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# **Agricultural Recovery in CIS: Lessons of 15 Years of Land Reform and Farm Restructuring<sup>1</sup>**

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**Plenary paper prepared for presentation at the joint IAAE - 104<sup>th</sup> EAAE Seminar**  
**Agricultural Economics and Transition:**  
**„What was expected, what we observed,**  
**the lessons learned."**

**Corvinus University of Budapest (CUB)**  
**Budapest, Hungary. September 6-8, 2007**

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## Agricultural Recovery in CIS: Lessons of 15 Years of Land Reform and Farm Restructuring<sup>1</sup>

The objective of this paper is to examine the impacts of land reform policies in CIS countries on agricultural performance, including growth and productivity. The focal thesis of the study is that agricultural development in CIS is mainly driven by policy factors, and it is changes in policies (whether agricultural or general economic) that cumulatively affect growth, employment, and productivity in the large rural sector in CIS. International development organizations, such as the World Bank, USAID, and FAO, have a clear role in these countries because of their large rural population and the strong dependence on agriculture as a source of family incomes. Continuing policy advice can help on two interlinked levels: (a) helping CIS farmers achieve higher profitability and thus accelerate capital formation through farming activities; (b) helping CIS farmers use their accumulated profits to diversify into non-agricultural activities as an essential component of a new rural (as distinct from agricultural) development orientation.

The data used in this report are taken from official statistical sources of the 12 CIS countries. An authoritative database is published annually on a CD-ROM by the Interstate Statistical Committee of the CIS in Moscow, utilizing statistics regularly reported by the member countries. In this study we have used the 2005 database (CIS, 2005). The CIS database covers all the years from 1980 to 2004, and thus provides a useful comparative view of the last decade of the Soviet regime and the 15 years of transition. Some inevitable gaps in the CIS database have been filled in from country yearbooks.

### Setting the stage

The 12 former Soviet republics that form the Commonwealth of Independent States (CIS) span three geographical regions – the European part of the former Soviet Union, Transcaucasia, and Central Asia (**Table 1**). Russia is generally regarded as a “European” country, although a huge part of its territory (though not population) is in Asia. In addition to geographical location, the CIS countries are usually classified into “small” and “large” by both population and area. Turkmenistan is generally regarded as a “small” country because of its small population (5-6 million), although its territory – mostly desert – is the fourth largest in CIS after Russia, Kazakhstan, and Ukraine. Uzbekistan has a large population but a relatively small territory. It is accordingly classified as “medium” in **Table 1** and is lumped with the small countries for purposes of analysis.

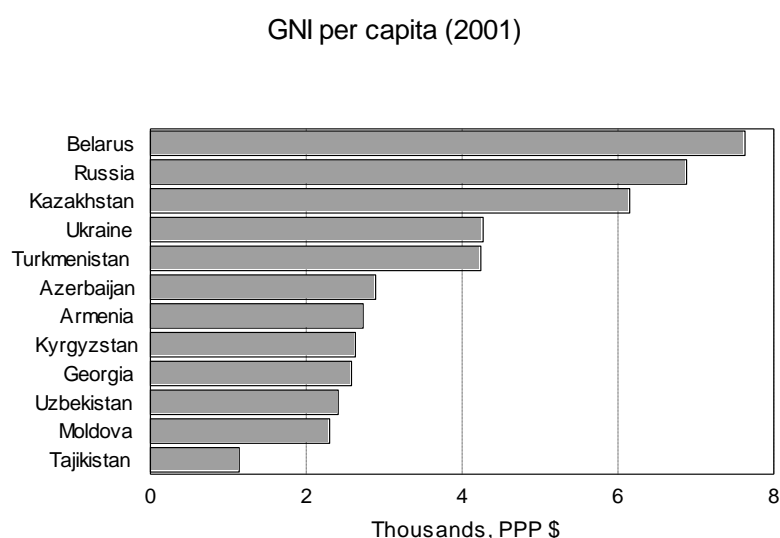
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<sup>1</sup> Paper prepared for the Joint IAAE-EAAE Seminar *Agricultural Economics and Transition: What Was Expected, What We Observed, The Lessons Learned*, Corvinus University, Budapest, September 6-8, 2007. The analysis was developed during the months of July-October 2006 when the author was Visiting Expert at FAO's Regional Office for Europe and Central Asia in Rome. Close collaboration with David Sedik, Head of the Regional Office's Policy Assistance Branch (REUP), greatly contributed to this study. The author wishes to acknowledge the insightful comments of John Nash and Paloma Anos of the World Bank on an earlier draft.

**Table 1. A typology of CIS countries**

	Location	Size	Income categories	ECA Agricultural Policy Index (2004)	ECA Land Reform Index (2004)
Russia	“Europe”	Large	Middle Income	6.2	5
Ukraine	“Europe”	Large	Lower Middle Income	6.2	6
Belarus	“Europe”	Large	Middle Income	2.6	2
Moldova	“Europe”	Small	Low Income	6.0	7
Armenia	Transcaucasia	Small	Low Income	7.8	9
Georgia	Transcaucasia	Small	Low Income	6.0	7
Azerbaijan	Transcaucasia	Small	Low Income	6.6	9
Kazakhstan	Central Asia	Large	Middle Income	6.2	5
Kyrgyzstan	Central Asia	Small	Low Income	7.4	8
Tajikistan	Central Asia	Small	Low Income	5.2	6
Turkmenistan	Central Asia	Small	Lower Middle Income	1.8	2
Uzbekistan	Central Asia	Medium	Low Income	4.0	5

Another useful classification of the CIS countries is into “poor” and “not poor”. This classification can be based, in particular, on GNI per capita, which is shown in **Figure 1** for all 12 countries (in PPP \$). In **Table 1**, the 12 countries are categorized into Low Income, Lower Middle Income, and Middle Income based on WDI thresholds for these income categories (the GNI data for Turkmenistan and its classification as an LMI country are doubtful).

**Figure 1.**

Source: WDI

The last two columns in **Table 1** give the World Bank’s ECA Agricultural Policy Reform Index and the ECA Land Reform Index, which quantify the status of agricultural reforms in each country as of the end of 2004.<sup>2</sup> The ECA Agricultural Policy Index is a composite measure that incorporates progress with land reform (as expressed by the Land Reform Index) and four additional components: liberalization of agricultural markets, privatization and demonopolization of agricultural services (both upstream and downstream), establishment of an institutional framework for market agriculture, and development of rural finance.

The ECA Agricultural Policy Reform Index is constructed on a scale from 1 to 10, where 1 corresponds to a command economy and 10 to an economy with completed market reforms.

<sup>2</sup> The World Bank’s ECA Agricultural Policy Reform Index was introduced in 1997 (Csaki and Nash, 1998) and subsequently updated on an annual basis. For latest updates see Csaki and Kray (2005).

Accordingly, countries with policy reform index above 7 are characterized as advanced reformers, countries with policy reform index between 6 and 7 are moderate reformers, and countries with policy reform index below 6 are slow reformers. Among the CIS countries, only Armenia and Kyrgyzstan are advanced reformers. Most countries – Russia, Ukraine, Kazakhstan, Moldova, Azerbaijan, Georgia – are moderate reformers. Belarus and three Central Asian States – Tajikistan, Turkmenistan, and Uzbekistan – are classified as slow reformers. In terms of regional classification, all three Transcaucasian countries are in the top two groups of advanced in moderate reformers, whereas three of the five Central Asian states (with the exception of Kyrgyzstan and Kazakhstan) are in the bottom group of slow reformers. The ranking by the ECA Agricultural Policy Index is closely correlated with rankings by other popular indices, such as the EBRD Transition Index or the Freedom House Index.

### *Land reform and changing farm structure in CIS*

The land reform component of the ECA Agricultural Policy Index (see the last column in **Table 1**) essentially measures how far land tenure and farm structure have advanced from the socialist model of predominantly large-scale collective agriculture to the market model with predominance of relatively small family-operated units. This approach to land reform emphasizes individualization of agriculture – and not just privatization of land in the formal sense of ownership transfer from the state to private owners or the establishment of sophisticated land titling and registration systems. **Table 2** summarizes the different forms of land tenure and farm structure that have emerged across the CIS countries as a result of differences in the implementation of land reform.

**Table 2. Differences in implementation of land reform in CIS**

	Potential private land ownership	Allocation strategy	Transferability	Farm organization	Watershed date for individualization
Armenia	All	Plots	Buy/sell, lease	Individual	1992
Georgia	All	Plots	Buy/sell, lease	Individual	1992
Azerbaijan	All	Plots	Buy/sell, lease	Individual	1996
Moldova	All	Shares to plots	Buy/sell, lease	Individual + corporate	1998
Ukraine	All	Shares to plots	Buy/sell, lease	Individual + corporate	2000
Kyrgyzstan	All	Shares to plots	Buy/sell, lease	Individual + corporate	1998
Kazakhstan	All	Shares to plots*	Buy/sell, lease	Individual + corporate	2003
Russia	All	Shares	Buy/sell, lease	Corporate + individual	**
Tajikistan	None	Shares to plots	Use rights	Individual + corporate	1999
Turkmenistan	All	Leasehold	None	Individual leaseholds	1998
Uzbekistan	None	Leasehold	None	Individual leaseholds	2004
Belarus	Household plots only	None	None	Corporate + individual	**

\*The June 2003 Land Code practically annulled the permanent rights associated with land shares and forced the share-holders either to acquire a land plot from the state (by outright purchase or by leasing) or to invest the land share in the equity capital of a corporate farm.

\*\*In Russia and Belarus individual farms began to be created in 1992, but the process of individualization has not taken off as in other countries.

Land privatization in the strictly legal sense of “destatization” of land ownership has been implemented by most CIS countries. Only three countries – Belarus, Uzbekistan, and Tajikistan – retain exclusive state ownership of land, while Turkmenistan allows a curious form of private land ownership that rules out transferability and is thus stripped of the main characteristics of private property. Individualization of land tenure shows much greater diversity across the CIS countries. Armenia and Georgia resolutely individualized their

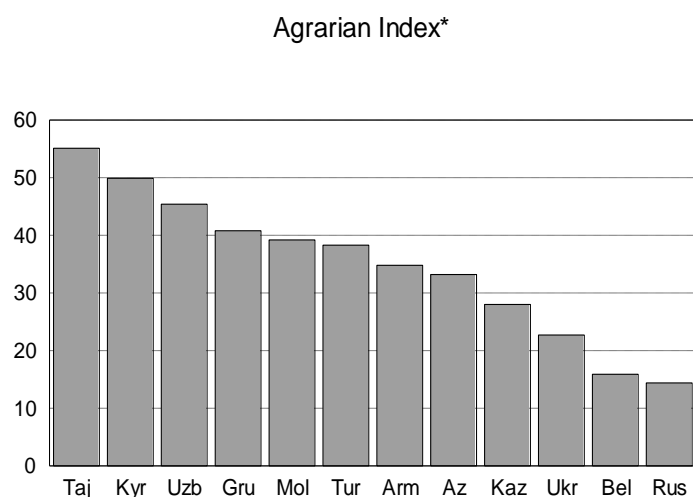
agriculture back in 1992 by distributing all land traditionally held by large collectives to rural households. Azerbaijan followed in 1996. In these three countries, virtually all agricultural land today is in individual tenure and family farms produce almost the entire agricultural output. The average Land Reform Index for these three countries is accordingly 8.3 out of 10. At the other extreme we find Russia and Belarus, where family farms now exist in much greater numbers than before 1991, but 80%-90% of agricultural land is still controlled by large former collectives. The Land Reform Index for these conservative countries is 3.5. In the middle there are Moldova and Ukraine, with an average Land Reform Index of 6.5: these countries initially followed the Russian model of distributing land to the rural population in the form of paper certificates of entitlement ("land shares") but ultimately began to convert the paper shares into physical land plots given to rural households (Moldova in 1998, Ukraine in 2000). In Central Asia, Turkmenistan and Uzbekistan follow their own peculiar strategy of farm individualization, which is based on leasehold arrangements entrusting the cultivation of farm land to rural families through lease contracts linked to production quotas. In Kazakhstan individual farms predominantly rely on land leased from the state, although private land ownership was formally recognized in the June 2003 Land Code. Tajik farmers individualized their holdings, mainly after 1999, by converting land shares to plots of state-owned land in use rights. Kyrgyzstan made important progress toward full recognition of private land ownership in 1999-2000, and this policy change was followed by significant distribution of land to individuals and families. The Land Reform Index for Central Asian countries reflects the variability in their land reform policies, ranging from a low of 5 for Turkmenistan and Kazakhstan to a high of 8 for Kyrgyzstan.

## Changes of agrarian scene

Most CIS countries are generally regarded as highly agrarian, especially compared to Western Europe and North America. The rural or agrarian character of a country can be assessed by three indicators: the share of rural population (in percent of total population), the share of agricultural employment (in percent of total employment), and the share of agricultural Gross Value Added (GVA) in the country's GDP. These components of a country's agrarian profile are given in **Table 3**, which also calculates an ad hoc "agrarian index" of each country as the arithmetic average of the three components (the agrarian index is thus expressed in percent). This is an aggregate characteristic of a country's agrarian nature (**Figure 2**).

**Table 3. The agrarian profile of CIS countries (2004 or latest available data)**

	Share of rural population	Share of agriculture in total employment	Share of agriculture in GDP	Agrarian index
Azerbaijan	48.5	40.0	11.3	33.2
Armenia	35.9	45.8	22.7	34.8
Belarus	28.0	10.7	8.9	15.9
Georgia	47.8	58.6	16.0	40.8
Kazakhstan	42.9	33.2	7.9	28.0
Kyrgyzstan	65.1	51.8	32.9	49.9
Moldova	59.0	40.4	18.2	39.2
Russia	27.0	11.0	5.1	14.4
Tajikistan	73.6	67.6	24.2	55.1
Turkmenistan	56.4	no data available	20.2	38.3
Uzbekistan	62.6	no data available	28.3	45.4
Ukraine	32.6	24.6	10.8	22.7

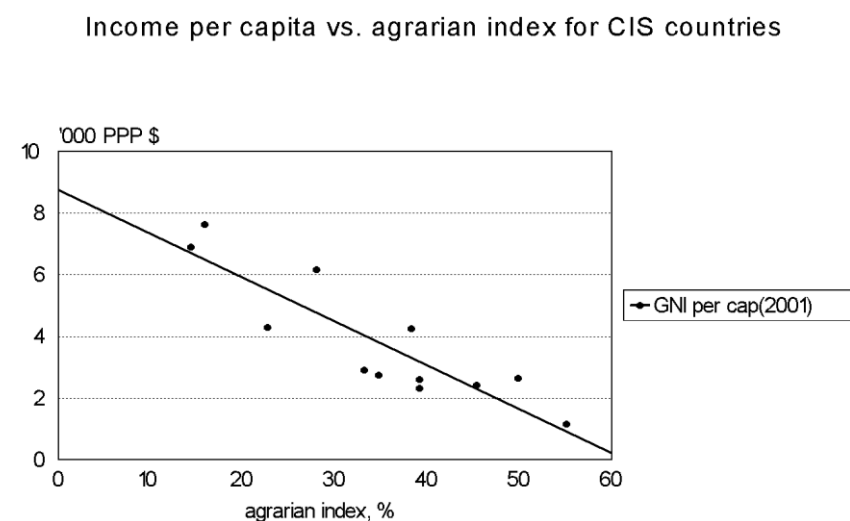


\*Average of rural population share, ag employment share, and ag share in GDP

**Figure 2.**

The highest income countries – Russia, Belarus, Ukraine, and Kazakhstan – are also the least agrarian (**Figure 2**). The poorest country – Tajikistan – has the highest agrarian index. Overall, there is a strong negative correlation between the agrarian index and income per capita: as the agrarian index increases, GNI per capita decreases (see **Figure 3**; the coefficient of correlation is  $-0.9$ ). This inverse relationship between the country's agrarian profile and per capita income is a standard empirical fact in development economics

(Chenery and Syrquin 1975). We now proceed to examine the changes in the components of the agrarian profile of CIS countries over time.



**Figure 3.**

### *Rural population*

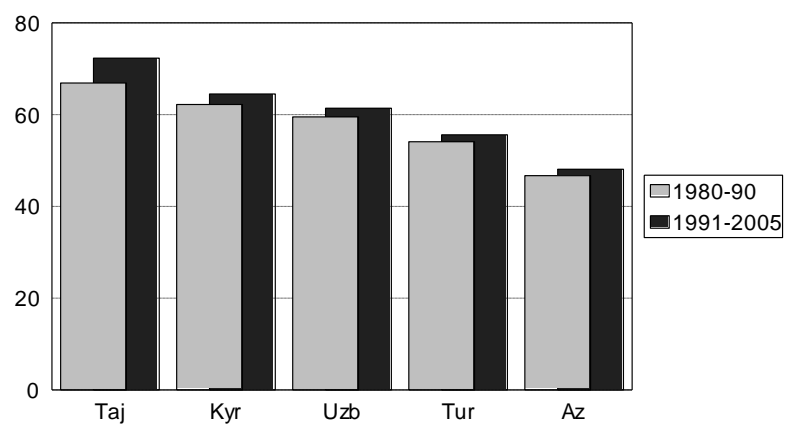
Examining the changes in the share of rural population over time, we notice that the 12 CIS countries fall into three distinct groups (**Table 4; Figures 4A, 4B, 4C**):

- (1) The group of 5 countries where the average share of rural population increased between 1980-90 and 1991-2005. These five countries – Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan in Central Asia and Azerbaijan in Transcaucasia – are undergoing increasing ruralization, which is a surprising phenomenon in the developed world.
- (2) The three Slavic countries – Russia, Ukraine, and Belarus – are undergoing increasing urbanization, as is evident from the decrease in their share of rural population.
- (3) In the remaining four countries – Armenia and Georgia in Transcaucasia, Kazakhstan in Central Asia, and Moldova in the European CIS – the share of rural population did not change over time.

The share of rural population increased between 1980-90 and 1991-2005 in countries with growing rural population, such as Central Asia and Azerbaijan (see the last two columns in **Table 4**). This implies that the rural population in these countries is growing faster than the urban population – another facet of ruralization. On the other hand, in countries characterized by declining or unchanged share of rural population, the rural population is generally shrinking, either due to the overall population decline or to faster growth of urban population. The different growth patterns of rural population in the two groups of countries are shown in **Figure 5**, where the rural population index (with 1980=100) has been aggregated as the arithmetic average of the indices for the group of six countries with growing rural population and the group of six countries with declining rural population.

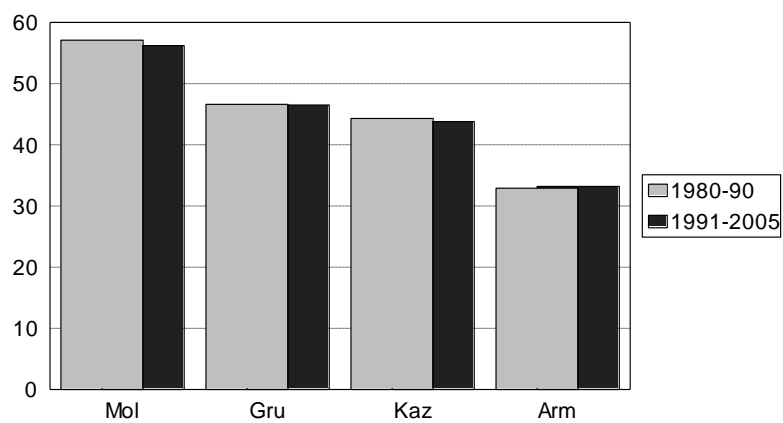


Share of rural population increasing 1980-2005



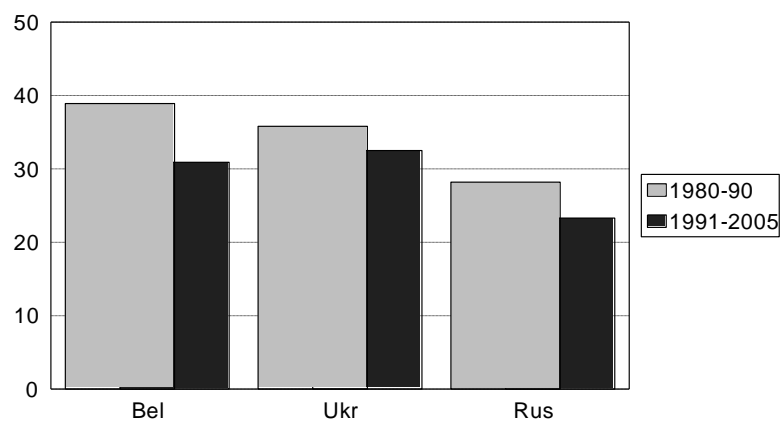
**Figure 4A.**

Share of rural population unchanged 1980-2005



**Figure 4B.**

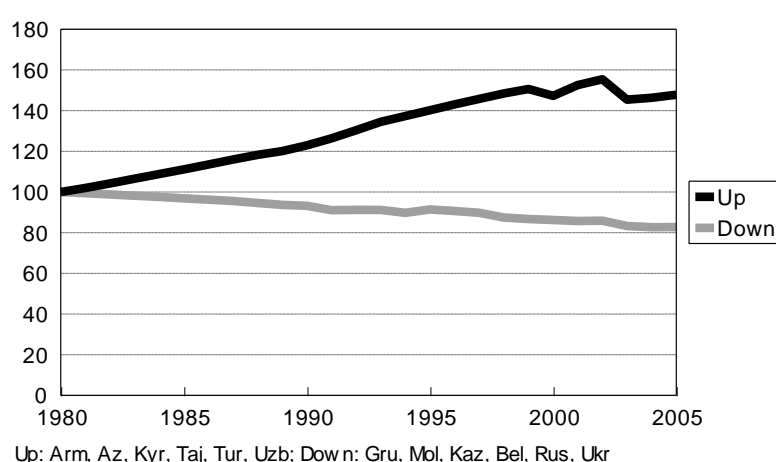
Share of rural population decreasing 1980-2005



**Figure 4C.**

**Table 4. Changes in share of rural population between 1980-90 and 1997-2005**

Country	1980-90	1991-96	1997-05	Direction of change from 1980-90 to 1991-2005	Rural population in percent of 1980	Rural population trend since 1980
Tajikistan	67	71	73	Up	194 (2005)	Growing
Kyrgyzstan	62	63	65	Up	148 (2004)	Growing
Uzbekistan	59	61	62	Up	164 (2000)	Growing
Turkmenistan	54	55	56	Up	183 (2001)	Growing
Azerbaijan	47	47	49	Up	140 (2005)	Growing
Armenia	33	32	34	No change	109 (2005)	Growing
Moldova	57	54	58	No change/Down	88 (2004)	Declining
Georgia	47	46	47	No change	84 (2004)	Declining
Kazakhstan	44	44	44	No change	94 (2005)	Declining
Belarus	39	32	30	Down	65 (2005)	Declining
Ukraine	36	32	32	Down	80 (2005)	Declining
Russia	28	27	21	Down	92 (2005)	Declining

**Rural population growth in CIS 1980-2005****Figure 5.**

### *Agricultural employment*

While the share of rural population behaved over time differently for different groups of countries, the share of agricultural employment increased over time in all CIS countries, except Belarus. Even in Russia and Ukraine, where the share of rural population declined, the share of employed in agriculture increased between 1980-89 and 1990-2004 (albeit slightly). The countries that showed the strongest increase in agricultural employment were Tajikistan, Kyrgyzstan, Armenia, and Moldova (**Figure 6, Table 5**). There is no clear relationship between the change in rural population and the change in agricultural employment in the two periods.

The additional labor force came into agricultural through layoffs in manufacturing industries, as the share of industrial employment *decreased* in all CIS countries between 1980-89 and 1990-2004. The share of employment in other sectors (services, construction, extractive industries) shows a variable pattern: in some countries these sectors absorbed part of the slack

from the shrinking industries, while in other countries these sectors also contributed to the increase in agricultural labor.

Share of agricultural employment 1980-2004

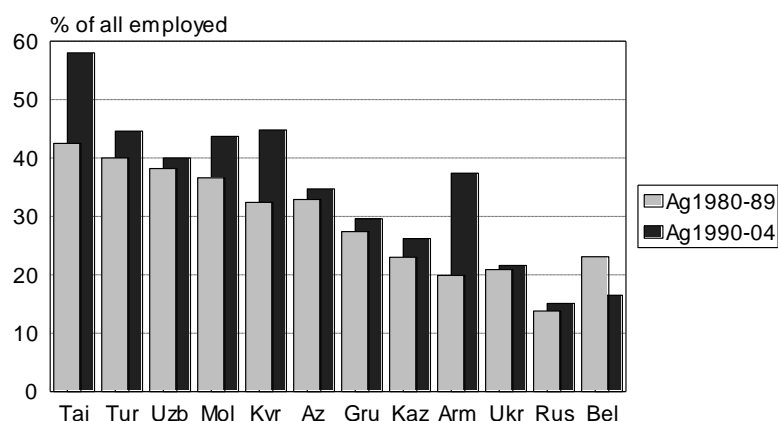


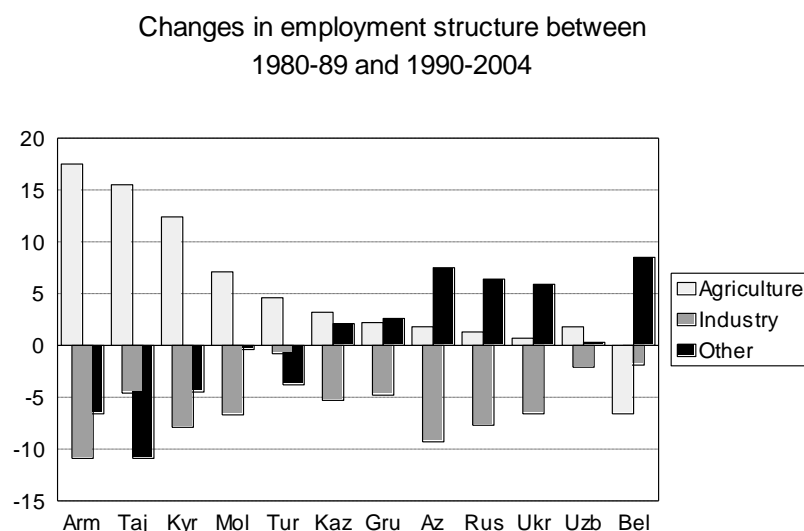
Figure 6.

**Table 5. Changes in share of agricultural employment by subperiods between 1980 and 2004 (percent of all employed)**

	1980-89	1990-95	1996-04	1990-04
Tajikistan	42	50	64	58
Turkmenistan	40	43	47	45
Uzbekistan	38	43	38	40
Moldova	37	40	47	44
Kyrgyzstan	32	39	49	45
Azerbaijan	33	32	37	35
Georgia	27	29	30	30
Kazakhstan	23	23	28	26
Armenia	20	29	43	37
Ukraine	21	20	22	22
Russia	14	14	16	15
Belarus	23	19	14	17

**Figure 7** shows the changes in sectoral structure of employment between 1980-89 and 1990-2004. The changes are in percentage points, calculated by taking the difference between the share of employment of each of the three sectors in 1980-89 and the corresponding share in 1990-2004. The changes for the three sectors – agriculture, manufacturing industries, and other sectors – sum to zero in each country. The light-gray upward bars represent agriculture: here the change in share of agricultural employment was positive in all countries, except Belarus. The dark-gray bars represent the decline of the share of manufacturing industries in total employment: these bars always point downward, signifying decline in the share of industry in all CIS countries. Finally, the black bars represent the change in the share of employment in all other sectors: some point down (negative change), others point up (positive change). In terms of intersectoral labor flows we distinguish three groups of countries. In the first group (Armenia, Tajikistan, Kyrgyzstan, Moldova, and Turkmenistan) agriculture expanded at the expense of labor ejected from all non-agricultural sectors of the economy (including manufacturing industries). In the second group (Kazakhstan, Georgia, Azerbaijan, Russia, Ukraine, Uzbekistan), industry was the only source of labor for both agriculture and the other sectors of the economy (in these countries, the share of agricultural labor increased to a much smaller extent than in the first group). Finally, Belarus on its own

falls in the third group, where both agriculture and industry shrank, releasing labor for other sectors of the economy.



**Figure 7.**

**Table 6** shows the average sectoral structure of employment in three periods (1980-89, 1990-95, and 1996-2004) obtained by aggregating the employment shares data over the CIS countries in the two main groups identified in **Figure 7** (excluding Russia and Ukraine, as well as Belarus). The data in the table confirm the previous conclusions: the share of agriculture in employment increased for both groups of countries, but especially so for group A; the share of industry in employment declined for both groups roughly to the same extent; the share of employment in other sectors decreased for group A countries and did not change for group B countries. Agriculture thus absorbed the layoffs from all the sectors of the economy in group A countries and from industry only in group B countries.

**Table 6. Changes in sectoral structure of employment between 1980 and 2004 for the two groups of countries from Figure 7**

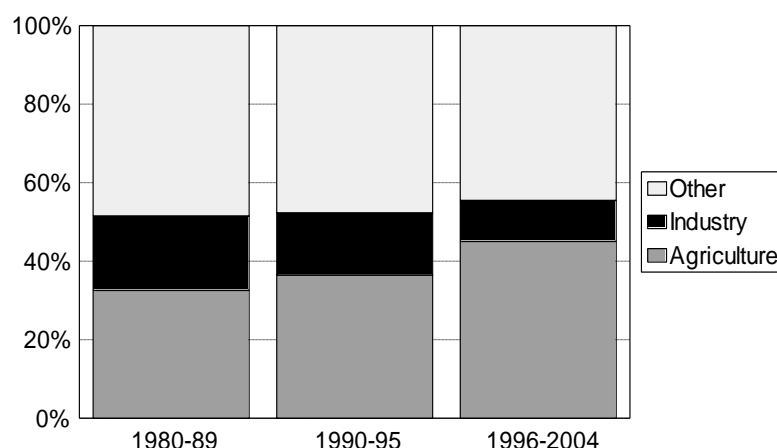
	Group A			Group B		
	1980-89	1990-95	1996-2004	1980-89	1990-95	1996-2004
Agriculture	34	40	50	30	32	39
Industry	19	16	11	19	15	10
Other sectors	47	44	39	51	53	51

Group A: Arm, Taj, Kyr, Mol, Tur

Group B: Kaz, Gru, Az, Uzb

**Figure 8** shows the average sectoral structure of employment in three periods obtained by aggregating the employment shares data over all CIS countries (except Russia, Ukraine, and Belarus), without dividing them into two groups. The figure clearly shows that, overall, the increase in share of agricultural employment was achieved primarily at the expense of layoffs in industry, as the share of the other sectors did not change much between the three periods. The results remain practically the same when Russia and Ukraine are included.

### Changes in sectoral structure of employment\*



**Figure 8.**

\*Excluding Russia, Ukraine, and Belarus

### *Share of agriculture in GDP*

While many statistical data for CIS countries are available since 1980 (and even earlier), internationally acceptable GDP data began to be calculated as part of the new National Accounts systems that replaced the traditional Soviet “material product” statistics around 1992. Comparable and consistent calculations of the share of agriculture in GDP across the CIS countries could therefore be carried out only for the period since 1993. Furthermore, absolute values of GDP required for calculating the share of agriculture are available only in current prices in national currencies, and constant-price data are published only in the form of year-to-year changes of total GDP.

Subject to these restrictions, we proceeded to calculate the share of agriculture and the share of industry in GDP in current prices using the available data from 1993 through 2004 for 7 of the 12 CIS countries: Armenia, Georgia, Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, and Moldova. Two other Central Asian countries, Turkmenistan and Uzbekistan, had to be dropped from the analysis due to lack of data, while Russia, Ukraine, and Belarus were omitted as falling outside the scope of interest of the present study.

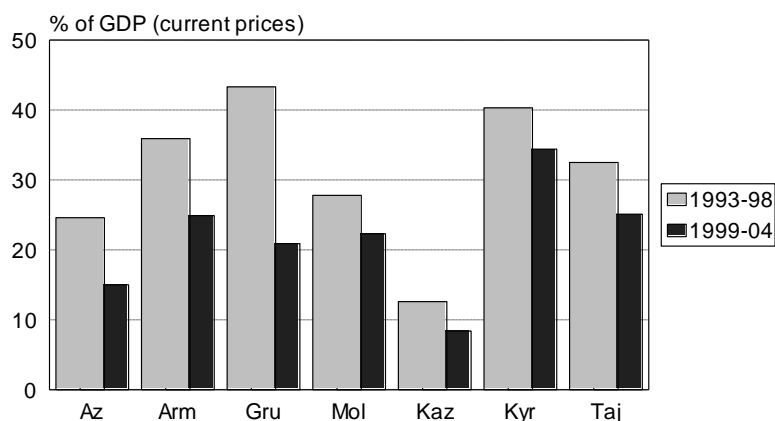
Visual examination of the pooled data for the 7 countries followed by a simple trend analysis for 1993-2004 (**Table 7**) revealed two basic facts: (1) the share of agriculture in GDP declined over time (producing a trend line with a statistically significant negative coefficient); (2) the share of industry in GDP did not have a statistically significant trend coefficient (either positive or negative).

**Table 7. Trend analysis of shares of agriculture and industry in GDP for 7 CIS countries, 1993-2004**

	Trend coefficient 1993-2004	Significance	R-square
Share of agriculture in GDP	-1.637	<0.0001	0.265
Share of industry in GDP	-0.052	0.8224	0.001

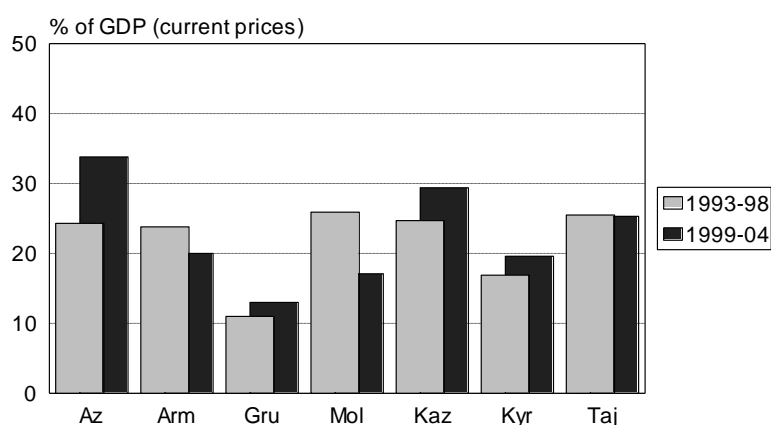
Based on these preliminary findings, we divided the 12-year period 1993-2004 into two 6-year subperiods 1993-1998 and 1999-2004 and calculated the average share of agriculture and industry in GDP by country for each subperiod. The results are presented in **Figures 9A and 9B**.

### Shares of agriculture in GDP: 1993-98 and 1999-2004



**Figure 9A.**

### Shares of industry in GDP: 1993-98 and 1999-2004



**Figure 9B.**

These figures visually reinforce the trend results from **Table 7**. In **Figure 9A**, the share of agriculture in the second subperiod 1999-2004 is less than the share of agriculture in the first subperiod 1993-98 for each of the 7 countries shown: this is consistent with the negative trend coefficient for the share of agriculture in GDP in **Table 7**. In **Figure 9B**, the share of industry in 1999-2004 is higher than in 1993-98 for four of the seven countries (Azerbaijan, Georgia, Kazakhstan, and Kyrgyzstan), lower than in 1993-98 for two of the seven countries (Armenia and Moldova), and practically unchanged for one country (Tajikistan). This is again consistent with the trend analysis results, which give a zero trend coefficient for the share of industry in GDP.

**Table 8. Sectoral structure of GDP and its change over time for 7 CIS countries**

	1993-2004	1993-1998	1999-2004
Agriculture	26	31	22
Industry	23	22	23
Other sectors	51	47	55

The average sectoral structure of GDP for all seven countries is shown in **Table 8**. The two notable features of the observed changes over time are the decrease in the share of agriculture (from 31% of GDP in 1993-1998 to 22% in 1999-2004) and the increase of the other non-

manufacturing sectors (construction, services, extractive industries, etc.) from 47% of GDP in 1993-1998 to 55% in 1999-2004.

**Table 9. Change in relative productivity of labor in agriculture and industry between 1993-1998 and 1999-2004**

	Agriculture		Industry	
	1993-1998	1999-2004	1993-1998	1999-2004
Azerbaijan	0.79	0.37	2.82	4.99
Armenia	0.94	0.56	1.21	1.47
Georgia	1.05	0.39	0.95	2.40
Kazakhstan	0.56	0.26	1.50	2.27
Kyrgyzstan	0.89	0.65	1.37	2.40
Moldova	0.63	0.47	2.08	1.50
Tajikistan	0.56	0.38	2.51	3.73
<b>Average (6 countries)</b>	<b>0.78</b>	<b>0.44</b>	<b>1.78</b>	<b>2.68</b>

We have observed previously that the share of employment in agriculture on the whole increased over time, whereas the share of employment in manufacturing industries decreased. We now see that the shares of the two sectors in GDP moved in opposite directions relative to their shares in employment. This suggests that the productivity of labor in agriculture may have declined over time, whereas the productivity of labor in industry may have increased. This conclusion, however, needs to be verified, as the employment and GDP data presented so far correspond to different time frames and to different sets of countries. **Table 9** gives the relative productivity of labor in agriculture and industry, calculated as the ratio of the sectoral share in GDP to sectoral share in employment. The relative productivity for the entire economy of each country is 1, as 100% of GDP is produced by 100% of labor. Relative productivity of less than 1 implies that the corresponding sector is less efficient than the average for the economy as a whole, whereas relative productivity of more than 1 implies that the sector is more efficient than the economy on average. The results in **Table 9** for a subset of 7 countries with full matching data for both employment and GDP shares support our tentative hypothesis: the relative productivity of agricultural labor was lower in 1999-2004 than in 1993-1998 (0.44 compared with 0.78 for all 7 countries), whereas the relative productivity of labor in the manufacturing industries increased over time (2.68 in 1999-2004 compared with 1.78 in 1993-1998).

## Productivity of resource use in agriculture

While agricultural production relies on a whole range of resources, land and labor are clearly the two main inputs. Fortunately, sufficiently reliable and consistent time-series data are available on both land and labor in official statistics of CIS countries. Information on other factors of production, such as farm machinery, capital assets, purchased inputs, fuel, is fragmentary and much less reliable and in most cases can be used only for cross-section analysis at a single point in time (e.g., in farm surveys). In this section we will describe the evolution of agricultural land and agricultural labor in CIS countries over time and apply this information to calculate the partial productivity of these factors.

### *Evolution of agricultural land over time*

Agricultural land is naturally characterized by high inertia and we do not expect to see wild fluctuations in land stocks from year to year. During the last decade of Soviet rule (1980-89) agricultural land remained fairly constant in all CIS countries. After 1990, however, we are beginning to witness more variability, which may be attributable to purely technical reasons, i.e., changes in statistical systems, or to substantive changes in farm structure and producer behavior during the transition from plan to market. **Table 10** presents information on changes in agricultural land in CIS countries from 1980 to 1989 and then to 2004. The information is presented as percentage change since 1980 for each country.

**Table 10. Change of agricultural land in CIS 1980-1989 and 1980-2004 (1980=100)**

	1980-1989		1980-2004	
	Percent of 1980	Characterization	Percent of 1980	Characterization
Turkmenistan	<b>111</b>	<b>Increase (irrigation)</b>	<b>134</b>	<b>Increase (irrigation)</b>
Azerbaijan	102	No significant change	<b>113</b>	<b>Increase (irrigation)</b>
Armenia	101	No significant change	104	No significant change
Tajikistan	102	No significant change	98	No significant change
Moldova	98	No significant change	95	No significant change
Georgia	101	No significant change	94	No significant change
Belarus	97	No significant change	92	No significant change
Ukraine	99	No significant change	<b>89</b>	<b>Moderate decline</b>
Russia	98	No significant change	<b>88</b>	<b>Moderate decline</b>
Uzbekistan	101	No significant change	<b>76</b>	<b>Significant decline</b>
Kyrgyzstan	100	No significant change	<b>45</b>	<b>Significant decline</b>
Kazakhstan	102	No significant change	<b>40</b>	<b>Significant decline</b>

During the Soviet period 1980-1989, agricultural land in all countries (with the exception of Turkmenistan) remained virtually constant, fluctuating within 2% up and down.

Turkmenistan was the only exception, as ambitious irrigation projects in this desert country increased the stock of agricultural land by as much as 11% during the decade 1980-1989. The transition period brought significant variability in the behavior of agricultural land across countries. By 2004, Turkmenistan and Azerbaijan had much more agricultural land than in 1980 (due to extensive irrigation projects). Uzbekistan and especially Kyrgyzstan and Kazakhstan had gone through a period of serious land abandonment. Russia and Ukraine registered moderate declines in agricultural land, also mainly through abandonment, while the remaining countries – Armenia, Tajikistan, Moldova, Georgia, and Belarus – maintained their agricultural land largely unchanged, although with a slight tendency to decline.

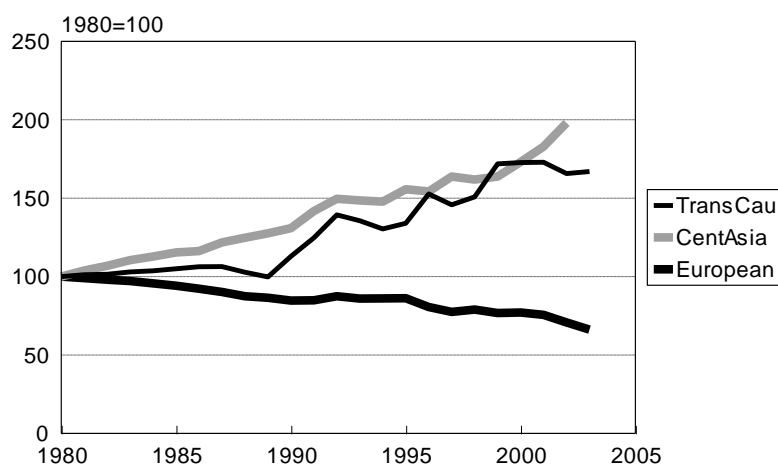


### *Evolution of agricultural labor over time*

In a previous section we showed that the share of agriculture in total employment (expressed in percent) increased over time in all CIS countries, with the exception of Belarus. We now proceed to examine the changes in the absolute number of employed in agriculture since 1980. Because of huge differences in scale (ranging from about 10 million employed in Russia to less than half a million in Armenia or Kyrgyzstan), the actual number of workers in each country is normalized to an index number with 1980=100. Changes in agricultural labor over time are thus expressed in percent of the number of employed in the base year of 1980.

**Figure 10** collapses the 12 time series into three aggregate curves: one for the three Transcaucasian countries (Armenia, Georgia, Azerbaijan), one for the five Central Asian countries (Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, and Kazakhstan), and one for the four “European” countries (Russia, Ukraine, Belarus, and Moldova). This classification is based on geographical location, ignoring the size. While all the Transcaucasian countries are small, the Central Asian group includes one large country (Kazakhstan) and the European group includes one small country (Moldova).

Agricultural labor: CIS 1980-2004



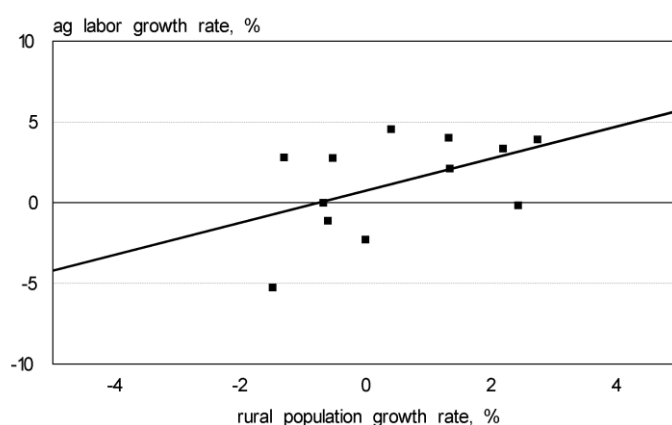
**Figure 10.**

We see from **Figure 10** that the agricultural labor in the European CIS countries is steadily (and fairly slowly) decreasing over time. This trend is not related to transition: it goes back to 1980 and is part of the long-term trend of exit of labor from agriculture in the relatively developed and high-income countries of the European CIS. On the other hand, agricultural employment in Central Asia is increasing, and at that fairly rapidly. Again, this trend is observed since 1980 and does not appear to be related to transition. It is apparently driven by the high population growth rates in these countries and the increasing rural population. Finally, in the three Transcaucasian countries agricultural labor began to grow in 1990, and it seems to be linked to transition, especially to the fast transformation of the farm structure from the traditional Soviet collectives to small family farms (it is empirically known that family farms act as “labor sink”, attracting much more workers per unit of land or unit of other resources than large corporate farms; see Lerman and Schreinemachers (2005)).

It is tempting to hypothesize that the growth or decline of agricultural labor is linked at least to two factors: population growth and growth of non-agricultural sectors of the economy.

Population growth, and especially rural population growth, affects the supply of labor and may thus create upward pressures on agricultural labor. Growth in non-agricultural sectors of the economy (manufacturing industry, extractive industry, construction, transport, services) creates alternative employment opportunities and may thus encourage migration of labor out of agriculture. The reality is not as clear cut as this, and given the available statistics it is impossible to identify rigorously the drivers of agricultural employment. Thus, the share of agriculture in GDP is decreasing in all CIS countries: this is clear from **Figure 9A**, which shows the change in the share of agriculture in GDP for 7 of the 12 countries; the picture is practically the same for three additional countries – Russia, Ukraine, and Belarus; the remaining two countries – Turkmenistan and Uzbekistan – simply do not provide the relevant data. The share of non-agricultural sectors in GDP correspondingly increases in all CIS countries, and we cannot use this crude percentage statistic to explain the highly variable changes in agricultural labor.

**Ag labor growth vs rural population growth  
1990-2003**



**Figure 11.**

The population growth statistics are better for our purposes, as the variability in annual population growth rates is quite high. **Figure 11** shows for the 12 CIS countries the relationship between the annual rates of change in agricultural labor and in rural population between 1990 and 2003. The coefficient of correlation is positive and significantly different from zero, but it is fairly low (0.5; the coefficient of correlation with total population growth is less than 0.3). Dichotomizing the 12 countries into those with growing rural population and those with declining rural population (6 countries in each group), we observe that in countries with growing rural population agricultural labor increases fairly fast (at an annual rate of nearly 3% between 1990 and 2003), whereas in countries with declining rural population agricultural labor declines (at an annual rate of 0.5% between 1990 and 2003). This provides some support for the hypothesis that population pressures are a driver for agricultural employment.

**Table 11** shows the average changes in rural population and in agricultural labor for the three regions presented in **Figure 10**. The decrease in agricultural labor in European CIS is associated with decreasing population in general and decreasing rural population in particular. The increase in agricultural labor in Central Asia and Transcaucasia is associated with increasing rural population. It is interesting to note the difference in changes in total population and rural population in Transcaucasia. Total population growth in the three

Transcaucasian countries is negative, and yet the rural population is increasing (albeit slightly). This is probably the result of civil unrest and outright war that plagued Transcaucasia in the early 1990s, resulting in massive refugee flows and urban-to-rural migration. Rural areas, with their promise of a private land plot that could be used in the least to grow food for the family, probably looked like an attractive option for urban people exposed to severe deprivation. The absolute and especially the relative increase in rural population drove up the agricultural employment in these countries.

**Table 11. Growth of population and agricultural labor 1990-2003 (annual rates of change in percent, unweighted averages)**

Region	Population	Rural population	Agricultural labor
Countries with increasing rural population (6)	-0.83	-0.77	-0.51
Countries with decreasing rural population (6)	1.22	1.74	2.97
Central Asia (5)	1.29	1.63	2.79
Transcaucasia (3)	-0.50	0.15	3.16
European CIS (4)	-0.66	-0.70	-2.16

### *Evolution of agricultural production over time*

The value of agricultural production (as measured by Gross Agricultural Output, or GAO) is the standard aggregated variable that expresses the output produced by given resources (land and labor in our case). In analyzing agricultural production trends in CIS, we are particularly fortunate in that consistent GAO data (in volume terms or constant prices) are available since 1965 (and sometimes even earlier) for all 12 CIS countries. The period up to 1990 is covered for all former Soviet republics by the USSR Statistical Yearbooks; the period after 1990 is covered by the statistical publications of the CIS Central Statistical Bureau in Moscow (this database actually starts in 1980, providing a generous overlap that ensures consistency).

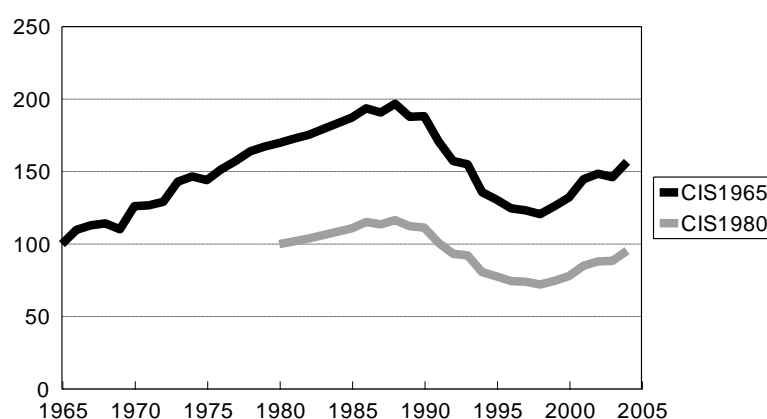
GAO growth thus can be expressed in index numbers starting with 1965=100, 1980=100 (as our land and employment series), or 1990=100 (if only the transition period is of interest). To visualize long-term trends of agricultural performance, we start with **Figure 12**, which shows the average GAO curve for all 12 CIS countries in percent of 1965 (the black curve) and for comparison also in percent of 1980 (the gray curve). The GAO index numbers used to construct these curves were calculated as the simple (unweighted) arithmetic average of the 12 index numbers for all CIS countries. The difference between the two curves is merely visual: the curve starting with 1965=100 shows a much longer growth period than the other curve truncated to start at 1980=100. In other respects, the two curves are identical, with an appropriate vertical shift representing the shift of base year from 1965 to 1980.

The GAO curves clearly show that the agricultural history of the CIS during the last 40 years can be divided into four consecutive phases:

- (a) Rapid and continuous agricultural growth between 1965 and 1985 (the Soviet period before Gorbachev).
- (b) Stagnation going into slight decline between 1985 and 1990 (the last five years of the Soviet regime under Gorbachev).
- (c) Steep decline during the first years of transition (1990-1997).
- (d) General recovery manifested in resumption of agricultural growth after 1997-98.

The four phases are clearly related to the policy environment. The stable supportive environment characterizing the traditional Soviet attitude toward agriculture was responsible for the growth in 1965-85 (growth in production volumes, not necessarily in profitability or productivity). The weakening of the Soviet system under Gorbachev produced the stagnation phase in 1985-90. The dismantling of the command economy in 1990 with the ensuing disruption of all supply and marketing channels was responsible for the decline in the first half of the 1990s. Finally, the implementation of substantive reforms after 1997 – in particular transition to individual or family agriculture in a significant number of countries – triggered the recovery and resumption of agricultural growth.

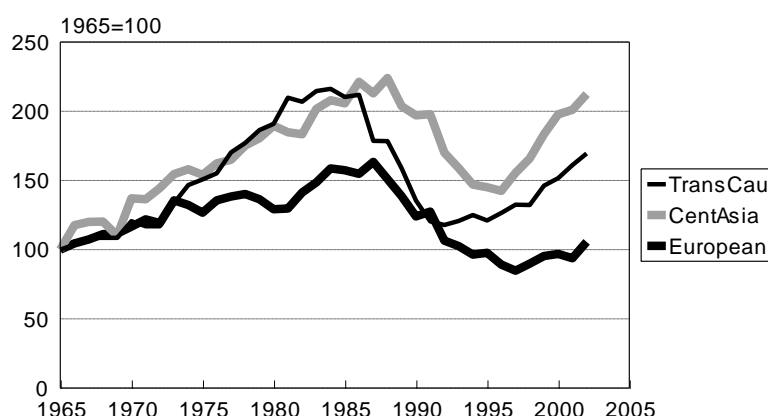
GAO 1965-2004 and 1980-2004:  
average for 12 CIS countries



**Figure 12.**

**Figure 13** decomposes the single CIS curve of **Figure 12** into three regional curves (as in **Figure 10**): Transcaucasia, Central Asia, and the European CIS. The four phases – growth, stagnation, collapse, and recover – are clearly visible in each regional curve. The interesting difference is the shift of the point where recovery starts. In Transcaucasia recovery started in 1991-92, because two of the three Transcaucasian countries – Armenia and Georgia – made resolute efforts to dismantle collective agriculture and distribute land to individual farms at the very beginning of transition. The rate of recovery subsequently accelerated in 1998, when Azerbaijan adopted a farm individualization policy. In the European CIS, recovery began around 1998, as two of the four countries – Ukraine and Moldova – began moving in earnest toward distribution of land plots to holders of paper land shares. The extent of the recovery in this group is moderate, because two other countries – Russia and Belarus – have not done much by way of actual land reform. Finally, the recovery in Central Asia began in 1996-1997, when all countries began implementing various reform measures in various ways. It is particularly important to note that both Turkmenistan and Uzbekistan contributed to this recovery despite their image as “slow reformers”, mainly because they allowed farm structure to shift from collective form of organization to family leaseholding. The traceable link between the beginning of recovery and the implementation of significant farm structure reforms provides further evidence of the importance of policy decisions on agricultural performance.

GAO 1965-2004:  
averages for 3 groups of countries

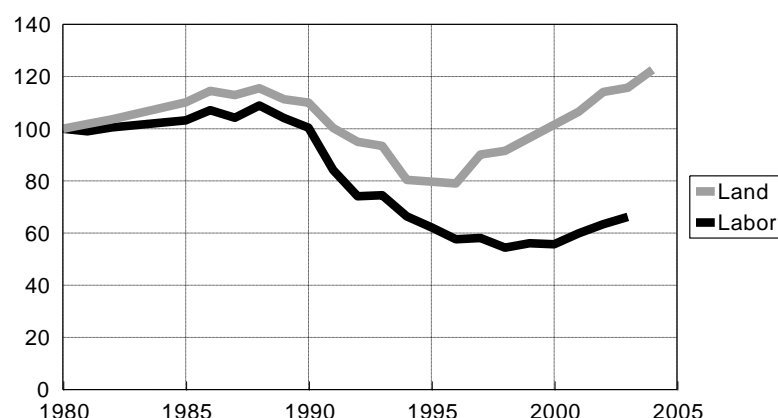


**Figure 13.**

*Partial productivity of agricultural labor and land*

Productivity is usually calculated as the value of output per unit of input: output per worker is the partial productivity of labor, and output per hectare is the partial productivity of land. Up to 1990, the value of output was published by statistical organs in constant rubles for all former Soviet republics, and productivity could be computed in these constant rubles per worker or per hectare. After 1991 the CIS countries abandoned the ruble and switched to different national currencies, so that productivity measures calculated using the value of output become noncomparable across countries. An alternative approach in this setting is to calculate the productivity index as the ratio of the GAO index to the index of the corresponding input (labor or land), making sure that both indexes are expressed to the same base year (for a justification of this technique see Lerman, Csaki, and Feder 2004). We used the time series of index numbers for GAO, agricultural labor, and agricultural land to calculate for each country the two partial productivity indexes for the years 1980-2004 that include the different agricultural development phases discussed in the previous section.

Land and Labor Productivity in CIS 1980-2004



**Figure 14.**

**Figure 14** shows the partial productivity curves aggregated over all CIS countries (simple average of the productivity index numbers). The productivity of both land and labor increased during the Soviet growth phase (up to about 1987) and then began to decline during the

stagnation phase (1987-90). The decline accelerated during the transition period and agricultural labor productivity began to recover only in the late 1990s, when GAO growth had overtaken the general increase of agricultural labor. The productivity of land began to increase much earlier, in 1996, due to the huge abandonment of land (especially pastures) that Kazakhstan and Kyrgyzstan initiated at that time.

The regional productivity curves obtained by decomposing the aggregate CIS curves into three regions are shown in **Figures 15, 16, 17**. The Transcaucasian countries were characterized by relatively constant productivity (of both land and labor) until about 1987, when productivity began to decline. Productivity of land bounced back already in 1993-94, probably due to the sweeping land reform that transferred land to individual farms. Productivity of labor generally stagnated, also probably as a result of the transition to predominantly individual farming, which acts as a “labor sink” (Lerman and Schreinemachers, 2005).

In Central Asia, the productivity of both land and labor remained fairly constant until 1990, after which time the productivity of labor declined due to the growing population pressures. The productivity of land took off into the stratosphere in 1996, entirely due to the sweeping land abandonment programs in Kazakhstan and Kyrgyzstan.

In the European CIS the productivity of land and labor follow identical paths: increase up to 1989, decline between 1989 and 1997, recovery after 1997.

Land and Labor Productivity in Transcaucasia 1980-2004

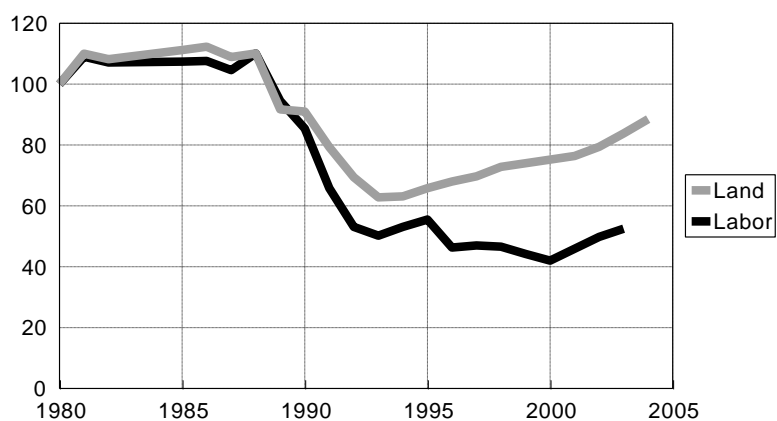


Figure 15.

Land and Labor Productivity in Central Asia 1980-2004

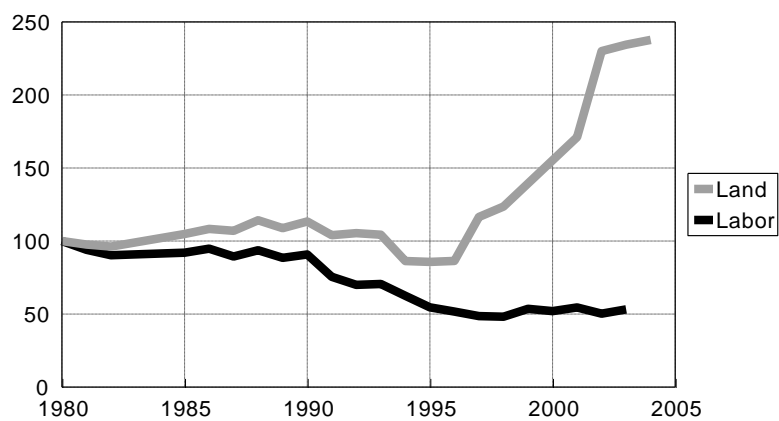
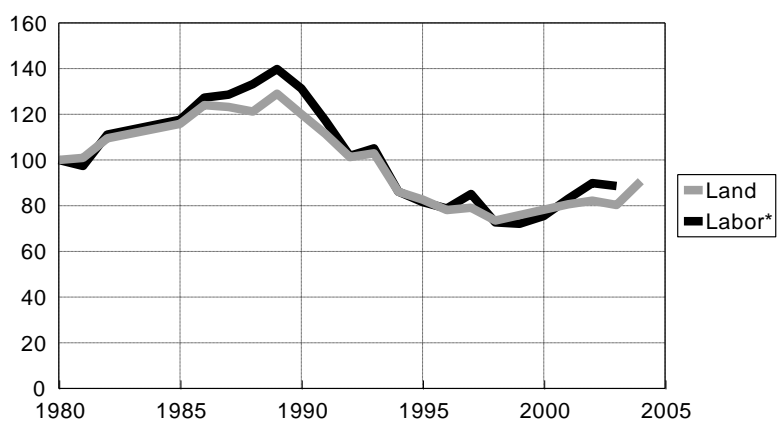


Figure 16.

Land and Labor Productivity in European CIS 1980-2004



\*Excluding Belarus

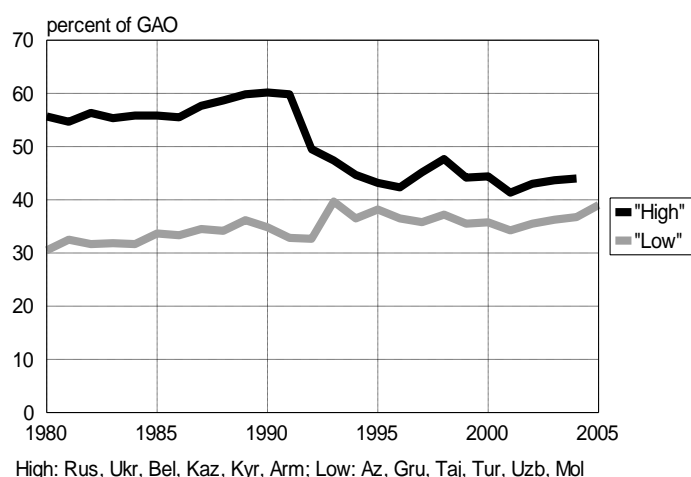
Figure 17.

## Reallocation of productive resources: changes in crop/livestock mix

We have examined the evolution of the two main agricultural resources – land and labor – and its impact on changes in partial productivity. Livestock is another important resource in agriculture, that alongside with land, contributes to GAO. In this section, we examine the changes in livestock in CIS and provide some evidence supporting the view that these changes came in response to market signals.

Prior to 1990, the 12 CIS countries fell into two evenly matched groups: a group of six countries with livestock production ranging over time in a rough band between 50% and 60% of GAO (“high livestock countries”); and a group of six countries with livestock production between 30%-40% of GAO (“low livestock countries”).<sup>3</sup> The separation between the two bands was statistically significant (**Figure 18**). However, there was no clear regional attribution: the high-livestock group included two of the five Central Asian countries (Kazakhstan and Kyrgyzstan), three of the four European countries (Russia, Ukraine, Belarus), and one Transcaucasian country (Armenia). Three Central Asian countries (Tajikistan, Turkmenistan, Uzbekistan), two Transcaucasian countries (Azerbaijan and Georgia), and one European country (Moldova) were in the low-livestock group. On balance, the low-livestock group was mainly characteristic of Central Asia and Transcaucasia, while high-livestock production characterized mainly the European countries. Thus, the average share of livestock production in the European countries between 1980-89 was 52% of GAO, whereas in Transcaucasia and Central Asia the livestock share was 38% and 43%, respectively (**Table 12**).

### Livestock production shares: 1980-2005



**Figure 18.**

After 1990, all the 12 countries bunched together in one band, with livestock production varying over time mostly between 35% and 45% of GAO. The averages for the three regions converged to 40%-42% (**Table 12**), which is substantially below the “high” average for 1980-89 and only slightly higher than the “low” average for 1980-89. Thus, on the whole,

<sup>3</sup> The data available on crop/livestock proportions are heterogeneous: prior to 1990 the crop/livestock shares are reported based on constant prices; after 1992 the statistics are a mix of calculations based on current and constant prices. Moreover, the data for some countries are incomplete.



livestock production after 1992 became much less prominent in CIS than during the last decade of the Soviet era.

**Table 12. Share of livestock production, percent of GAO**

	1980-89	1992-2005
“High” livestock production	57	47
“Low” livestock production	33	36
Transcaucasia	38	42
Central Asia	43	40
European CIS	52	42

### *Changes in livestock numbers*

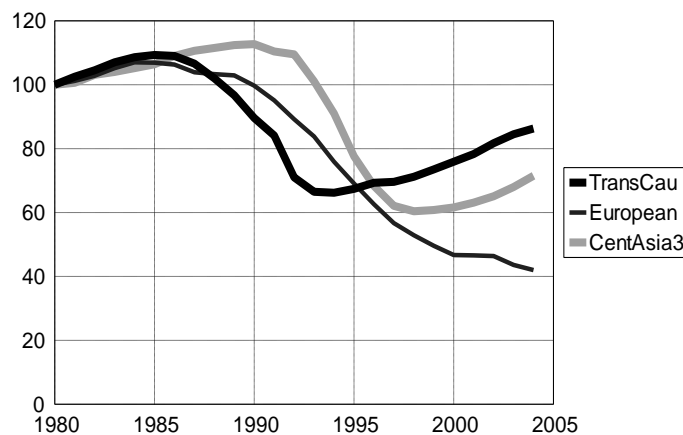
The decrease in the share of livestock in GAO is reflected in the dramatic reduction in herd size in CIS. The changes in herd size over time are expressed in terms of the livestock head index, which is based on the number of animals calculated in standard head by weighting the number of cattle, pigs, sheep, and poultry with weights 1, 0.1, 0.1, and 0.01 respectively.

In all CIS countries (with the exception of Turkmenistan and Uzbekistan) the livestock herd in 2004 is much smaller than it was in the Soviet period up to 1990 (**Figure 19A**). The decline is particularly significant for the European CIS countries, where the livestock herd size today is a mere 40% of the herd in the Soviet era. In Transcaucasia and the three Central Asian countries the herd size appears to be recovering in recent years, but it is still substantially below the level observed in the 1980s. **Figure 19A** clearly shows three distinct patterns of herd size changes: the European CIS exhibits a steady downward trend (which actually began back in 1985); in Transcaucasia, the fairly steep decline that had begun in 1985 changed to recovery in the early 1990s; in Central Asia<sup>3</sup>(excluding Turkmenistan and Uzbekistan) the decline started much later, after the dissolution of the Soviet Union, and it changed to recovery in 1996-97.

Turkmenistan and Uzbekistan form a separate fourth pattern – no decline ever (**Figure 19B**). Turkmenistan especially stands out because of the steep increase in its livestock herd in recent years. It is noteworthy that the increase in livestock numbers began in 1997-98, just as Turkmenistan was shifting to family leasehold arrangements for crop production. The contractual obligations of the leaseholders to produce mainly the two “strategic” commodities – cotton and wheat – for state marketers encouraged an increase in livestock production in the small household plots, a family choice that ensured at least some diversification of income between revenues from the state (crop production) and sales in the market.

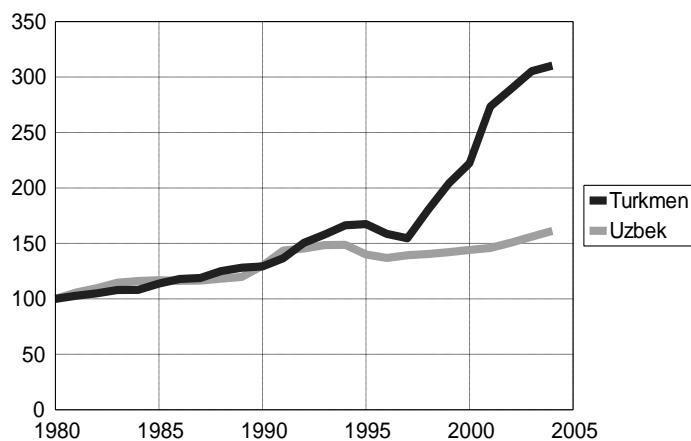
In general, we observe in **Figure 19A** that the sharp downward adjustment of livestock changed to growth in countries with rapidly increasing population (Transcaucasia, Central Asia). Livestock production is highly labor intensive, and thus provides productive occupation to the growing rural population in these countries.

Livestock herd by regions (1980=100)  
(without Tur, Uzb)



**Figure 19A.**

Livestock herd: Turkmenistan and Uzbekistan (1980=100)



**Figure 19B.**

On the other hand, in the European CIS – Russia, Ukraine, Moldova – the decline in livestock accompanies a general downward decline of the population (see **Figure 5**). There is some evidence for these countries that the decline in livestock came as a response to lack of profitability in livestock production. In Russia, for instance, farms with profitable livestock enterprises maintained their herd, while farms with unprofitable livestock production reduced the herd by as much as 50%-60% between 1998 and 2003 (**Table 13**). In Ukraine, corporate farms had negative margins of -30% on livestock sales and positive margins close to +30% on crop sales (averages for 1995-2004). The reduction of the unprofitable livestock herd by as much as 80% between 1995 and 2004 reduced the number of corporate farms reporting losses from 80% of all farms in 1997-99 to 40% in 2000-2004. This market-driven behavior in the last decade in Ukraine contrasts sharply with the situation in the 1980s, during the era of central planning. Then, as today, crop production was profitable, whereas some livestock enterprises (especially pigs and sheep) were deeply unprofitable. Yet the herd size and the production volumes remained constant, and no attempt was made to adjust production in response to profit signals. A similar pattern is observed for Moldova.<sup>4</sup>

<sup>4</sup> Data for Ukraine provided by N. Pugachev, Agricultural Policy Unit, Kiev. Data for Moldova provided by D. Cimpoeis, Moldova Economics University, Chisinau. All data are based on official statistics.

**Table 13. Change in herd size between 1998 and 2003 by livestock profitability categories (percent of 1998)**

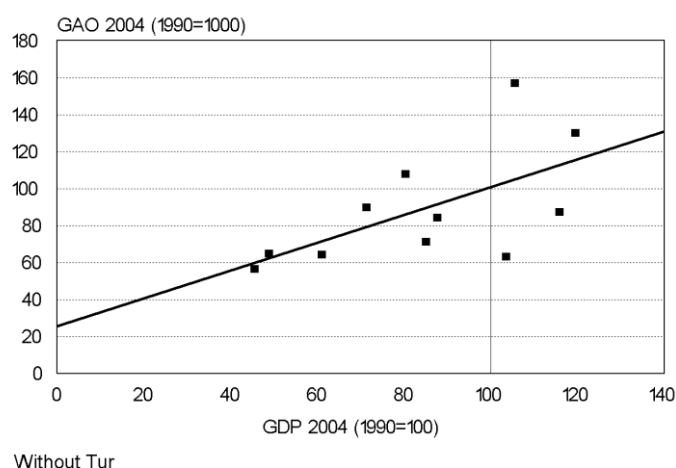
	Profit rate >10%	Profit rate 0-10%	Loss rate <10%	Loss rate >10%	All farms
Dairy	88.4	73.1	67.0	39.0	58.5
Beef	104.3	84.0	77.0	55.5	61.8

Source: V. Uzun, Agrarian Institute, Moscow, based on official statistics (private communication).

## Conclusion: The link between performance and policy

We have demonstrated that the long-term pattern of agricultural development in the former Soviet Union and today's CIS countries is driven by the political environment (**Figure 12**). We have also demonstrated that the cumulative effect of reforms eventually produced a significant recovery in agriculture. This did not happen immediately, as it took a better part of 10 years of sustained reforms for their impact to begin showing in agriculture, but eventually the predictions of Western scholars and experts materialized and agricultural growth resumed in the CIS countries. It is also quite clear that the exact timing of recovery is associated with the depth and decisiveness of agrarian reforms, specifically with the transition to individual farming. This link is demonstrated in **Figure 13**.

### GAO growth vs GDP growth 1990-2004

**Figure 20.**

GAO growth in CIS is positively correlated with GDP growth (**Figure 20**), a well-known phenomenon in development economics. The existence of a positive correlation, however, does not specify the direction of causality: is it the general economic environment (GDP growth) that drives agriculture (GAO growth) or conversely, is it agricultural growth in the relatively agrarian CIS countries that drives the entire economy? Unfortunately, statistical tools do not help us to answer this question, and we are left with the conclusion that the two growth measures are closely interrelated, with each measure influencing the other in most cases. Overall economic growth thus appears to be conducive to growth in agriculture. Positive changes in the overall economic environment lead, among other things, to creation of functioning market services, which were missing in the command economy. The emergence of market services stimulates agricultural production through improved supply of farm inputs, better access to financial facilities, and improvements in sales and marketing channels. It is hard to imagine agricultural recovery in a country with a stagnating general economy, while a generally positive economic atmosphere reflected in a reasonable GDP

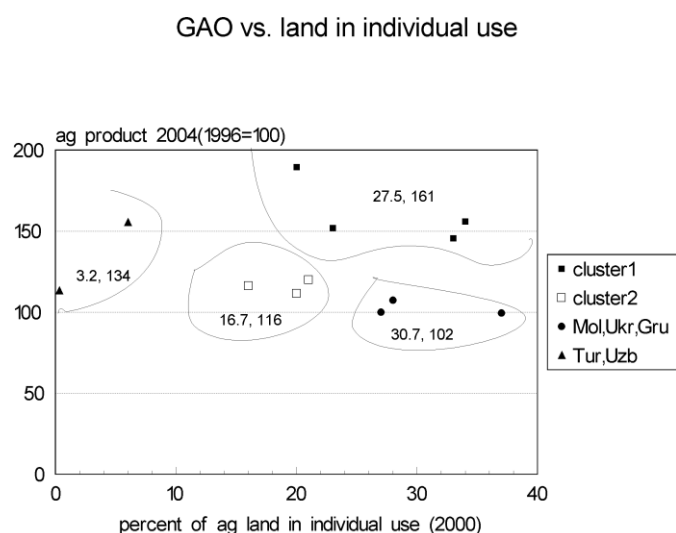
growth is likely to induce growth in agriculture. The positive correlation between GDP growth and agricultural growth justifies the general sequencing prescription, “get the economy in order, and agriculture will fix itself.”

Following the cue of **Figure 13**, we have tried to explore more rigorously the link between agricultural performance and the most obvious manifestation of policy reform in agriculture – the share of land in individual use. We have accordingly ran hierarchical clustering of the CIS countries by the change in GAO from 1996 to 2004 as a performance measure and percent of agricultural land in individual use in 2000 as a reform measure. Cluster analysis has produced four sharply differentiated clusters of countries, which are shown in **Table 14** and again in **Figure 21** (the numbers inside the cluster boundaries are the mean share of land in individual use and the cumulative GAO growth 1996-2004 from **Table 14**). In addition to the two basic variables used for clustering – agricultural growth as a performance measure and land in individual use as a reform measure – **Table 14** shows two alternative reform measures: the ECA Agricultural Policy Reform Index and the Land Reform component of this policy index for the four clusters (for more details of these indexes see **Table 1** and the discussion in the first section *Setting the stage*).

**Table 14. Hierarchical clustering of CIS countries by agricultural growth and share of land in individual use**

Cluster		Land in individual use (2000)	Cumulative GAO growth 1996-2004	ECA agricultural policy reform index*	ECA land reform index*
<b>1</b>	<b>Az, Arm, Kyr, Taj</b>	<b>27.5</b>	<b>160.7</b>	<b>6.8</b>	<b>8</b>
<b>2</b>	<b>Bel, Rus, Kaz</b>	<b>16.7</b>	<b>116.0</b>	<b>5</b>	<b>4</b>
3	Gru, Mol, Ukr	30.7	102.3	6.1	6.7
4	Tur, Uzb	3.15	134.2	2.9	3.5

\* On a scale of 1 to 10, where 1 = command economy, 10 = economy with completed market reforms.



**Figure 21.**

For clusters 1 and 2, higher agricultural growth goes with more land in individual use: in **Figure 21** cluster 1 lies to the “northeast” of cluster 2. The two policy indexes move in the same direction: they are higher from cluster 1 than for cluster 2. All in all, cluster 1 (Azerbaijan, Armenia, Kyrgyzstan, and Tajikistan) has more land in individual use and is more advanced on the reform scale, and these factors are reflected in higher growth since 1996.

Clusters 3 and 4 are outliers. Cluster 4 (Turkmenistan and Uzbekistan) should not surprise us: these countries do not have much land in individual use according to conventional statistics<sup>5</sup>, their policy reforms are negligible, and yet they report exceptionally robust agricultural growth – probably due to the vagaries of state controlled statistics. But cluster 3 – Georgia, Moldova, Ukraine – is a real surprise. These countries have a lot of land in individual use and yet they display very sluggish growth performance. The policy index may shed some light on this curious behavior: in these countries, the progress of reform is much below the level attained in cluster 1, where the countries have a comparable level of land individualization. Less progress with reform than in cluster 1 translates into less growth despite the relative high share of land in individual tenure.

**Table 15. Change in Total Factor Productivity (TFP) and ECA Policy Reform Index for CIS**

	ECA policy index 1997	TFP growth 1992-97
Armenia	7.4	22.9
Georgia	6.2	32.9
Russia	6.0	7.4
Kyrgyzstan	5.8	-1.7
Kazakhstan	5.8	-5.2
Moldova	5.8	2.4
Ukraine	5.4	2.5
Azerbaijan	5.0	-3.9
Tajikistan	3.8	-11.5
Uzbekistan	2.2	-10.7
Turkmenistan	1.8	-29.4
Belarus	1.6	2.9

Source: Lerman et al. (2003).

While cluster analysis reveals a positive relationship between GAO growth and policy reform measures, we have been unable to detect a statistically significant correlation between various performance measures and policy reform indices using raw country data without clustering. Further evidence of the link between agricultural performance and policy reform at the country level is provided by Lerman et al. (2003), who estimate the growth in Total Factor Productivity (TFP) for the CIS countries between 1992 and 1997. TFP growth is calculated by standard Solow growth calculus taking the ratio of the change in output to the change in the aggregated basket of inputs.<sup>6</sup> TFP growth aggregating changes in productivity of land, labor, and other farm inputs constitutes a much more appropriate measure of performance improvement than GAO growth. Unfortunately, TFP growth is much more difficult to estimate than GAO growth, which explains why it is only seldom used in analysis. The TFP growth for 1997-97 and the ECA Agricultural Policy Reform Index for 1997 are presented for the 12 CIS countries in **Table 15**. We clearly see a strong positive correlation between TFP growth and the policy reform index. The coefficient of correlation is 0.7, and only three countries – Kyrgyzstan, Kazakhstan, and Belarus – deviate from the nearly monotonic relationship between TFP growth and the policy index. These findings, like the clustering results, suggest that implemented policies affected recovery in agriculture.

<sup>5</sup> Land in individual leasehold arrangements is not reported as individual tenure in the official statistics of these countries.

<sup>6</sup> The aggregated basket of inputs is calculated by weighting five conventional inputs – arable land, agricultural labor, farm machinery, fertilizer use, and livestock – by the coefficients of the meta-production function estimated for the CIS countries.

Our final attempt to link agricultural performance with policy reform is based on a totally non-agricultural measure of reform. This is the so-called Sachs-Warner Openness Indicator, which dichotomizes countries into “open” and “closed” by a trade-based measure incorporating three dimensions: tariffs, non-tariff barriers, and black-market premium on foreign exchange.<sup>7</sup>

Prior to 1994, all CIS countries were classified as closed. In 1994 only two CIS countries were classified as open: Moldova and Kyrgyzstan. Four more countries “opened up” between 1994 and 1996: Armenia, Georgia, Azerbaijan, Tajikistan. Russia and Ukraine were classified as closed even in 1999 (as were Belarus, Kazakhstan, Uzbekistan, and of course Turkmenistan). It may of interest to note that the open countries are “small” while the closed countries are “large”.

We have calculated the cumulative growth in both GDP and GAO between 1990-1994 (the early reform phase) and then between 1994-2004 (the agricultural recovery phase). It turns out that the “open” countries did much worse than the “closed” countries in the early transition period 1990-1994 by both GDP growth and GAO growth. In fact, the “open” countries dropped much more than the “closed” countries during the initial decline phase. But then their rebound was much stronger in 1994-2004: the “open” countries overtook the “closed” countries by a very wide margin by both GDP and GAO. These results are summarized in **Table 16**.

**Table 16. Growth and openness in CIS countries: the decline period 1990-1994 and the recovery period 1994-2004**

Openness status as of 1999	Cumulative GDP growth		Cumulative GAO growth	
	1990-1994	1994-2004	1990-1994	1994-2004
Open: Armenia, Azerbaijan, Georgia, Kyrgyzstan, Moldova, Tajikistan	-55.7	65.0	-35.1	43.3
Closed: Belarus, Russia, Ukraine, Kazakhstan, Turkmenistan, Uzbekistan	-31.8	40.6	-22.9	5.0

\*Note: All CIS countries were “closed” before 1994. The “open” countries changed their status between 1994 and 1996.

While this evidence is not conclusive, it is certainly quite compelling. All this adds up to a fairly clear conclusion: better agricultural performance is achieved by countries that are more advanced on the path of reform, irrespective of how we measure reform – whether by share of land in individual farming, by agriculture-related policy reforms (as in the ECA index), or by non-agricultural reform indicators (the Openness Indicator). The weight of the cumulative evidence seems to support our initial hypothesis quite strongly.

<sup>7</sup> The openness indicator was introduced by Sachs and Warner (1995); some fascinating update work was done by Wacziarg and Welch (2003).

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