in a number of previous studies. Note that our controls for progress of reforms and restructuring ameliorate this restriction to certain extent. Thus, like it is common in the literature (e.g., Mankiw et al., 1992; Islam, 1995; Caselli et al., 1996), the natural logarithm of the sum of agricultural employment growth and 0.05 (for constant technological progress and depreciation rate) is calculated for $\ln(l+a+d)$.

We augment the model with a control variable measuring the effect of general economic reforms as well as with a measure of individualization. Progress in general economic reforms

(REFORM) is measured (in natural logarithm) as the average of the EBRD indicators for price and trade liberalization, and small-scale privatization.[20] These indicators capture the extensiveness of the so-called "first phase" reforms, which are necessary condition for the successful implementation of institutional reforms.

The extent of farm restructuring and individualization is measured by the share of TAL used in private (family) farms and household plots (INDIVID).[21] This is the variable of main interest in our analysis. We use data from countries' National Statistics and Macours and Swinnen (2000a) as the values are calculated in natural logarithms.

Our maintained hypothesis is that the levels of INDIVID and REFORM induce resource reallocation and productivity shifts that importantly affect ALP. Table 2 reports descriptive statistics of the regression variables.

- Table 2 -

5 Results and discussion

Base and augmented specifications

The results of the GMM-IV estimations based on the neo-classical growth model as specified in equation (2) are reported in table 3. All regressions include time dummies (not reported), which were found to be jointly significant in every regression. There is no second order serial correlation (the m_2-test is fulfilled) and the Sargan test does not reject the validity of

[20] See chapter 2 of the EBRD Transition Report 2002 (EBRD, 2002) for a detailed definition of these indicators.

[21] There is literature pointing out to initial disorganization effects of enterprise restructuring during transition (Blanchard and Kremer, 1997; Roland and Verdier, 1999). By using levels of individualization rather than changes, we try to avoid capturing the initial disorganization of agricultural sectors due to the breakup of collective farms.

instruments in all specifications. The left hand side variable is the yearly change in the natural logarithm of real per worker agricultural output (ALP).

- Table 3 -

First, a regression corresponding to the base specification neo-classical growth model was run; the results are presented in column (1). All variables are significant at the one percent level and have the expected signs. Results reported are under the assumption that right-hand site variables are predetermined.[22] The negative coefficient on initial ALP as in most published work is interpreted as conditional convergence while investment is positive and growth in employment is negative as suggested by the neo-classical growth model. The implied speed of convergence, c is quite high at about seven percent per annum, not surprising for the case of economic transition. It seems that the most important determinant of the growth in agricultural productivity is the reduction in excess labor.[23]

Next, we run regressions augmented with measures of progress in economic reforms and of individualization of agricultural production in order to assess their effects on productivity growth. In column (2) results of an augmented version of the neo-classical growth model, with the measure of general economic reforms (REFORM), are reported. The results of the base regression hold while the coefficient of the reform variable is significant at the five percent level and positive as expected. REFORM is a synthetic indicator of reform policies adopted (and their outcomes) thus, measuring the advancement in general economic

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[22] Treating investment and employment growth rates as exogenous led to estimation failing the m_2-test, which implies that in transition factor reallocation is indeed affected by transition-specific shocks such as reforms and enterprise restructuring. Versions of regressions where investment and growth in employment are assumed endogenous were also run but the results were not significantly different from ones reported. These alternative treatments are available upon request.

[23] Labor adjustment in transition is interpreted as an indicator of initial (passive) restructuring while active restructuring is defined as new investment (e.g., Coricelli and Djankov, 2001).

reforms.[24] As in other studies it is interpreted as an important condition for successful restructuring of the agricultural sector (Macours and Swinnen, 2000a, 2000b; Lerman, 2001). We recognize that the impact of reforms is affected by policy choices and initial conditions. It is not the goal of our analysis, however, to distinguish between these effects. In the next section we (tentatively) analyze the direct impact of reform policies and initial conditions on productivity growth.

Individualization of agricultural production is an important indicator of restructuring in agriculture. It is the major outcome of the agriculture-specific land reform policies adopted. Some countries adopted the restitution method (mainly Central European and Balkan countries, except Albania, Poland and Slovenia) while others distributed property rights through paper shares (CIS). Albania stands out as the only country in our sample that followed the approach of distributing land in the form of physical plots. Poland and Slovenia do not fall into any of these three categories because they started the transition with large proportions of land already in individual farms, and did not introduce any substantial land reform afterwards. The importance of these land reform choices lies in the fact that they resulted in different magnitude of the shift of land to individual farming (INDIVID). Thus by assessing the impact of individualization on productivity growth we can provide an implicit evaluation of the success of land reform policies adopted.

Results in column (3) from estimating the neo-classical growth model augmented with INDIVID show that individualization is important for productivity growth. The coefficients on the base variables are as in the previous model specifications, with respect to sign and magnitude while the coefficient on the individualization variable is positive and significant at the one percent level. This result is important because we find a positive effect

[24] All specification tests, in this and in the following specifications, are satisfied if regression variables are treated as predetermined.

of individualization in a dynamic model controlling for investment and changes in employment, which are the most important factor of the agricultural sector transformation during the period of analysis.[25]

In column (4) we report results from a neo-classical growth model specification augmented with both REFORM and INDIVID. Again the results from the base specification are maintained and the impact of both REFORM and INDIVID is positive and significant. The speed of conditional convergence, c has doubled when both economic reforms and restructuring of farms through individualization are implemented. The results are robust to alternative treatment of INDIVID and REFORM as predetermined or endogenous.

"Implied" country productivity: A tentative analysis

Panel-data technique permits besides controlling for the (unobservable) individual country effects in the estimation of the parameters of main interests in our analysis, specifically the coefficient on INDIVID, to also obtain estimates of these effects themselves. Following the approach in Islam (1995), we use the consistent GMM-IV estimates $\hat{\beta}*$ and $\hat{\gamma}$ (column 1 of table 3) to calculate the "implied" country productivity factor, $\hat{A}_i$ that corresponds to ln$A(t)$, in the notation of section 3. Thus, $\hat{A}_i = (\overline{q}_i - \hat{\beta}*\overline{q}_{i,-1} - \hat{\gamma}\overline{x}_i)/(1-e^{-c})$, where $\overline{q}_i$, $\overline{q}_{i,-1}$, and $\overline{x}_i$ are averages taken over the entire period of analysis.

The $\hat{A}_i$ productivity factor is a measure of efficiency with which countries have been transforming their capital and labor resources into output over the period of analysis; the

[25] Assessing the sensitivity of this result to alternative assumptions about endogeneity of the individualization variable showed that results reported are robust. Nevertheless, with respect to the importance of the impact of individualization a caveat must be made that despite robust our results are based on proxies for investment and technological progress.

values of $\hat{A}_i$ are reported in Appendix 1. It is reassuring that our results are similar in magnitude to estimated productivity factors in Islam (1995), for the "emerging markers" group of countries.[26] Furthermore, the ranking of the estimates corresponds well to the perceived level of development (productivity) of the countries analyzed. Thus, CEE and Baltic countries are characterized by higher efficiency in comparison with Balkan and CIS countries. Exception worth mentioning is the relatively low $\hat{A}_i$ value for Poland, which suggests potential problems with respect to agricultural-sector competitiveness of this country in light of the forthcoming EU accession.

For the purposes of our analysis it is important to look at the determinants and implications of the estimated ln$A(t)$. First of all $A(t)$ is a part of the production function and hence it should be correlated with the output levels of the countries. To check this we plot in figure 1a the relationship between $\hat{A}_i$ and $\overline{q}_i$ which show close association; the simple correlation coefficient is 0.88.

- Figure 1 -

Next we explore to what extent is $\hat{A}_i$ important in explaining growth. According to the neo-classical growth model, steady state growth is given by the exogenous rate of technological progress. Hence, our focus here is on growth in transition and how does $\hat{A}_i$ affect transition growth. According to the model countries move towards their respective steady states and ln$A(t)$ is one of the variables explaining the dynamics around steady state (see equation (2)). It can be shown that other things equal, the distance between the steady state and initial level of output increases with the increase in ln$A(t)$ and other way round, the

[26] It should be noted that the estimates in Islam (1995) refer to productivity factors of whole countries while our estimates correspond to productivity factors of agricultural sectors only, in the respective transition countries, and cover different time-period.

more distant a country is from its steady state, the higher the growth rate (see Islam, 1995). Hence, there should be a positive relationship between the observed output growth rates and $\hat{A}_i$. Figure 1b confirms this assertion; the simple correlation coefficient is 0.65.

The above analysis shows that higher values of $\ln A(t)$ are associated with both higher levels of productivity and higher growth rates. The important question then is what the determinants of growth in $\ln A(t)$ are.[27] In order to evaluate the impact of country-specific observed characteristics, z_i on productivity growth, $\Delta\hat{A}_i$ (see Appendix 1) we can use OLS level estimation: $\Delta\hat{A}_i = \delta z_i + (v_i * + \varepsilon_i *)$, where v_i* and ε_i* are unobserved country-specific effects and the error term of the auxiliary regression, respectively. However, OLS will generate a consistent estimate of δ iff all z_i characteristics are uncorrelated with v_i* which is a very strong assumption. Therefore we cannot attach much casual significance to the estimate $\hat{\delta}$, and proceed by simply two-way plotting the relationships of interest.

Natural candidates in analyzing transition countries are reform and restructuring variables as well as initial conditions. First, in figures 2a and 2b, we plot the relationships of $\Delta\hat{A}_i$ with REFORM and INDIVID, respectively. The simple correlation coefficients are quite high, 0.49 and 0.58, respectively, which confirm the findings from our regression analysis in the previous section. It does seem that individualization of agricultural production (and general economic reforms) stimulate productivity not only by inducing efficient reallocation of capital and labor but also by shifting upwards the efficiency of resource utilization.

- Figure 2 -

[27] We calculated the growth in $\ln A(t)$, $\Delta\hat{A}_i$, as the difference between $\hat{A}_i$ s estimated at the beginning (1990) and at the end (2000) of the period of analysis (see also equation (2)). Results are reported in Appendix 1.

Finally, we address the issue of the impact of initial conditions on productivity growth. Country-specific time-invariant characteristics are eliminated in the first differenced GMM-IV estimator, as it can be seen in equation (5). However, as it was shown, the ln$A(t)$ term embodies the effects of the country-specific characteristics and therefore it is interesting to see if initial conditions affect $\Delta\hat{A}_i$; note that $\Delta\hat{A}_i$ is calculated on the basis of equation (4). The (observed) initial conditions are measured by two synthetic indexes, which summarize a number of variables describing the status of former socialist countries' economies at the beginning of transition (see Appendix 1).[28] The first index (IC1) can be interpreted as a measure of inherited distortions. Positive values of this index indicate lower initial distortions. The second initial conditions' index (IC2) captures the degree of development of the economy. Higher values of this index characterize countries with higher initial development and thus better initial conditions.

Previous studies (e.g., Macours and Swinnen, 2000a, 2000b; Falcetti et al., 2002) have emphasized the importance of initial conditions in determining countries' performance during transition. Their results show that the impact of initial conditions is stronger with respect to gross output while it is vague with respect to labor productivity and running mostly through the effects of reform policies. Our results of plotting $\Delta\hat{A}_i$ on the initial conditions, IC1 and IC2 (see figures 3a and 3b, respectively) show that initial conditions do not directly affect productivity growth in any significant way. The simple correlation coefficients are low, 0.27 and 0.25, respectively.[29] To check if initial conditions played more significant role

[28] These indexes are based on a principal component analysis of a number of general and agricultural sector-specific variables. See Box 2.1 of the EBRD Transition Report 1999 (EBRD, 1999) for similar calculations and more details.

[29] Plotting the REFORM variable on IC1 and IC2 shows that the impact of initial conditions on ALP is indirect and runs through the impact of the reforms adopted. Specifically, the correlation of REFORM and IC1 measuring inherited distortions is particularly high, at 0.68. This result is similar to findings in Macours and Swinnen (2001b).

during the first five years of transition we also calculated $\Delta\hat{A}_i$ for only the first five-year period. The correlation of $\Delta\hat{A}_i$ with IC1 and IC2 again proved to be low; correlation coefficients were 0.32 and 0.28, respectively.

- Figure 3 -

6 Conclusion

In this paper we address the question whether individualization of agricultural production as measured by the share of total agricultural land used in individual farms helps productivity of transition agriculture. The main result that individualization does positively affect productivity growth is robust to alternative treatments with respect to endogeneity assumptions. Advantage of our approach is that we analyze this relationship within the well-defined theoretical framework of the neo-classical growth model. Furthermore, using panel data and a first differenced GMM-IV estimator we are able to obtain consistent coefficient-estimates, by controlling for endogeneity and unobserved country-specific effects, and to isolate the effects of capital and labor deepening on the one hand and technological and institutional changes on the other, in the process of transition.

Our results have a number of important policy implications (keeping in mind the caveats made throughout the paper). First, we cast light on an important institutional debate concerning the appropriateness of policies aiming at individualization of agricultural production in transition countries. Applying a robust theoretical and empirical framework we are able to qualify so far inconclusive results of other studies (Macours and Swinnen, 2000a, 2000b; Lerman, 2000, 2001) and prove that the shift to individual farming has had a positive impact on productivity growth in transition countries. Second, investment and the reduction in excess labor, which are associated with active and initial (passive) restructuring, respectively (Coricelli and Djankov, 2001) are found to be very important determinants of the productivity growth in transition agriculture. Furthermore, resource reallocation is not exogenous but rather affected by reforms and enterprise restructuring, with a lag of a year or more. Third, our study highlights the role of the country productivity factor, $A(t)$ as a determinant of the efficiency with which factors of production are being converted into output. Thus, improvements in $A(t)$ brought about by appropriate reform measures (such as individualization of production) can have positive direct and indirect (via s and l rates) effects on productivity and incomes. Finally, our analysis confirms previous findings (Macours and Swinnen, 2000a, 2000b; Falcetti et al., 2002) that general economic reforms positively affect productivity growth while the differences in initial conditions do not have significant direct impact throughout the transition period.

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Table 1 Land reforms, farm restructuring and the changes in agricultural indicators over the 1990–2001 period

Region	Country	Performance indicators in 2000[a]		Farm restructuring/Individualization [b]			Land reform	
		ALP [c]	GAO [d]	Pre-reform	1995	2000	Progress index [e]	Procedure [f]
CEE	Czech Rep	170	73	1	21	26	90	R [4]
	Hungary	236	77	13	46	51	90	R
	Poland	88	92	76	82	84	90	-
	Slovakia	130	62	2	7	9	80	R
Balkans	Albania	110[1]	116[1]	3	96	90[1]	80	DP [5]
	Bulgaria	62[2]	67[2]	14	51	56[2]	80	R
	Romania	79	91	14	71	85	80	R
	Slovenia	115	117	83	93	94	90	-
Baltics	Estonia	138	42	4	53[3]	61	90	R
	Latvia	64	38	4	80[3]	89	90	R
	Lithuania	76	65	9	66	87	90	R
CIS	Belarus	85	57	7	11	14	20	DS [6]
	Kazakhstan	72[2]	56[2]	0	5	24[1]	50	DS
	Russia	69	62	2	9	13[1]	50	DS
	Ukraine	54	55	6	16	18[1]	60	DS

Notes: [a] Cumulative index (1990=100); [b] Share of total agricultural land used in individual farms; [c] ALP = agricultural labor productivity; [d] GAO = gross agricultural output; [e]Progress index (max=100) of land reform; [f] Dominant form; [1] Data for 1998; [2] Data for 1999; [3] Data for 1996; [4] R = restitution; [5] DP = distribution of plots; [6] DS = distribution of shares.

Sources: EBRD, FAO, ILO, National Statistics, WB

Table 2 Descriptive statistics of the regression variables by country

Region	Country	Variables					
		ALP growth, %	ALP_{-1}, ppp US dollars	Investment rate index	Employment growth, %	Individual land use, %	Reform index
CEE	Czech Rep	5.32	18530.87	11.63	-8.48	15.42	3.31
	Hungary	8.58	10031.14	16.01	-11.18	34.93	3.37
	Poland	-1.48	6079.18	17.41	-0.42	80.00	3.52
	Slovakia	2.66	8764.09	12.86	-7.47	5.50	3.30
Balkans	Albania	1.17	3381.08	18.47	0.67	65.62	2.97
	Bulgaria	-5.33	6840.50	11.92	0.87	37.45	2.78
	Romania	-2.34	6786.30	12.97	1.42	61.30	2.72
	Slovenia	1.37	10741.11	16.47	0.24	89.09	3.53
Baltics	Estonia	3.24	7997.83	15.83	-11.92	49.89	3.04
	Latvia	-5.92	8490.59	9.76	-2.70	73.68	2.97
	Lithuania	-2.73	8367.27	8.90	-1.62	67.11	2.98
CIS	Belarus	-1.76	5675.12	16.94	-4.46	11.05	1.64
	Kazakhstan	-3.59	5061.88	9.89	-2.77	4.19	2.52
	Russia	-4.13	7391.19	8.52	-1.50	8.19	2.67
	Ukraine	-6.07	7191.80	9.79	0.03	13.85	2.16

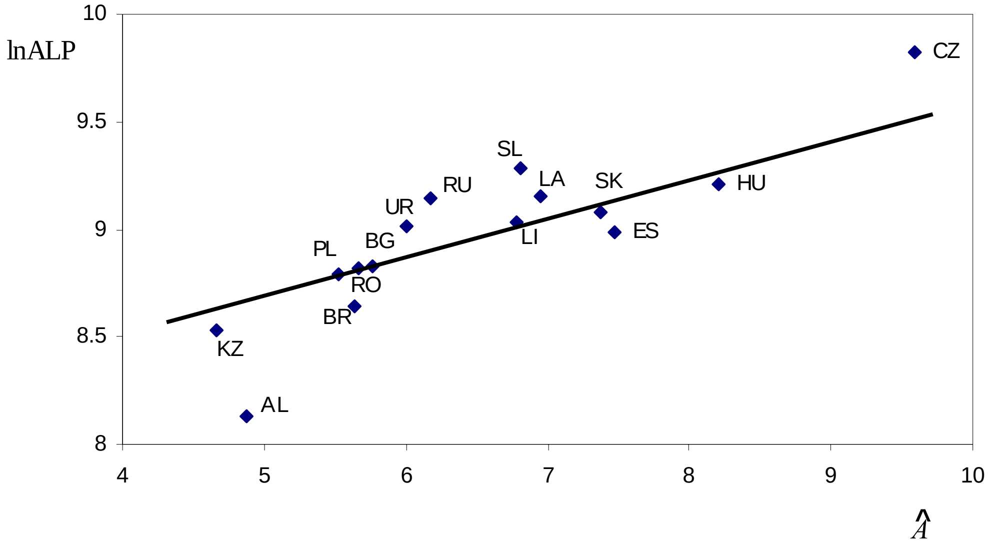
Notes: All figures are annual averages over the period of analysis; the number of observations is 107 for 15 countries.

Table 3 GMM-IV neo-classical growth model estimations

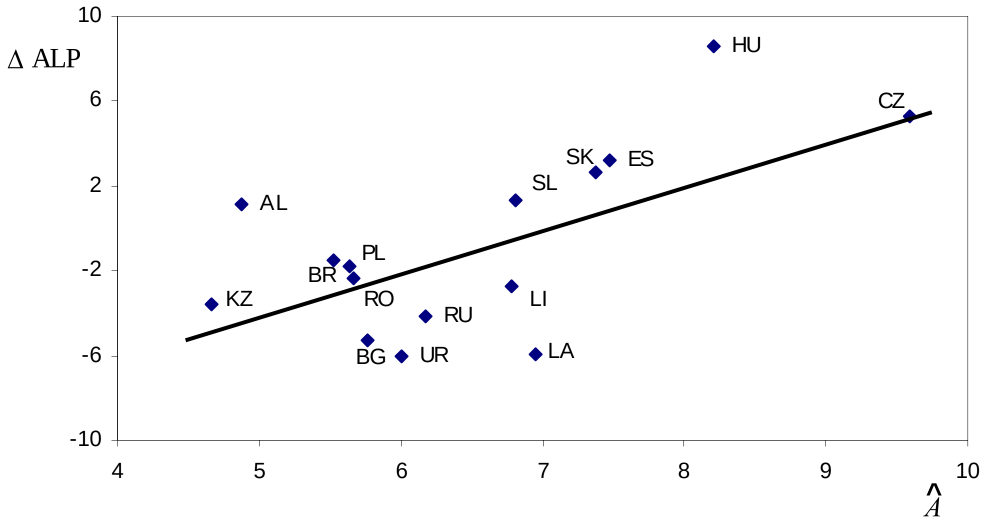
Dependent variable: ALP growth								
Variables	(1)		(2)		(3)		(4)	
ln(q_{t-1})	-0.0699	***	-0.0830	***	-0.1180	***	-0.1508	***
	(0.0158)		(0.0161)		(0.0183)		(0.0268)	
ln(s)	0.1164	***	0.1587	***	0.1514	***	0.1577	***
	(0.0369)		(0.0359)		(0.0333)		(0.0330)	
ln(l+a+d)	-0.6955	***	-0.6794	***	-0.7237	***	-0.7772	***
	(0.1339)		(0.1246)		(0.1200)		(0.1165)	
lnREFORM	-		0.0686	**	-		0.0654	*
			(0.0319)				(0.0343)	
lnINDIVID	-		-		0.0597	***	0.0492	**
					(0.0228)		(0.0213)	
m_1	0.00		0.00		0.00		0.00	
m_2	0.13		0.13		0.16		0.15	
Sargan test	0.87		0.96		0.90		0.90	

Notes: Standard errors robust to general heteroskedasticity are reported in parentheses under the coefficients; ***, ** and * denote 0.01, 0.05 and 0.10 level of significance, respectively; for m_1 and m_2 and the Sargan test p-values of the null hypothesis for valid specification are reported; the number of observations is 107 for 15 countries.

Figure 1 Skater plot of $\hat{A}_i$ vs. lnALP (a) and ALP growth (ΔALP), % (b)

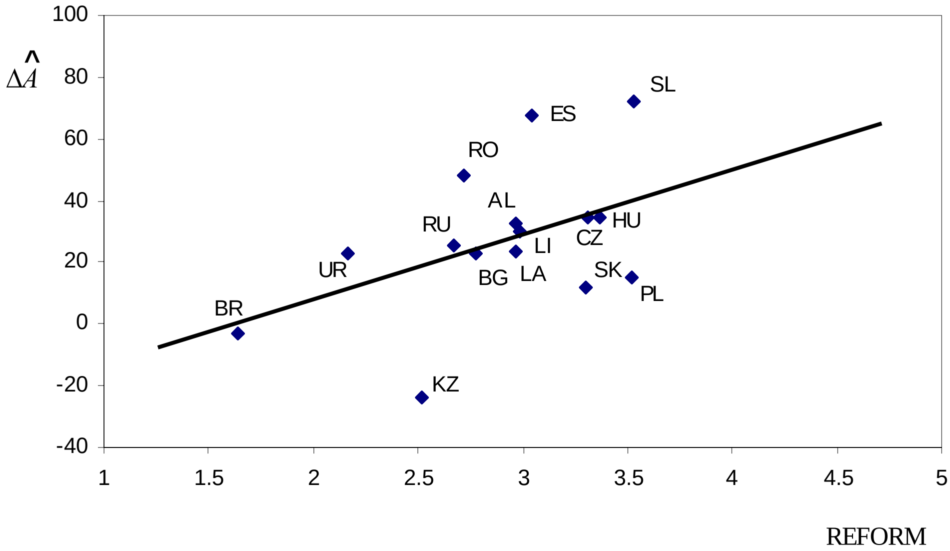


(a)

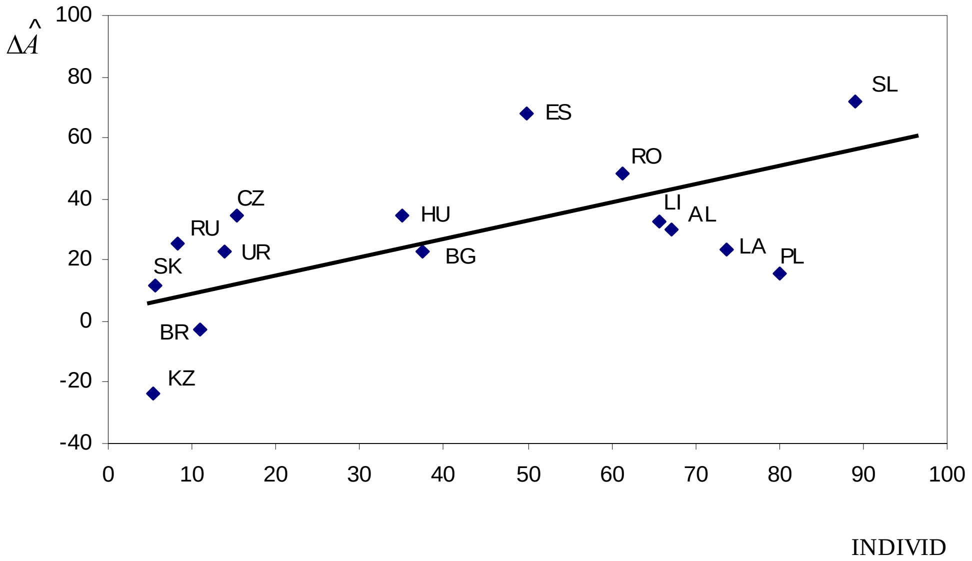


(b)

Figure 2 Skater plot of $\Delta\hat{A}_i$, % vs. REFORM (a) and INDIVID, % (b)

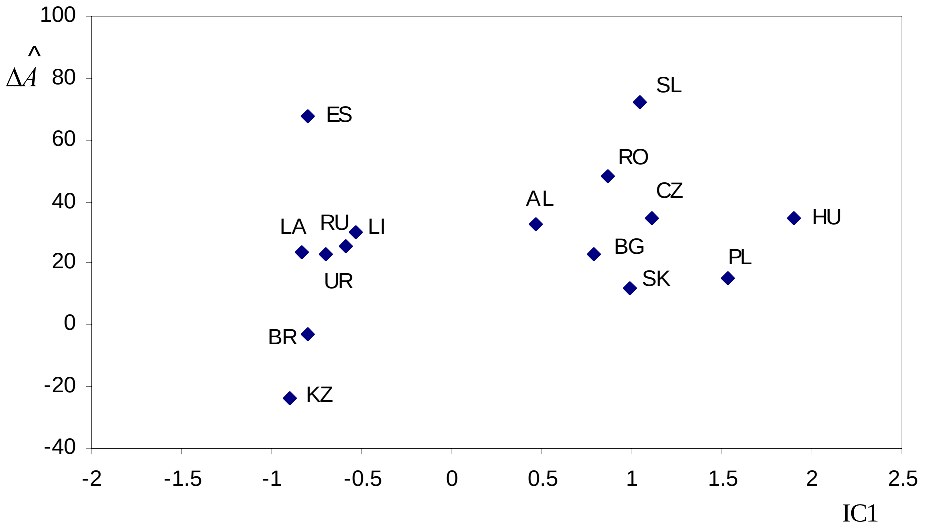


(a)

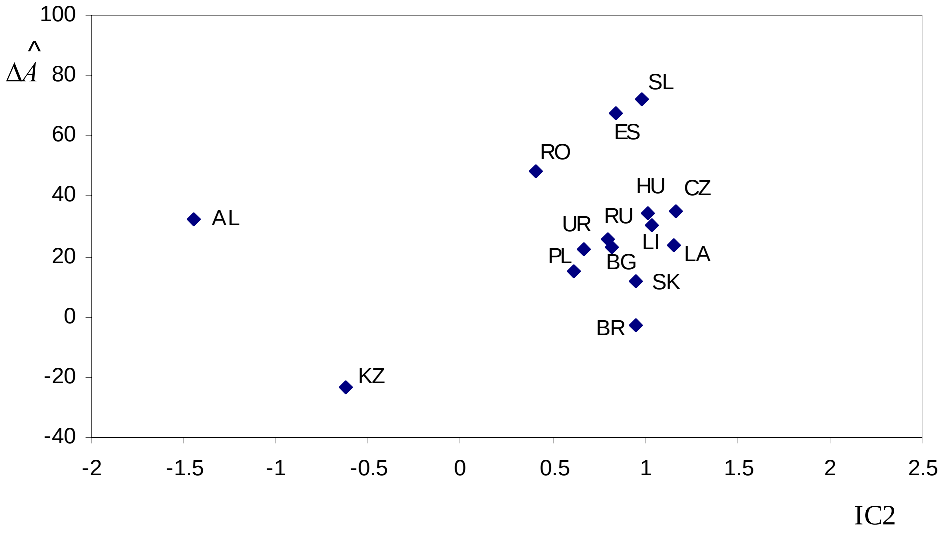


(b)

Figure 3 Skater plot of $\Delta\hat{A}_i$ % vs. IC1 (a) and IC2 (b)



(a)



(b)

Appendix 1 "Implied" productivity factors and initial conditions by country

Region	Country	Code	Variables			
			$\hat{A}$	$\Delta\hat{A}$, %	IC1	IC2
CEE	Czech Rep	CZ	9.59	34.71	1.11	1.16
	Hungary	HU	8.21	34.47	1.90	1.01
	Poland	PL	5.52	15.36	1.54	0.61
	Slovakia	SK	7.37	11.89	0.99	0.95
Balkans	Albania	AL	4.88	32.58	0.47	-1.45
	Bulgaria	BG	5.76	23.00	0.79	0.82
	Romania	RO	5.66	48.32	0.87	0.40
	Slovenia	SL	6.81	71.98	1.04	0.98
Baltics	Estonia	ES	7.47	67.78	-0.80	0.84
	Latvia	LA	6.96	23.54	-0.84	1.15
	Lithuania	LI	6.79	30.24	-0.54	1.04
CIS	Belarus	BR	5.64	-2.83	-0.80	0.94
	Kazakhstan	KZ	4.67	-23.72	-0.90	-0.62
	Russia	RU	6.18	25.48	-0.59	0.80
	Ukraine	UR	6.01	22.55	-0.70	0.67

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