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Reforms and Efficiency Change in Transition Agriculture

Johan Swinnen and Liesbet Vranken

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REFORMS AND EFFICIENCY CHANGE IN TRANSITION AGRICULTURE

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Keywords: transition, production efficiency, reforms

Abstract

Studies on efficiency changes in transition agriculture yield mixed results. This paper develops both a theoretical model and an empirical analysis of how distribution of efficiency scores changes with the various stages of transition. We use a unique set of representative farm survey data to calculate farm level efficiency scores, compare the efficiency distributions of different transition countries and correlate these with various indicators of particular reforms. Our study indicates that, in particular, general institutional reforms and reforms focused on market institutions and on reducing market imperfections in input and output markets have an important positive impact on farm efficiency.

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1 Introduction

Economic and institutional reforms have dramatically affected agricultural organization, output, and production efficiency in transition countries from Central Europe to East Asia. Following the introduction of the the household responsibility system (HRS) in China and the Doi Moi in Vietnam, productivity and incomes in both countries soared (Justin Lin, 1992; John McMillan et al, 1989; Prabhu Pingali and Vo-Tong Xuan, 1992).[1] As a consequence, expectations were high ten years later when leaders in many nations of Central and Eastern European (CEE) and the former Soviet Union began to dismantle Socialism and liberalize their agricultural economies. The reforms, however, disappointed many nations. Not only did farm output fall dramatically in the transition countries of Europe and the former Soviet Union (FSU), some studies find that efficiency decreased as well during transition. In a review of the evidence, Rozelle and Swinnen (2004) conclude that productivity started increasing early on during transition in Central Europe and parts of the Balkans and the Baltic, but continued to decline much longer in parts of the FSU. Declines in productivity are associated with initial disruptions due to land reforms and farm restructuring in Eastern Europe (Macours and Swinnen, 2000) or with poor incentives and soft budget constraints in some of the countries of the former Soviet Union (Sedik et al, 1999; Lerman, Csaki and Feder, 2004) and disorganization in the supply chains (Gow and Swinnen, 1998).

However, there are several problems in comparing efficiency studies and drawing implications from them. First, a limitation is that those studies which include more countries and a longer time horizon use aggregate data (Mathijs and Swinnen, 2001) while studies using farm-level data are restricted to one country and short time periods, often even one year (Mathijs and Vranken, 2001). Second, comparisons and cross-country conclusions are complicated by differences in data samples. Third, with few exceptions, the available studies focus solely on the empirical aspects without providing a conceptual approach of how efficiency would evolve during transition, or how various reforms would affect them differently. In other words, these studies pay little attention to the process of efficiency change and how reforms affect this. Linking efficiency changes to specific reforms is important to understand which factors have been crucial in constraining or stimulating efficiency growth. Such issues are particularly relevant in the debate on optimal sequencing and complementarities of policies.

This paper develops both a theoretical model and an empirical analysis of how the distribution of efficiency scores changes with the various stages of transition. The empirical analysis uses a unique set of farm survey data from five East European countries, collected in the 1997-2001 period and based on a common set of survey instruments. The countries for which data are collected (Albania, Bulgaria, Czech Republic, Hungary, and Slovakia) are all in Eastern Europe and started reforms more or less simultaneously, but they have done so at different speed and depth. As such the combined data allows for cross-country comparisons without the complexity of vastly different starting positions (as none of them was part of the former Soviet-Union, or in Central or East Asia). We calculate farm-level efficiency indicators using data envelopment analysis (DEA) and calculate kernel density estimates for each of the countries.

In the second part of the paper we compare the efficiency distributions of the countries and we correlate these with various indicators of particular reforms. We discuss how the share of farmers producing efficiently changes during transition and which aspects of the reforms are important in explaining differences in the efficiency distributions of the countries.

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[1] The reforms lifted hundreds of millions of rural households out of dire poverty (World Bank, 2000). Economists praise the Chinese reforms as the “biggest antipoverty program the world has ever seen” (John McMillan, 2002, p. 94) and have claimed that the reform policies have led to "the greatest increase in economic well-being within a 15-year period in all of history" (Stanley Fischer, 1994, p. 131).

The last part of the paper wants to explain what causes the shift in the distribution of efficiency scores during transition. Therefore, we develop a theoretical model on how reforms, which are implemented in the process of the transition of a communist system to a market economy, affect heterogeneity in production efficiency within a country. The model assumes that (potential) farm managers are heterogeneous in their managerial capacities but face similar market constraints. These heterogeneities and constraints affect farm efficiencies. We model how reforms change constraints in input and output markets, and thereby farm efficiencies, and we use the theoretical model to simulate how the distribution of farm efficiencies would change during transition. We show that the variations in a few reform parameters yield simulation outcomes consistent with the empirical results.

2 Data

We use a unique set of representative farm survey data from five East European countries, collected in the 1997-2001 period and based on a common set of survey instruments. The surveys in Hungary and Bulgaria were implemented in 1998 and have representative data for 1997. Data for Albania, Czech and Slovak Republic are for the production year 1999. The surveys were done within a project coordinated by the University of Leuven. As a result, the format of the surveys is consistent among countries which increases the comparability of the data. To increase the accuracy of comparisons, we take only crop farms into consideration to enhance the homogeneity of the dataset. To be included in our analysis the value of grain production in the value of total production need to be more than 50%. Selection of farms out of the total sample occurred according to objective criteria and did not occurred randomly. Further, all five country data were checked for outliers and observations with incomplete information were dropped. The cleaning of the data resulted in a dataset of 178 Hungarian farms (63 cooperatives, 40 companies and 75 family farms), 93 Bulgarian farms (45 cooperatives, 9 companies and 39 family farms), 183 Czech farms (38 cooperatives, 14 companies and 131 family farms) and 210 Albanian family farms.

The Albanian, Hungarian and Bulgarian dataset is representative for the whole country, while in the Czech and Slovak Republics some regions were selected for surveying, but we selected regions with significant variations in the location of the farms (hills, low land and more urban areas).

All countries differ largely in terms of agricultural reform, land use and economic conditions. In Albania, the poorest country of Europe, almost half of the active population is still employed in agriculture, and virtually all agricultural land is cultivated by small individual farms. In Hungary and Bulgaria, land is used by a mixture of large-scale farming companies and small scale individual farms, with much regional variation. Share of agriculture in total employment is 23% in Bulgaria and 8% in Hungary. Slovakia and the Czech Republic are the opposite of Albania in most respects. They are much richer and only around 5% of employment is in agriculture. The vast majority of the land is used by large-scale farming companies, successor organizations of former collective and state farms.

All countries have a highly fragmented ownership structure of land due to land restitution or distribution processes implemented in early 1990s. However in all countries the land reform process was well advanced by the time of the survey. In terms of the land reforms progress indicator, as calculated by the World Bank, all have an indicator between 7 (Bulgaria) and 9 (Csaki and Lerman, 1997). The countries vary most strongly in terms of their income levels and broader institutional progress (see table 3.3).

3 Methodology

To investigate how average efficiency and the distribution of efficiency scores have changed during various stages of transition, we first calculate farm level total technical efficiency scores using Data Envelopment Analysis for each country. To measure technical efficiency requires the specification of a frontier production function, and the measurement of the deviation or distance of the farms from the frontier, which is then a measure of technical inefficiency. The technique of Data Envelopment Analysis (DEA) constructs a convex hull around the observed data (Charnes et al., 1978). As in Färe et al. (1985), we assume that production is characterized by a non-parametric piecewise-linear technology, so that simple linear programming techniques can be used to calculate efficiency. We further assume strong disposability of outputs and inputs and estimate the non-parametric deterministic frontier, expressed in terms of minimizing input requirements.

For each production unit we can obtain a measure of the ratio of all outputs over all inputs such as $u'y_i/v'x_i$ where u is a vector of output weights and v is a vector of input weights. To select the optimal output weights we formulate the following mathematical program: $\{\max u,v\ u'y_i/v'x_i$ subject to $u'y_i/v'x_i \leq 1;\ u,v \geq 0\}$. By imposing the constraint that $v'xi=1$ and using the duality in linear programming, one can derive an equivalent envelopment problem: $\{\min\lambda,z\ \lambda$ subject to $z\ Y \geq Y_i;\ z\ X \leq \lambda\ X_i;\ z \geq 0\}$, where Y_i denotes the output of farm k, X_i is a vector of inputs employed by farm i, and z is a vector of intensities that characterizes each farm.

A farm displays total technical efficiency if it produces on the boundary of the production possibility set, i.e. it maximizes output with given inputs and after having chosen technology. This boundary or frontier is defined as the best practice observed.

The data used in the DEA calculations are similar for all countries and include gross output, expressed in local currency, and data on land, labour, capital and other variable inputs. Output is the value of physical production valued at fixed prices. These fixed prices are calculated based on the price information in the survey. Labour is expressed in annual working units which correspond to 2150 labour hours or the number of hours that a full-time worker can perform in one year. Land is the total amount of agricultural land cultivated. To take into account quality differences in land, the area cultivated is multiplied with a land quality indicator. The value of estimated farm buildings is used as a proxy for capital. Further, we also take into account the amount of money spent on the purchase of seeds, feed, grains, roughage, concentrated feed, fertilizers, energy and services. Five different frontiers are assumed, i.e. one for each country.

4 Results of efficiency calculations

The DEA calculations yield a two peaked efficiency distribution in all countries. In Albania, a high share of farmers have an efficiency score lower than 30 and only a very small share of the farmers are efficient, i.e. they achieve an efficiency score close to 100. For Bulgaria, the lower peak shifted a bit to the right: the majority of farms reach an efficiency score between 10 and 40. 14% of the Bulgarian farms can be found on the frontier. In Slovakia, the majority of farms reach an efficiency level between 20 and 50 and a large share (22%) can be found close to or on the frontier. In the Czech Republic and Hungary, the lower peak shifts even more to the right. In the Czech Republic the majority of farms reach an efficiency level between 30 and 60 and 12% can be found in the highest efficiency category (90-100). In Hungary, most farmers have an efficiency score between 40 and 70 and 9 % have an efficiency score between 90 and 100. However, we have to take into account that the Slovak sample includes only registered farm households so that the Slovak efficiency distribution in figure 3.1 looks too positive compared to other countries.

The efficiency distribution illustrates that a country which is farther advanced in the transition stage has more farms that can be found on the boundary of the production possibility set and that the majority of farms reaches on average a higher efficiency level. Based on the efficiency distribution for each country, we estimate a kernel density function. This allows us to correct for the fact that the Slovakian data does not include non-registered farms and we can calculate the average total technical efficiency for each country assuming these density functions. Albanian farmers reach an average efficiency score of 25, Bulgarian farms an average efficiency level of 37, Czech farms an average efficiency level of 43 and Hungarian farms an average efficiency level of 47.

To illustrate the process of efficiency change, we present the estimated density function of the efficiency scores of 3 transition countries (Czech 1997, Bulgaria 1997, Albania 1999)[2] in figure 3.2. Figure 3.2 shows that Albania and Bulgaria have more observations with low total efficiency scores and "low efficiency" peaks. In the Czech Republic, a country more advanced in transition, there are more farms with higher efficiency scores. This suggests that transition induces a shift in the distribution of efficiency indicators.

To see how relative farm efficiencies are distributed in a market economy, i.e. in the final stage of the transition process, we use the results of a study by Wilson et al. (1998) on efficiency distribution among UK potato producers in 1992. The potato sector is good for comparison since it is one of the few EU crop sectors which are not distorted by large GDP subsidies. The efficiency distribution of the

[2] Replacing Czech Republic with Slovakia or Hungary would give similar results. Putting all in however complicates the picture without yielding more insights.

UK potato farms, compared to the other distributions (see figure 3.4) shows that in a market economy, most farms are close to the efficiency frontier. In fact there are few farms below 75% efficiency scores and the distribution is quasi-exponential towards the 90% efficiency.

5 Correlation between efficiency and reforms

The distributions in figure 3.1 and 3.2 suggest a particular relationship between farm efficiency and progress in some reform aspects. To analyse this further, we first compare the average farm efficiency with reform indices as calculated by the World Band and EBRD[3] in figures 3.3 and 3.4. The graphs show that there is a clear positive relation between the stage of transition of a country and the average efficiency level reached by the agricultural producers. In countries which are less advanced in the transition process, there are relatively more inefficient production units. In countries more advanced in transition, there are less efficient farms. While the strong correlations between the aggregate reform indicators suggest an important causal affect, the indicators as such tell us little about the mechanism. For this reason we want to develop a theoretical model. However, before doing this, let us take a closer look at the correlations between efficiency scores and the reform indices. The first observation, which at first sight is somewhat remarkable, is that there is a closer correlation with the EBRD index (a non-agricultural index) than with the WB agricultural reform index. This suggests that the key factor may be not specific to agriculture. One important factor is that all surveys were done in countries, and at times, when farms used private land plots and faced hard budget constraints. Hence, in these situations, other factors, such as access to input and output markets become the prime determinants of efficiency.

Second, if we disentangle the reform indices and correlate them with the observed efficiency scores (table 3.3), we see that there is significant correlation between efficiency and competition policy, enterprise reform, and institutional reforms. Again these correlations indicate the importance of general institutional reforms and reforms of the sectors "surrounding agriculture" as a source of efficiency growth. In general, good competition policy to reduce abuse market power is beneficial for the performance of an industry. However, in agriculture there is little market power. Therefore, maybe most important though is its indirect impact on agricultural producers. It may have an important impact on firms up- and downstream such as agribusiness and food processors. Domination of large companies in the in- or output markets will strongly affect farms. Enterprise reforms which contributed to significant and sustained harden budget constraints and to promote corporate governance (e.g. through privatisation combined with tight credit and subsidy policies and/or enforcement of bankruptcy legislation) may also cause higher efficiency of the farms.

In the next section, we will use these hypotheses that general institutional reforms and factor market imperfections in labour and capital are the prime determinants of farm efficiency to derive theoretical model of efficiency change during transition.

6 Theory

Following, the production model described in Gardener and Rausser (2001), each producer i chooses the input x_i to maximize the expected profits $\pi^i = q^i - wx_i$ where q^i is the value of output (whit the output price normalized at one), x_i the inputs used and w the (exogenous) input price. A single-input Cobb-Douglas function describes the production function:

$$q_i = Ax_i^{\beta} e^{m_i} \qquad (1)$$

[3] The World Bank agricultural reform index is an aggregate index of progress in land reform, price and market liberalization, reforms in the agro-processing sector and rural finance and of the institutional reforms. A score of one means no reform, i.e. a situation comparable with a centrally planned economy. The maximum score that a country can reach is 10 which means the market reforms have been completed and the situation is a free market economy. The EBRD transition indicator gives a score from 1 to 4. It aggregates assessments of the privatisation of small- and large scale enterprises, enterprise restructuring, price liberalisation, trade and foreign exchange system liberalisation, competition policy, bank and non-bank financial sector reforms. A rate of 4+ is given when standards and performance are comparable with those of advanced industrial economies. The general EBRD indicator is the average of the score given to the reforms in each area. We can assign to the UK the highest EBRD reform and WB agricultural reform index as the country is not in transition.

with m_i the firm effect, or management. The first order condition implies that at the optimum $\beta A x^{*\beta-1}_i = we^{m_i}$ which determines the optimal input x^{*i} and, givrn the Cobb-Douglas production function, also the optimum output q^{*i}.

In the DEA efficiency calculations, we calculate input-oriented efficiency scores. The technical efficiency is the amount by which all inputs could be proportionally reduced without a reduction in output. To calculate efficiency measures, we compare therefore the output-input ratio of producer i with the output-input ratio of a producer that can be found on the frontier and that produces that same output as household i, namely q^{*i}. We define the efficiency score as follows:

$$e^{*i} = \frac{q^{*i} / wx^{*i}}{q\# / wx^{\#}} \text{ with } q^{*i} = q^{\#} \tag{2}$$

and $wx^{\#}$ the cost function of the "efficient" producer, i.e. on the production possibility frontier. Combining (1) and (2), we can write the efficiency scores as follows:

$$e^{*i} = e^{(m_i - m_{\#})/\beta} \tag{3}$$

This means that the efficiency level of producer i depends on its own firm effect and on the firm effect of the producer that can be found on the frontier and that produces that same output as household i, namely q^{*i}. Assume that the firm effect depends on the managerial capacities *h* and on access to certain production technologies δ. We define δ as a discontinuous variable equal to H when the firm has access to high productive technologies or equal to L when the firm uses low productive technologies. We assume that the farmers that can be found on the frontier have all access high productive technologies. This allows defining the efficiency measure as follows

$$e^{*i} = e^{*i}(h^i, \delta^i, h^{\#}, \delta^{\#} = H) \tag{4}$$

Suppose that there are two factors that determine access to technology, namely the managerial capacity *h* and the market imperfections or transaction costs in accessing new technology which are exogenous to each producer, but which can be more easily overcome with higher managerial capacities.

One way to think about this process is that innovative or entrepreneurial strategies are needed to overcome these transaction costs and that people with more managerial capacities are more likely to implement such strategies. Another way in which transaction costs can be overcome is through a process of vertical integration in agri-food supply chains as described by Gow and Swinnen (1998, 2001) and Dries and Swinnen (2004). In this process, technology is provided to the producer by other companies, such as processors or traders, which face less credit and technology market constraints. Studies show that such companies are more likely to provide new technologies to suppliers with high managerial capacities.

Therefore, define Θ as the extent of market imperfections or transaction costs in the technology market for the farms. In order to have access to high productive technologies a producer needs to overcome this hurdle and therefore s/he needs at least the threshold amount of management capacities $\bar{h}$[4]. The magnitude of the threshold $\bar{h}$ is a positive function of Θ so that

$$\bar{h} = \bar{h}(\Theta) \text{ with } \frac{\delta \bar{h}}{\delta \Theta} > 0 \tag{5}$$

$$\delta = \delta(h, \bar{h}(\Theta)) \tag{6}$$

We assume that the following conditions hold for the efficiency function defined in (4):

$$e^{*i}(h^i, \delta = H, h^{\#}, \delta^{\#} = H) > e^{*i}(h^i, \delta = L, h^{\#}, \delta^{\#} = H) \text{ and } \frac{\partial e^{*i}(.)}{\partial h} > 0 \tag{7}$$

[4] One could argue that the magnitude of *h* is not exogenous to the above decision making process since each person takes into account that his/her managerial capacities affect access to production technologies when they decide how much to invest in acquiring these skills. Although, under communism several freedoms were limited as was the choice on how much to invest in development of certain skills.

Further, we assume that to continue farming a producer needs to reach a threshold income or amount of profits $\bar{\pi}$. Here, we assume that the threshold profit $\bar{\pi}$ that a producer needs to generate to continue farming is the opportunity cost of his labour which can be either off-farm wages, or retirement or unemployment benefits. Hence, a producer stays active in agriculture only if $\pi^{*i} > \bar{\pi}$. Less productive producers cease their activities.

We now can formulate the effective efficiency function $e^{effective}$ for each producer i as follows[5]:

$$e^{effective} = e^{H} \ \ if\ h > \bar{h}(\Theta)\ and\ \pi > \bar{\pi} \tag{8}$$

$$e^{efeictive} = e^{L} \ \ if\ h < \bar{h}(\Theta)\ and\ \pi > \bar{\pi} \tag{9}$$

Economic reforms are assumed to reduce market imperfections and therefore to lower transaction costs Θ, and also to increase the opportunity costs $\bar{\pi}$ because of improved labour mobility and more job alternatives. Consequently, more farmers will move from e^{L} to e^{H}. In addition, the least productive farmers will leave agriculture so that the number of farmers with low technology e^{L} decreases even more.

As a result, economic reforms will cause an increase in the share of high efficiency producers and a decline of low efficiency producers through this process of endogenous technology adoption with falling transaction costs and increasing opportunity costs. Other factors which affect opportunity costs will affect the number of inefficient producers, but not that of efficient producers.

7 Simulation Model

To see how these changes affect the distribution of production efficiencies in a heterogeneous population, we will use a simulation approach. By using specific parameters for the model described above, we can simulate how the efficiency of the producers and, the average efficiency of the agricultural sector changes with the state of reforms. Suppose equations (8) and (9) have the following functional form:

$$e^{L} = e^{(0.08h-1)/0.6} \text{ with } h \in [1,10] \text{ and } e^{L} \in [0, 0.72] \tag{10}$$

$$e^{H} = e^{(0.1h-1)/0.6} \text{ with } h \in [1,10] \text{ and } e^{H} \in [0,1] \tag{11}$$

with h uniformly distributed over the interval [1,10] and different access to technologies incorporated in a different coefficient of h. Given (5), a possible correlation between $\bar{h}$ and Θ is $\bar{h} = \alpha\Theta$ and to start, we assume that $\alpha = 1$. Since each producer maximizes its profits and given the production function defined in (1), $\bar{\pi}$ can be expressed as a linear combination of e^{m_i}. Since the firm effect m_i depends on h_i, $\bar{\pi}$ is a function of h_i.

When *h* is large enough, i.e. larger than $\bar{h}$, the producer uses the best technology, as identified by condition (11) . Otherwise, the low efficiency technology in (10) is used.

The average efficiency equals $\frac{1}{n}\sum_{i=1}^{n} e_i^{effective}$ with n=number of producers.

We now stimulate the models with various parameters for $\bar{\pi}$ and Θ to reflect different stages in transition and reforms. We assume that initially (t=0) $\bar{\pi}$ equals 0 because at the start of the reforms, off farm labour opportunities are limited and soft budget constraints apply so that $\bar{\pi}$ is small. $\bar{\pi}$ increases with time. Furthermore, in the beginning of the transition period, farmers experienced a large hurdle Θ, but this hurdle decreases over time. As we move from t=0 to t=3, we move from a situation where more farms get access to better technologies due to lower constraints. The lower Θ, the more producers we find for which holds (11) i.e. the more producers reach the high efficiency function e^{H}. The higher $\bar{\pi}$, the fewer "low efficient farms" stay in agriculture. At t=3 we find only producers for which equation (11) holds. Figure 3.5 illustrates how the efficiency distribution changes

[5] To simplify our notification we will use the notation $e^{H}\ for\ e^{*i}(h^i, \delta = H)$ and $e^{L}\ for\ e^{*i}(h^i, \delta = L)$.

when a country moves from t=0 to t=3 under these simulation assumptions. This is comparable with the efficiency distribution we observe in transition countries (figure 3.3). To obtain the depicted shift in distribution both an increase in $\bar{\pi}$ and a decrease in Θ are necessary to shift the first peak to the right and an increase in Θ results in an increase of the second peak at the expense of the first peak.

As explained in the theory section, reduced transaction costs through reforms will affect Θ. The increase in $\bar{\pi}$ may be caused both by reforms which increase the opportunity cost of agricultural production and, in a cross-country comparison, by higher social benefits or higher off-farm wages. If one considers the degree of unemployment and a country's GDP per capita as a proxy for the opportunity cost of labour, the relationship between unemployment and efficiency, and GDP per capita and efficiency, as depicted in table 3.3, are then consistent with our hypothesis that one of the prime determinants of farm efficiency are a combination of general labour market imperfections and the relative size of social benefits.

8 Conclusions

In this paper, we use farm survey data from 5 East European countries collected in 1997-1999 to calculate farm efficiencies and to analyse how reforms affect the process of restructuring and efficiency change. In all 5 countries (Albania, Bulgaria, Czech Republic, Hungary, Slovak Republic) land reforms have been largely completed at the time of the survey and farms were largely private and working with hard budget constraints. However, they differ significantly in their role of agriculture, level of development, farm structure and progress in institutional reforms.

We first provide empirically strong support for a positive impact of reforms on productivity in agriculture. We find that the share of efficient agricultural producers is strongly positively correlated with reforms in the five countries in their stages of transition.

Second, the correlations suggest that, in particular, general institutional reforms and reforms focused on market institutions and on improving access to inputs and output markets have an important positive impact on farm efficiency for the countries included in the analysis.

Third, we develop a theoretical model to explain differences in efficiency distribution between countries at different levels of transition and reforms. According to our model, labour opportunity costs increase with transition and transaction costs to access capital and technology decrease. As a result, more farmers become efficient and the least efficient stop producing. The simulations based on our theoretical model are consistent with the empirically observed changes in efficiency distributions during transition. They further lend support to the hypotheses that farm productivity increases are strongly constrained by factor market imperfections, including labour market imperfections, and limited opportunities for off-farm employment. Farm productivity is strongly correlated with general institutional reforms and reforms of the sectors "surrounding agriculture".

Table 3.1 Country characteristics

	Albania	Bulgaria	Czech	Hungary	Slovakia
Share of land cultivated by individual farms (%)	95 (2000)	52 (1997)	26 (2000)	54 (1997)	9 (2000)
Land reform	Distribution (physical)	Restitution	Restitution + sale (renting) [a]	Restitution + distribution (physical) + Sale for compensation bonds	Restitution + Sale (renting)[a]
Share of agriculture in total employment	51 (2000)	23 (1997)	5 (2000)	8 (1997)	7 (2000)
Unemployment	18 (2000)	15 (1997)	9 (2000)	9 (1997)	19 (2000)

[a] Land is rented to individuals or entities pending sale
Source: National statistics

Table 3.2 Summary statistics

		Number of observations	Total cultivated land (ha)	Labour (AWU)
Albania	Individual farms	210	1.6	1.8
Bulgaria	Individual farms	39	6	1.2
	Enterprises	54	774	79
Czech Rep	Individual farms	131	54.4	2.1
	RIF	109	64.9	2.3
	NRIF	22	2.5	1
	Enterprises	52	1264	79.3
Hungary	Individual farms	75	26	1.2
	Enterprises	103	1504	46
Slovak Rep	Individual farms (RIF)	67	74	3
	Enterprises	71	2010	252

Source: Own calculations

Table 3.3 Efficiency and reform indices of 5 transition countries and the UK

	Albania - 1999	Bulgaria - 1997	Slovakia - 1999	Czech - 1999	Hungary - 1997	UK-1992	Correlation coefficient with ToE exl UK	Correlation coefficient with ToE incl UK
Est average ToE	**24.7**	**37.1**	**41.1**	**43.0**	**47.2**	**90**	1.00	1.00
EBRD reform indices	**2.6**	**2.9**	**3.3**	**3.5**	**3.7**	**4.3**	0.95	0.92
Price liberalisation	3.0	3.0	3.0	3.3	3.0	4.3	0.29	0.94
Forex and trade liberalisation	4.0	4.3	4.3	4.3	4.3	4.3	0.91	0.49
Enterprise reform	2.0	2.3	3.0	3.3	3.0	4.3	0.87	0.93
Competition policy	1.7	2.3	3.0	3.0	3.0	4.3	0.95	0.95
Small scale privatisation	4.0	3.3	4.3	4.3	4.3	4.3	0.38	0.37
Large-scale privatisation	2.0	3.0	4.0	4.0	4.0	4.3	0.96	0.69
Banking sector reform	2.0	2.7	3.3	4.0	2.7	4.3	0.66	0.77
Reform non-banking financial institution	1.7	2.0	3.0	3.3	2.3	4.3	0.65	0.87
WB agr reform indices	**6.8**	**5.4**	**7.6**	**8.6**	**8.6**	**10**	0.59	0.77
Price&market	8.0	6.0	7.0	9.0	9.0	10	0.30	0.66
Land reform	8.0	7.0	8.0	8.0	9.0	10	0.42	0.83
Agro-processing	8.0	5.0	8.0	9.0	9.0	10	0.31	0.58
Rural finance	5.0	4.0	8.0	9.0	8.0	10	0.70	0.72
Institutional	5.0	5.0	7.0	8.0	8.0	10	0.84	0.87
GDP per capita (constant 1995 US$)	**960**	**1349**	**4180**	**5206**	**4662**	**17698**	0.85	0.94

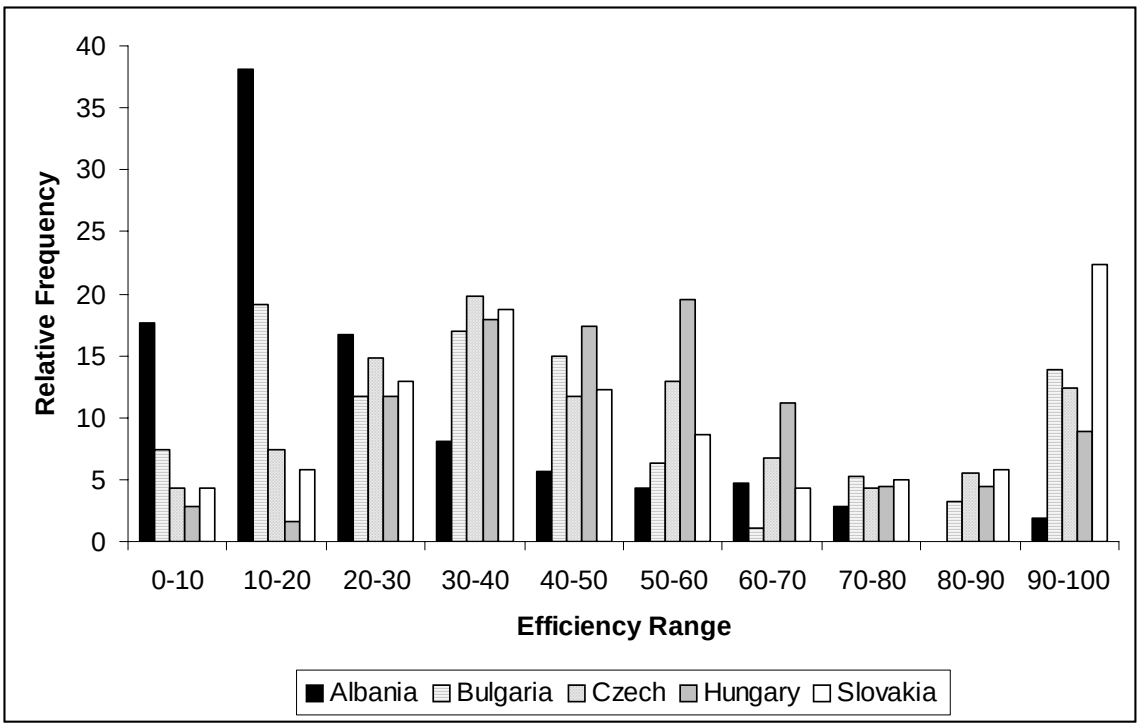

Figure 3.1a Distribution of total technical efficiency.

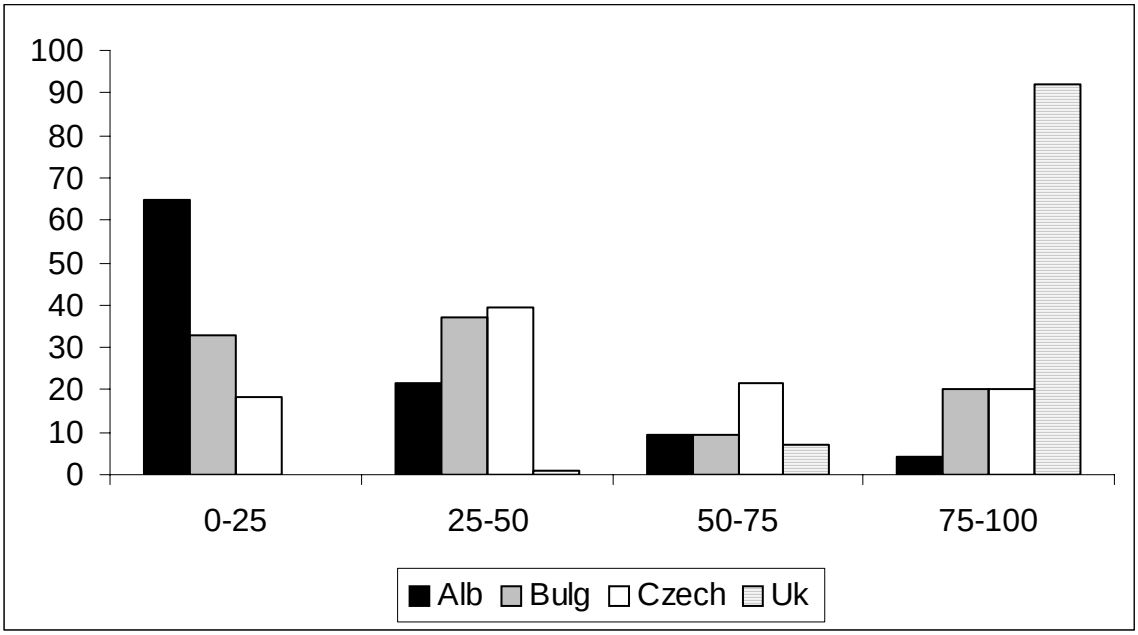

Figure 3.1b Distribution of total technical efficiency.

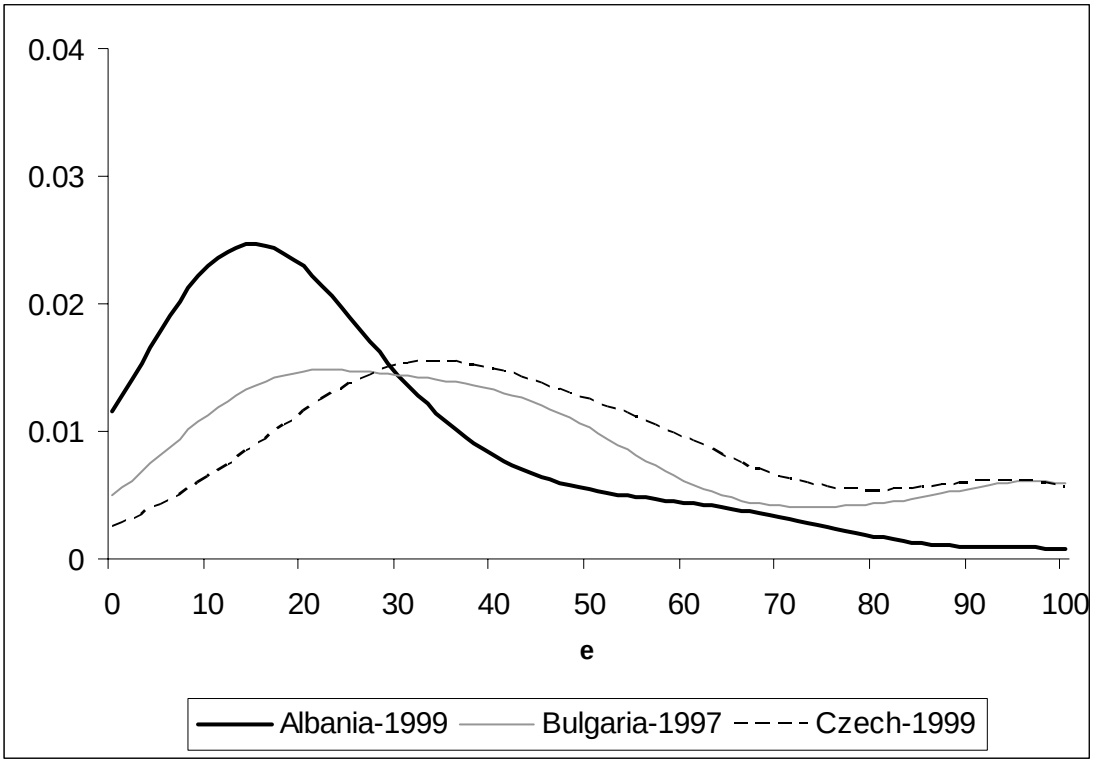

Figure 3.2a Kernel densities for 3 transition countries

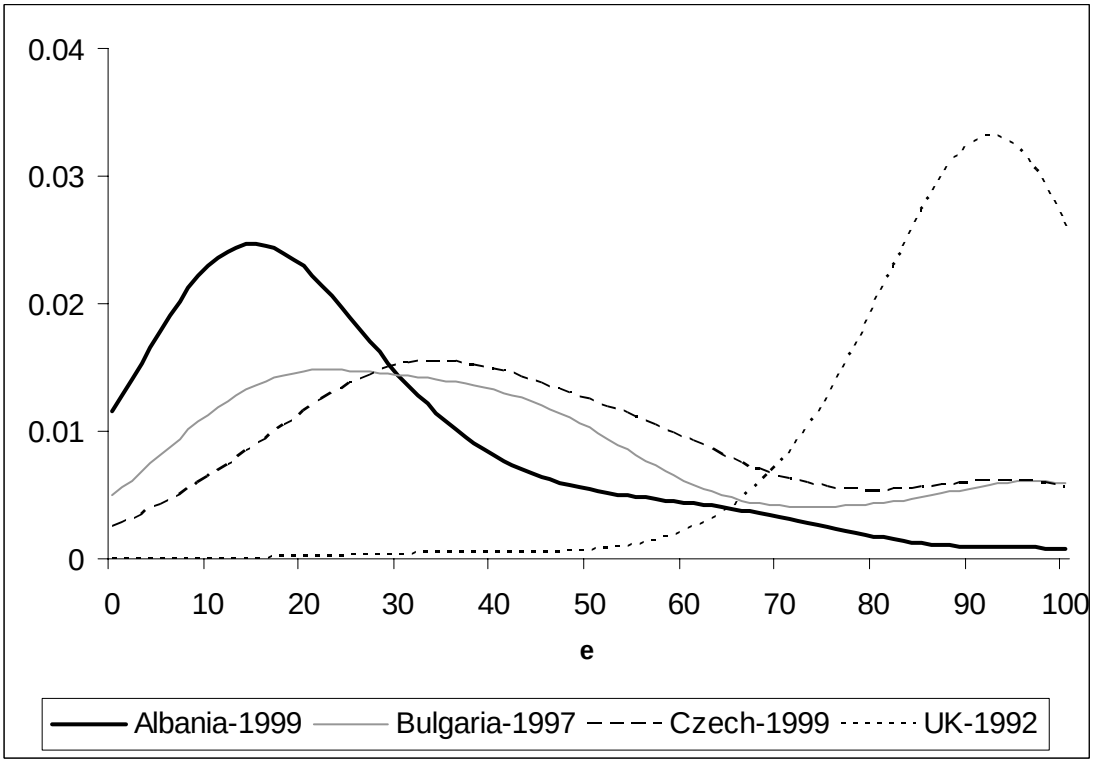

Figure 3.2b Kernel densities for 3 transition countries and the UK

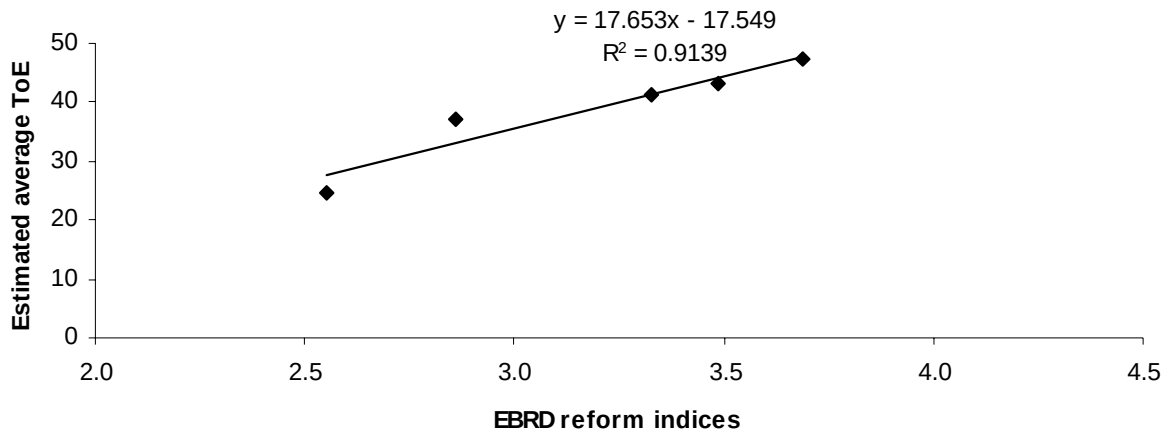

Figure 3.3a Relation between efficiency of agricultural production in 5 transition countries and EBRD reform indices, and fitted trend line

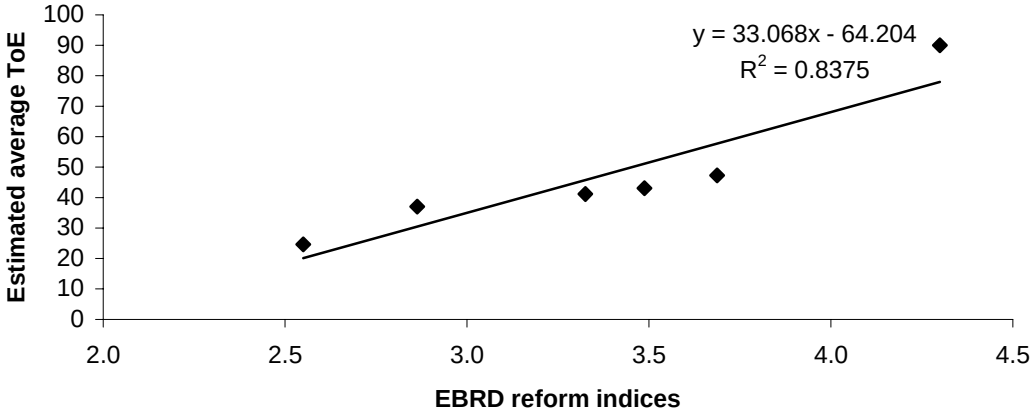

Figure 3.3b Relation between efficiency of agricultural production in 5 transition countries plus UK and EBRD reform indices, and fitted trend line

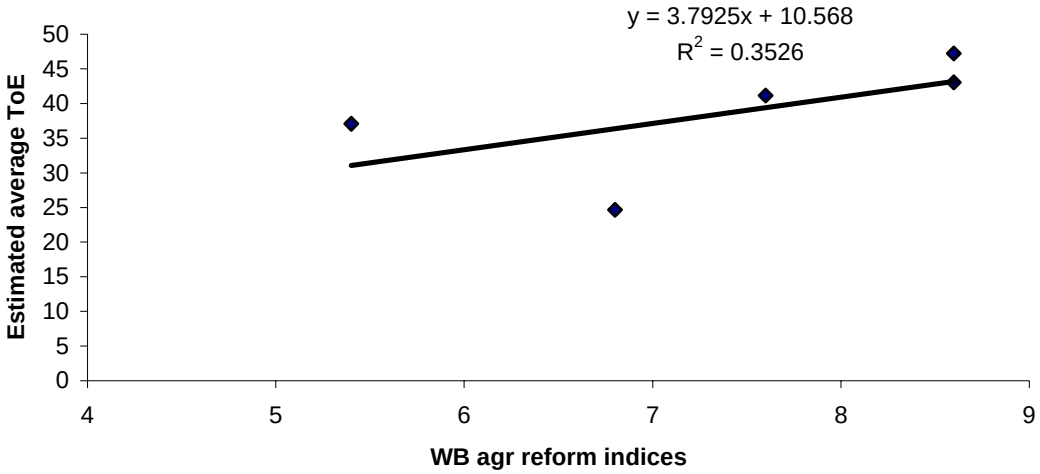

Figure 3.4a Relation between efficiency of the agricultural sector in 5 transition countries and WB agr. reform indices, and fitted trend line

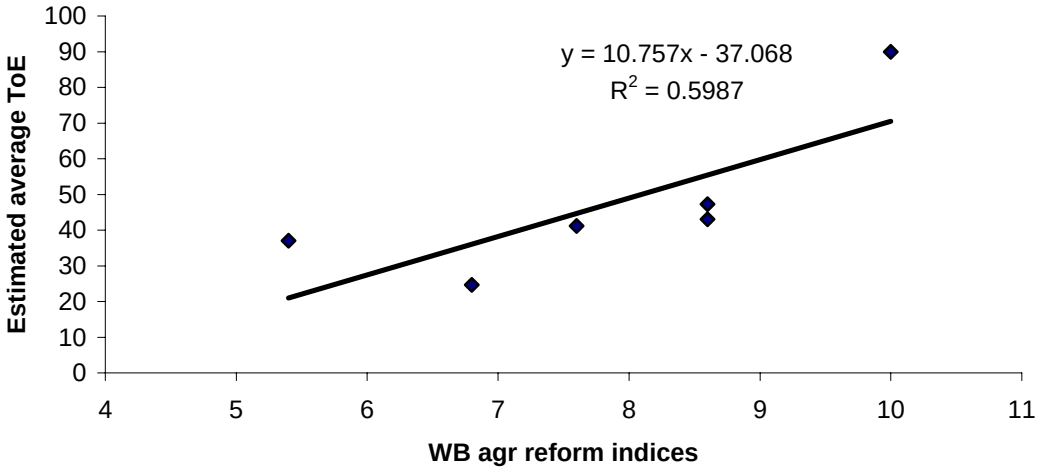

Figure 3.4b Relation between efficiency of agricultural production in 5 transition countries plus the UK and WB agr. reform indices, and fitted trend line

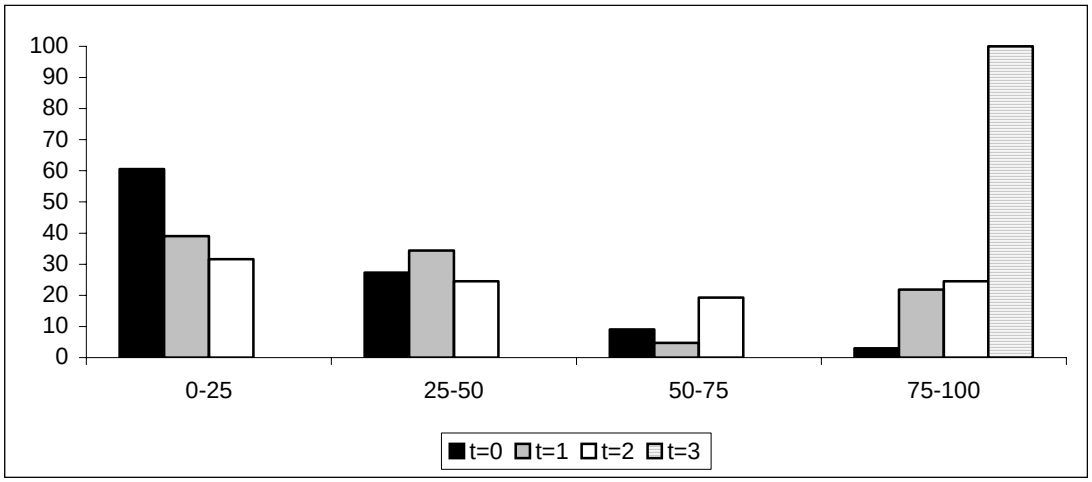

Figure 3.5a Simulated impact of reforms on the distribution of total technical efficiency for four transition stages

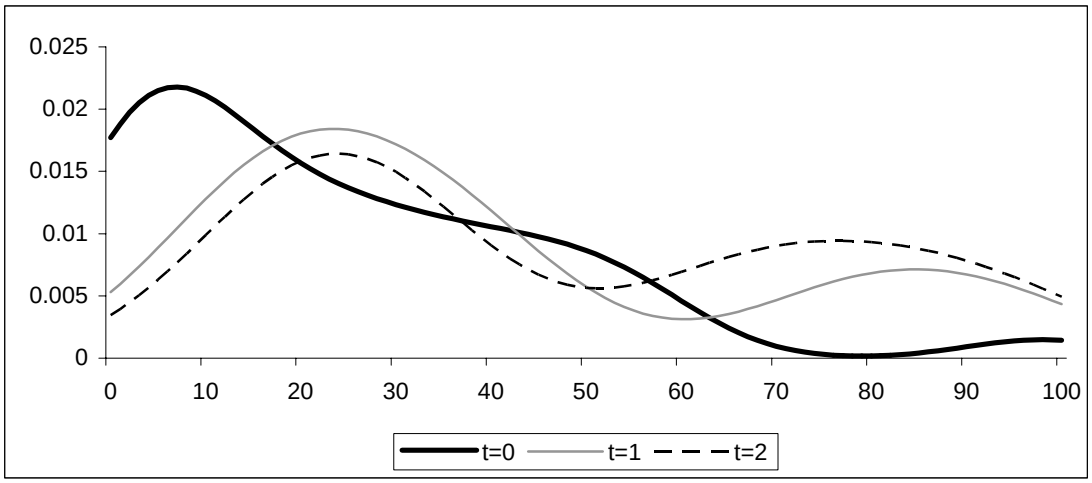

Figure 3.5b Simulated impact of reforms on kernel density of total technical efficiency for three transition stages

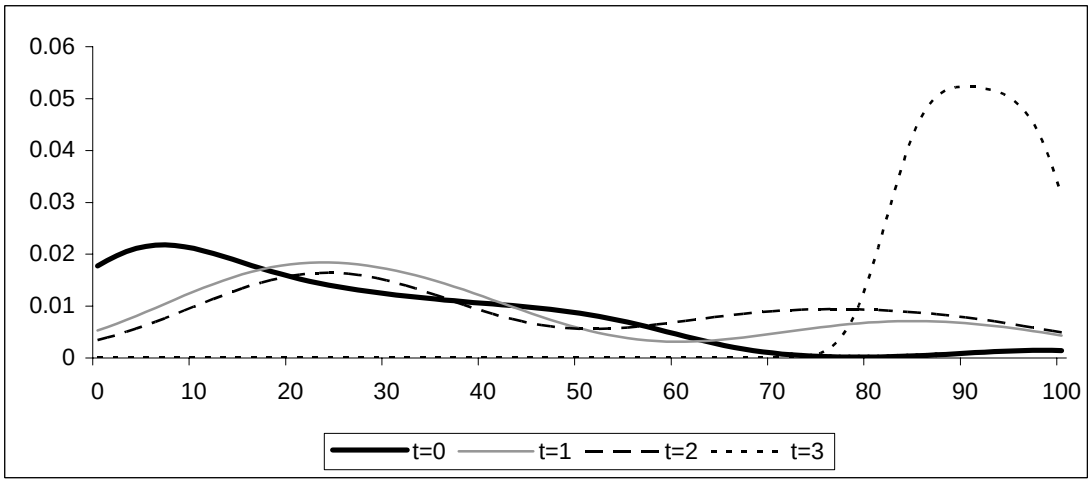

Figure 3.5c Simulated impact of reforms on kernel density of total technical efficiency for four transition stages

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