GROWTH AND TECHNOLOGICAL CHANGE IN KAZAKHSTAN ECONOMY

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Abstract
In this paper an attempt has been made to make use of a relevant methodology for growth accounting exercise in natural resource abundant economy, Kazakhstan, from 1991-2014. Growth accounting involves breaking down GDP growth into the contribution of labor inputs, capital inputs and multi-factor productivity (MFP) growth. This time period is divided into three phases 1991-1999, 2000-2007 and 2008-2014, in order to understand the progress of transition policies. Kazakhstan's economy has gone through stages of negative, high economic growth and declining growth after independence from the Soviet Union in 1990. The period from 1990 to 1997 was the period of negative economic growth. It was only from 2000 that Kazakhstan entered the phase of strong and sustained growth. During second phase 2000-2007, the Kazakhstan economy experienced an average growth rate of about 10 per cent. However, from 2008 the growth rate of Kazakhstan is showing declining trend. The paper highlights the fact that it is the technological progress (TFP) which has been the main source of economic growth in either dampening the severity of contraction during the 1990s or fueling the growth thereafter.

Keywords
Cobb-Douglas Production Function, Growth Accounting, Technology, Crisis, Recovery, Kazakhstan, Economic Growth, Annual Depreciation Rate, Policy Reforms.

Introduction

The technology and innovation is indispensable in the economic growth. According to Mokyr: "the difference between rich nations and poor nations is not that the rich have more money than the poor, but rich nations produce more goods and services. One reason they can do so is because their technology is better and have superior ability to control and manipulate nature and people for productive ends" (Mokyr, 1990). If Western Europe has been superior, in terms of economic growth, compared to most of the Central-Eastern and Former Soviet Union (F.S.U.) countries, this is undoubtedly, at least partly, due to technological superiority. However, although technology can be viewed from neo-classical, growth economists' point of view as

an (e.g. exogenous) independent variable determining the output, it is also country specific, that is it depends on the overall complex socio-economic framework of the historically specific social formation under investigation.

Kazakhstan Economy: An Overview

The breakdown of the Soviet empire initiated the largest transition from a socialist economy to a market economy. Kazakhstan is larger than Western Europe and has a low population density. The country has huge metallurgical reserves and one of the largest untapped oil fields found during the last 30 years. Since independence in 1991, Kazakhstan has been undertaking comprehensive reforms aimed at dismantling the command economy and creating a market economy (Johan Fredborn Larsson). The first few years of Kazakhstan's economy after the breakdown of Soviet Union were characterized by economic decline: by 1995 real GDP dropped to 61.4%of its 1990 level. The wide ranging inflation observed in the early 1990s peaked at annual rate of about 3000% at mid-nineties. Since 1992, Kazakhstan actively pursued a program of economic reform designed to establish a free market economy through privatization of state enterprises and deregulation . Kazakhstan remains today one of most successful reformers in the CIS, though its record is less than strong when compared with more advanced transition countries of Central and Eastern Europe, and it has strongest banking system in Central Asia and CIS. Some of the reforms taken by Kazakhstan are presented in Table-I.

Table-I

Summary of Kazakh Reform Programme

Policy Area	Introduction	Implementation
Systemic Reforms		
Liberalization of Internal Trade	1992	Internal trade restriction removed
Price liberalization	1992	Followed Russia's radical reforms, more than 80% of the prices were decontrolled.
Privatization of SOEs	1991	First Privatization Act passed in 1991, the privatization seriously started in 1992-1993, second wave in 1995-1996, slowed since 1997.

Foreign Investments	1991	"One-stop" State Investment Committee was Introduced in 1996.
Labor Market	1992	Introduction of wage flexibility and tax-based wage Policy.
Financial liberalization	1991	Restrictions on private and independent banking and financial institutions eliminated.
Legal Reforms	1991-1992	Property and commercial law.
Constitutional Reform	1991-1992	Independence and new constitution.
Stabilization Policy		
Fiscal Policy 1) Tax Reform	1992-1995	1992: Taxes for enterprises, personal income and VAT replaced old system. 1995: New tax code based on international standards enacted.
2) Public Expenditure Control	1992-1994	Fiscal deficit diminished significantly.
Monetary Policy Money Supply	1994	Control from 1995
1) Credit to the Public Sector	1993-1994	Control, hard budget constraints for SOEs
2) Central Bank Independence	1993-1995	Independence and increased autonomy
Trade and Exchange Rate Policy		
1) Liberalization of Foreign trade	1992-1996	State monopoly abolished, simplified regulation, Unified exchange rate
2) Import Tariff	1991-1992	Initially removed, later reintroduced at a low level
3) Export Taxes	1992	Reduced but later augmented
4) Currency	1993	National currency introduced

Source: Johan Fredborn Larsson (p.18).

Period of Negative GDP Growth (1991-1997)

Kazakhstan's transition from a planned to market economy was marked by difficulties. Like other post-Soviet countries, Kazakhstan's GDP

contracted dramatically during the first half of the 1990s. The economic downturn intensified during the early years of the transition, and was most serve in 1994. By 1995, Kazakhstan's economy had shrunk by a further 39%, and during the next four years growth remained flat. The rate of real GDP declines in the early 1990s were likely overstated in the official data, due to the emergence of the private sector, which in the early days of the transition was typically not fully included in the statistical base, and to the development of the underground economy.

Table-II

Main Economic Indicators of Kazakhstan (1991-1999)

Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Real GDP (% change)	-11	-5.3	-9.2	-12.6	-8.2	0.5	1.7	-1.9	2.7
Prices (% change)	96.3	1472.2	1243.4	1546.7	160.8	38.8	16.1	5.6	13.2
Gross capital formation (annual % growth)	-43.9	-2.6	-61.3	33.2	-42.4	-29.6	5.6	-11.9	12.6
Exports (bn$)	48.8	44.4	39.3	36.6	32.6	34.2	34.9	35.3	48.8
Imports (bn$)	88	68.4	51.1	48.3	38.7	32	34.4	32	26.1
Trade Balance (bn $)	-39.2	-24	-11.8	-11.7	-6.1	2.2	.5	3.3	22.7
Unemployment (%)	0.05	0.4	1.1	7.5	10.9	12.9	3.7	3.7	13.4

Source: World Bank Development Indicators.

It is evident from Table-II that during the initial years of independence, all indicators of development were showing negative and disturbing trend. There was negative growth rate but the inflation rate was very high. It was case of hyper inflation. Despite the dramatic contraction of GDP, the rate of the registered unemployment in Kazakhstan continued to remain low i.e. below 10 per cent until the mid 1990s. More specifically the rate of unemployment rose from 0.05 in 1991 to 3.7 in 1998. This is paradoxical[1]. The low unemployment rate did not avert the substantial decline of the living standards of the Kazakhstan population.

Increasing GDP Period (2000-2007)

After eight years of severe transitional crisis, Kazakhstan experienced an economic boom from 2000 to 2007. With average annual growth rates of 10 percent, the country became a success story not only in Central Asia but also in the Commonwealth of Independent States (CIS). Rising oil prices played a major role in this growth which can be seen by drastic increase in exports of country. As the price of oil climbed, the hydrocarbon sector's share in Kazakhstan's GDP also increased, from 11 percent in 1990 to almost 35 percent by 2007. In 2007, the hydrocarbon sector accounted for 57 percent of the country's total industrial output and 70 percent of export revenues; 27 percent of all foreign direct investments went into the extraction of crude oil and natural gas and 36 percent went into geological exploration and prospecting activities. But Kazakhstan's rapid growth in the last seven years did not exclusively depend on favorable world market conditions for these sectors. It is also the result of market-oriented economic reforms, especially rapid price and trade liberalization, privatization, sound macroeconomic policy, and the promotion of entrepreneurship. Moreover, the income and wealth effects resulting from expanded primary production stimulated other sectors, namely financial and general business services and construction/ real estate. The country's banking sector has been particularly praised by outside observers as Kazakhstan's major success and the most efficient one in the CIS.

Table-III
Main Economic Indicators of Kazakhstan (2000-20007)

Year	2000	2001	2002	2003	2004	2005	2006	2007
Real GDP (%change)	9.8	13.5	9.8	9.3	9.6	9.6	10.7	8.9
Prices (%change)	17.4	10.1	5.8	11.7	16.1	17.8	21.5	15.5
Gross capital formation (annual % growth)	10.7	37.52	11	6.3	15	35	31.7	23.4
Exports (bn$)	31.1	35.1	44.3	43.5	50.7	54.5	60.6	31.1
Imports (bn$)	33.4	32.9	33.9	31.4	36	40.6	45.7	57.6
Trade Balance (bn $)	-2.3	2.2	10.4	11.1	14.7	13.9	14.9	-26.5
Unemployment (%)	3.7	10.4	9.3	8.7	8.3	8.1	7.7	7.2

Sources: World Bank Development Indicators.

Period of Declining GDP

The high growth rates achieved during 2000-2007 came down suddenly in the succeeding phase as is evident from Table-IV. The growth rate of 10.7 per cent during 2006 came down to 3.3 per cent during 2008 and was just 1.2 per cent during 2009. Due to its heavy dependence on oil and gas exports, Kazakhstan's economy was hit again with the onset of the global credit crunch and subsequent economic downturn worldwide. The GDP growth slowed down by 1.8 percentage points in 2007, followed by a sharp slowdown in 2008 as the worsening global economic conditions resulted in lower oil and commodity prices. In the same time, the bust of the real estate market together with the massive devaluation of the tinge weakened the bank balance sheets as it increased dramatically the banking sector's external debt burden in tinge terms. As a result, a large fiscal support (7.5 per cent of GDP) was taken to support the banking sector and other measures were taken to support economic activity. In 2010, Kazakhstan's economy recovered rapidly, buoyed by the rise in the commodity prices due to global economic recovery and ongoing government stimulus and investment.

The growth rate was 7.3 per cent and 7.5 per cent for 2010 and 2011 respectively. Kazakhstan's growth rate remained at a moderate level of 4.8 per cent in 2012 and 6 per cent in 2013, even though this was still lower than before the global crisis. Growth slipped to 4.3 per cent in 2014 due to worsening conditions with a sharp decline in oil prices and spillover from sanctions on the Russian Federation, a major trading partner, but the growth was still higher than the world average of 3.3 per cent in 2014. Given the heavy dependence on oil and gas, and with its major trading partners being Russia and China, the future prospects of Kazakhstan's economy very much depend on external conditions.

Table-IV

Main Economic Indicators of Kazakhstan (2008-20014)

Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Real GDP (%change)	3.3	1.1	7.3	7.5	4.8	6	4.2	1.2
Prices (%change)	20.93	4.96	19.54	20.54	4.78	9.49	5.77	1.82
Gross capital formation (annual % growth)	-12.8	2.3	1.9	5.4	12.7	6.7	8.6	5.5
Exports (bn $)	72.11	63.53	65.5	65.76	68.92	70.78	69.01	66.18
Imports (bn $)	51.02	43.01	44.25	45.49	56.76	61.20	58.76	58.70
Trade .Balance (bn $)	2	2.2	10.4	11.1	14.7	13.9	14.9	-26.5
Unemployment (%)	6.63	6.55	5.76	5.38	5.28	5.19	5.05	4.97

Sources: World Bank Development Indicators.

Growth Accounting

Growth accounting was used by Abramovitz (1956) and Solow (1957) in explaining the determinants of growth worldwide, after World War II. In growth accounting, growth in a single country is decomposed over time, using a production function, into a part explained by growth in factor inputs and another part (i.e. the Solow residual), which is attributed to technological change, and is called Total Factor Productivity

(T.F.P.). The basic framework can be extended in other ways (Denison, 1967; Mankiw, Romer and Weil 1992), the most common of which is to consider different types of capital and labor (Romer, 1996). Growth accounting has been applied to numerous cases in the last two decades (Denison, 1985; Baily and Gordon, 1988; Griliches, 1988; Jorgenson, 1988; Young, 1994) with very satisfactory results. Cobb-Douglas production function, most commonly used production function in empirical investigations using aggregate data[2] (Thirlwall, 2001).

Following the methodology adopted by Michaelides, Economakis and Milios[3] in their study, we assume a Cobb-Douglas production function with two inputs, capital and labour and Hicks-neutral technological progress. So production at time t is given by:

$$Y(t) = A(t)\, L(t)^{\alpha} K(t)^{\beta} \qquad (1)$$

$$Y(t)>0,\ L(t)>0,\ K(t)>0,\ A(t)>0,\ \alpha>0,\ \beta>0$$

The notation is standard: Y is output, L labor, K capital, A the level of technology, while α and β are the elasticities of output with respect to labor and capital, respectively.

Technology constitutes a very crucial determinant of an economy's total productivity and competitiveness (O.E.C.D.,1996), however its direct quantification is difficult and it is often estimated indirectly using a production function.

From equation (1), using simple mathematics, we get that (see e.g. Thirlwall, 1999:181):

$$\frac{\vartheta y_t}{\delta t}\frac{1}{y_t} = \frac{\vartheta A_t}{\vartheta t}\frac{1}{A_{t+\sigma}}\frac{\vartheta L_t}{\vartheta t}\frac{1}{L_{t+\beta}}\frac{\vartheta K_t}{\vartheta t}\frac{1}{K_t}$$

$$\frac{\vartheta A_t}{\vartheta t}\frac{1}{A_t} = \frac{\vartheta y_t}{\delta t}\frac{1}{y_{t+\sigma}}\frac{\vartheta L_t}{\vartheta t}\frac{1}{L_{t+\beta}}\frac{\vartheta K_t}{\vartheta t}\frac{1}{K_t}$$

Equation (2) implies that the rate of change in output depends on growth in labour and capital, and on technological change, while equation (3) allows us to estimate technological change, indirectly.

Using simple mathematics, the rates of growth of labor productivity (Y/L) and capital productivity (Y/K) respectively, are given by:

$$1 = \frac{\vartheta y_t}{\delta t}\frac{1}{y_t} - \frac{\vartheta L_t}{\vartheta t}\frac{1}{Lt}$$

$$k = \frac{\vartheta y_t}{\delta t}\frac{1}{y_t} - \frac{\vartheta K_t}{\vartheta t}\frac{1}{K_t}$$

Thus, given that, typically, the sum of the values of α and β are set equal to unity (see e.g. Dornbusch and Fischer, 1993; Thirlwall, 2001; Stikuts, 2003; Billmeier, 2004), the Cobb-Douglas production function takes the form:

$$\frac{Y_t}{L_t} = \left(\frac{K_t}{L_t}\right)^{1-\sigma}$$

There are several approaches used by economists to estimating the shares of capital and labor in output. The first approach assumes that factor markets are perfectly competitive so that earnings of the factors (capital and labor) are proportional to their productivities. The second approach uses *a priori* measure of capital in the range of 0.3–0.4 (most commonly used in the growth literature). But many studies have found that the share of capital for developing countries is significantly larger than 0.4. The third approach would be to estimate the coefficients of the production function by regressing the growth rate of output on the growth rate of inputs and on the growth rates in capital and labor. The intercept (θ) then measures the growth in TFP, and the coefficients on the factor growth rates measure the shares of capital and labor, respectively.

As documented by Iradian, 2007,a fourth approach that does neither need perfectly market assumption nor the assumption of any particular functional form of the aggregate production function (Shigeru, Khan, and Murao, 2003). Their approach is based on nonparametric kernel derivative estimation techniques developed in the statistics and econometrics literature. This approach estimates much lower elasticity of output with respect to capital (around 0.20) for several East Asian countries, thus emphasizing even more the role of the residual (growth in TFP) in explaining growth.

Empirical Results

In this paper following the approach taken by De Broeck and Koen (2000)[3], the present accounting is done keeping the above Cobb Douglas

production function. It should be noted that this type of accounting relies on the assumption of the constant returns to scale production function. For simplicity the elasticities of output with respect to capital and labour are assumed to equal 0.3 and 0.7, respectively, and to be constant over time. Also the value of capital depreciation will be used in the calculation of the initial capital stock. In literature various values of the depreciation rate are used. Here we assume that rate of depreciation 0.05, which means that the full depreciation of a given capital unit takes place within 20 years. The choice of this value is based on estimates found in various pieces of research[4]. The computed changes in TFP should be interrupted as residuals that reflect a wide range of factors affecting the efficiency with which inputs are used.

The calculation results are summarized in Table-V, which reports average annual output, capital share, labour force share and residual total factor productivity of country Kazakhstan for the three phases: 1991-1999, 2000-2007and 2007-2014.

Table-V

Growth Accounting Results in Three Phases

Year	Output Growth	Capital Share*	Labor Share	TPF
1991 - 1999	-4.82	-5.87	-0.31	1.36
2000 - 2007	10.17	5.20	0.82	4.26
2008 - 2014	4.88	-0.13	1.19	3.84

Source: Results for different periods are obtained from own calculation using GDP, gross capital formation and total labor force data from the World Development Indicators.

**Annual depreciation rate is assumed to equal 0.5.*

During 1991-1999, the growth rate in production was negative, and declined by -4.82% per year. The major contributory factor in the collapse of output is attributed to drastic decline in rate of capital formation (-15.58%), by virtue of which capital stock share of output was recorded as -5.87 on an average. On the other hand, the labor force, another major factor of production, recorded almost a constant average growth rate (-0.005%) during this period and explains only a fall of -0.31 percent in its share of total collapse of output. Finally, the contribution of total factor productivity, on an average, in explaining the growth has remained positive and dominant with a share equal to 1.36 percent. We can see, therefore, that technology constituted the

"sheet-anchor" of the Kazakhstan economy during the period under investigation, since it kept the negative average annual rate of change in G.D.P. to only -4.82%, when a dramatic decline of the capital stock took place in the economy.

During second phase (2000-2008), the growth rate in production became positive but very high of the order 10.17 percent on an average. All the variables become positive. The capital stock contributed to this high GDP growth rate with a dominant share of 5.20 percent, while the share of labor made a contribution of only 0.82 percent. Finally, the annual average rate of change in T.F.P. during the period 2000-2007 was positive and equal to 4.26%. We can, therefore, conclude that capital and technology constituted the main driving force of the Kazakhstan economy during the second period. In third phase (2007-2014), growth rate once again declined and was 4.88 percent. The main reason of this decline was the negative contribution of capital stock. The capital stock contributed to this fall with a rate equal to -0.13 percent[5]. However, labor and technology contribution was positive and having values 1.19 percent and 3.84 percent respectively.

Conclusion

Soon after breakup from the erstwhile U.S.S.R. the Kazakhstan economy was shattered as reflected in the deterioration of its major macroeconomic indicators. Conditions were further aggravated due to embarking on the path of market economy from a system of central planning. The country found itself in a transformational recession that lasted for about more than seven years. However, it is evident from our analysis that the severity of the recession was somehow subdued by the role of total factor productivity (technology), under the conditions when there was serious collapse of investment. With the improvements in business climate due to progress made in establishing the foundations of free market economy by way of structural adjustments and stabilization policy, higher growth trajectories associated with sound macroeconomic indicators was experienced by the economy. As a result capital formation was on rise, which along with improvements in total factor productivity was responsible for sustained economic growth, especially during the second phase. However, this growth momentum seems to have slowed down in the recent past with the economy experiencing boom in the hydrocarbon sector. This has serious implications in the

sense that a lopsided growth may occur resulting into "dutch disease". For the balanced development of the economy it is, therefore, essential that measures are taken for improving productivity by diversification of the resources away from oil towards other sectors of the economy like agriculture, manufacturing and industry, enhancing the sector specific skills and education so that innovation, research and creativity can foster an environment of entrepreneurship leading to improvement in technological progress, finally leading to sustainable development.

References & Notes

1. *There could be various reasons assigned to existence of low unemployment rates alongside meltdown of production system like underestimation by official statistics, early retirement of the elderly as well as a decline in women's participation rates and above all privatization drive of SOEs was gradual and cautious retaining employment to ward off social crises. These reasons may be enough to explain why the collapse in production did not result in rapidly increasing unemployment.*
2. *There is certain limitation in using Cobb Douglas production as it is based on various assumptions. For a brief review of the model's theoretical limitations see Thirlwall (2001: 185-7.)*
3. *As for transition countries are concerned, De Broeck and Koen (2000) assumed shares of 0.3 for capital and 0.7 for labor. Loukoianova and Uigovskaya (2004) extended the period used by Broeck and Koen but using the same elasticities of output with respect to capital and labor for all transition countries.*
4. *Examples of such studies are Hern´andez and Maule´on (2003) for the economy of Spain, Cororaton (2002) for the Philippines, Felipe (1997) for a group of countries in East Asia, etc.*
5. *It is observed that during this period average growth rate of capital formation was 3.77 per cent compared to 10.17 per cent during the preceding period.*

De Broeck and Koen (2000), "The Great Contractions in Russia, the Baltics and the other countries of the Former Soviet Union", WP/00/32, *IMF Working Paper*.

Iradian, Garbis (2007), "Rapid Growth in Transition Economies; Growth Accounting Approach" *IMF Working Paper*, WP/07/164

Jeffrey A. Frankel and David Romer (March 1996), "Trade and Growth: An Empirical Investigation," *NBER Working Paper* No.5476, Massachusetts Avenue Cambridge.

Mankiw; Romer; and Weil(1992), "A Contributionto the Empirics of Economic Growth", *The Quarterly Journal of Economics*, Vol. 107, No. 2 (May, 1992), pp. 407-437 Published by: The MIT Press.

Organization for Economic Cooperation and Development (1995), "Recommendation of the Council of OECD on Improving the Quality of Government Regulation", Paris.

Shigeru, Khan and Murao (2003), "Sources of Economic Growth in East Asia; A Nonparatmeric Assessment," *IMF Working Paper*, WP/02/13.

Solow, Robert, M (1957), "Technical Change and the Aggregate Production Function", *The Review of Economics and Statistics,* Vol.39, No.3, MIT Press.