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Display of Factor – Utilization in Central Asia

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ABSTRACT

This paper illustrates a simple method to elicit the income accounts in the context of incomplete macroeconomic data. The method the enables the display of widely used factor utilization function in macroeconomics. The analysis of this function with reference to four Central Asian economies (Kazakhstan, Mongolia, Kyrgyzstan and Uzbekistan) provides the basis for studying factor shares of income and the relative contributions of factors to economic growth.

I. INTRODUCTION

An appreciation of factor-utilization at the aggregate level requires a study of the income accounts. These accounts detail the payments to factors utilized towards the formation of national income (Y). However, the income accounts are generally available for only a limited number of countries – mainly those belonging to the OECD group. The main aim of this brief note is to exposit a simple method for eliciting the income accounts in the context of sparse macroeconomic data.

We consider first the case of South Korea, which has its income accounts available for review on the public domain; (OECD 2014). We then compare the published estimates of the income accounts for South Korea with those derived from our proposed approach. As indicated below, this comparison validates our approach. Following its validation, we use our proposed approach to study changes in factor-utilization that have emerged in selected Central Asian economies since their transition to becoming market economies. The economies considered here are Kazakhstan, Kyrgyzstan, Mongolia and Uzbekistan. Both Kazakhstan and Mongolia are resource rich and mining contributes significantly to national income. In contrast, the role of mining is virtually insignificant in Uzbekistan and is minimal in Kyrgyzstan. As we indicate below, these varying resource endowments are likely to influence the patterns of factor-utilization.

II. FACTOR-UTILIZATION AND THE INCOME ACCOUNTS

To facilitate our illustration, we assume following standard texts such as Mankiw (2010) and Taylor (2012) that a Cobb-Douglas (C-D) factor-utilization function of constant returns to scale is a valid descriptor of the determinants of national income (Y). That is:

$$Y_t = \alpha_t KM_t^{\theta_t} L_t^{\lambda_t} \qquad (1)$$

In (1), KM_t and L_t, represent respectively the stock of manufactured capital and labor utilized in time t, whilst θ_t and λ_t represent the shares of national income that accrue respectively to KM and L during the same time period, and due to the assumption of constant returns to scale ($\theta_t + \lambda_t$,= 1). The coefficient α_t is a measure of total factor productivity.

The assumption of constant returns to scale enables the elicitation of the pertinent coefficients (α, θ, λ) of the C-D function as point-estimates in a time-series directly from the statement of national accounts – specifically the income accounts. This is because the statement of income accounts (Lequiller and Blade 2014, Ott 2008) is based on the following set of identities between Gross Value Added at Factor Cost (GVA), National Income (Y), Compensation of Employees (CE) and Operating Surplus (S):

$$GVA \equiv Y \equiv CE + OS \qquad (2)$$

Because CE and OS represent respectively payments accruing to L and KM, the point-estimate factor shares of Y can be defined as follows:

$$\lambda_t = \frac{CE_t}{Y_t}; \qquad \theta_t = \frac{OS_t}{Y_t} \qquad (3)$$

The major challenge to the illustration of point estimates as per (3) above is the absence of income accounts from the public domain for the countries chosen for our illustration. This absence includes as well the datasets compiled by organizations such as the World

Bank and the Asian Development Bank. Further, such absence is not unique to Central Asia. The income accounts are not readily accessible for almost all countries that remain outside the OECD.

Hence, the next section deals with a simple proxy approach for the estimation of CE and OS for the countries considered here. As indicated, in this section we test the validity of our approach by testing it with reference to South Korea, which has a detailed breakdown of the income accounts provided in the OECD statistics portal.

III. PROXY APPROACH FOR ESTIMATING THE INCOME ACCOUNTS

The estimates of gross domestic product (GDP) in terms of the expenditure and income accounts are defined as follows:

GDP (Expenditure) = C + I + G + X – M; GDP (Income) = CE + OS + T, where C = Final Household Consumption, I + Gross Capital Formation; G = General Government Expenditure; X = Exports; M= Imports; and T = Net Taxes. Therefore, it follows that in the context of GVA estimates being unavailable, whilst the expenditure estimates of GDP are available, GVA could be estimated as [GDP – T]. However, most non-OECD economies provide estimates of GVA, but, without the breakdown into CE and OS. The approach we suggest is to provide a proxy estimate CE. Then OS could be estimated as simply (GVA – CE). The proxy estimation of CE as a time series is based on the following steps:

1. Elicit the average wage rate for the base year in the time series. This elicitation is generally feasible by recourse to information on the public domain; for example, the publication of ministries of manpower, media reports and portals such as Economists Intelligence Unit[1] and Trading Economics[2].

2. Because (nominal wage = real wage) for the base year, the real wages of the rest of the time series can be estimated by simply multiplying the base year wage by

[1] http://www.eiu.com/home.aspx
[2] http://www.tradingeconomics.com/countries

the GDP deflator (P) of the relevant year. Generally, then, if the base year is *t* and the real wage of the base year is W_t, then the real wage of, say, year *j* is $\{W_j = W_t * P_j)\}$. In principle, this proxy method amounts to using the average real base year wage for each year in the time series.

3. CE of a given year, say year *j*, would be then the multiple of the average proxy wage and the size of labor employed that year; that is $(W_j * L_j)$.

However, a greater level of consistency between the proxy and OECD estimates of CE was observed when the base year real wage trended over time in terms of the observed trend of the real GVA compared to the process outlined in step-2 above.

As indicated, the validity of the proxy estimates were tested with reference to South Korea – for which CE estimates are provided by the OECD. The comparison of these two sets of estimates is presented in Figure-1 in terms of both the GDP deflator (Figure1-A) and the trend of real GVA (Figure1-B). As illustrated below, the Proxy CE estimate derived by recourse to trends of real GVA displays a greater proximity with the OECD estimate for CE than the estimate derived using the GDP deflator. The average divergence across the 23 year time period is approximately 6 per cent for the proxy method based on the GDP deflator. This average divergence is almost halved when the trend of the real GVA is used. Hence we generate the proxy estimates for our selected economies by recourse to trends on real GVA.

IV. FACTOR-UTILIZATION IN CENTRAL ASIA

The pertinent macroeconomic data for all four Central Asian economies were drawn from the most recent (2014) datasets of the World Bank and the Asian Development Bank. The data on wages as drawn from different sources is presented in Table-1.

This display of factor utilization as per (1) above necessitated the estimation of capital stock (KM) using the perpetual inventory method alongside the elicitation of data on employment (L) and the labor force (L_F). A comparison of the factor shares of income (θ, λ) and total factor productivity indicators (α) are summarized in Table-2. These are

also illustrated in Figures 2 and 3. The following observations appear pertinent with reference to the coefficients of the C-D function:

1. The factor shares of Y show signs of clear divergence for Kyrgyzstan implying that L is far more dominant a factor compared to KM.

2. Uzbekistan displays, subsequent to an initial period of convergence, divergence – but in a direction opposite to that of Kyrgyzstan; that is, KM reveals a tendency for dominance.

3. Both Mongolia and Kazakhstan display signs of convergence and there seems to be a greater sense of stability with the factor shares for Kazakhstan than for Mongolia.

4. The total factor productivity coefficient displays a more marked upward trajectory for Kyrgyzstan and Uzbekistan than for Mongolia and Kazakhstan. Mongolia's trajectory for this coefficient has been downward for the last 4 years, whilst Kazakhstan's upward trajectory has been slight, displaying a near stationary level.

The trends in the factor shares of income (1 – 3 above) illustrate the patterns of distribution of national income between the two factors. As an extension of these observations, a growth accounting exercise was completed in terms of period averages for Y, KM, L, θ, λ and α. That is, the relative contribution of L and KM to the average rate of economic growth that was observed during the period was estimated with reference to the following definition:

$$\frac{\dot{Y}}{Y} = \frac{\dot{\alpha}}{\alpha} + \theta \frac{\dot{KM}}{KM} + \lambda \frac{\dot{L}}{L} \qquad (4)$$

The results of the analysis are presented in Table-3. Over the respective periods considered, all four economies registered positive values for the rates of change of Y and of the contributions of KM and L to the changes of Y. The contribution of KM was greatest in Mongolia and Kazakhstan – the two resource rich economies. The contribution of L is almost zero in Kazakhstan and relatively less significant (less than 2%) in the remaining economies. This observation begs the question of whether resource dependency in Kazakhstan and Mongolia is curbing the mobilization of L.

The presence of technology and other institutional factors is generally explained by the residual; (Easterly and Levine 2001, Romer 2000). In the case of Mongolia, the negative contribution of the residual implies the possible absence of technology and other factors such as institutions. However, the reasonably positive value (2.62%) for the residual in Kazakhstan could imply the reverse. Improvements with indicators such as persistence with schooling and reduction in poverty gaps suggest that Kazakhstan is most likely making investments in human capital and is hence attempting to move away from resource dependency. With Mongolia, one observes the dominance of foreign direct investment in mining alongside a persistent deficit in the current account. The negative value of the residual in Mongolia in such a context suggests the possibility of an underlying resource dependency. This is probably because the technology embedded in the FDI and the associated imports is confined to mining and does not spillover to the rest of the economy. In contrast, Kazakhstan displays a positive value for the residual alongside a positive balance in the current account. Further, the size and nature of the residual is also likely to be associated with income distribution. A review of income distribution in terms of percentage shares of income (Table-4) shows that it is only Kazakhstan and Uzbekistan that have displayed some improvement – whilst the context in Mongolia has been the reverse and the improvements in Kyrgyzstan has been marginal.

V. CONCLUSION

As indicated, the main aim of this study has been the demonstration of a proxy method for generating the income accounts. These accounts have been illustrated for four Central Asian economies. The display of such accounts has enabled in turn the display of factor utilization functions based on the premise of a Cobb-Douglas function of constant returns to scale being a valid descriptor of Y. It was further possible to analyze these functions with reference to factor shares of income and the contribution of the factors to economic performance. As indicated, improved aggregate economic performance has not necessarily meant the gains of growth have reached the lower strata of society.

REFERENCES

Easterly, W. and Levine, R. (2001). "It's Not Factor Accumulation" *The World Bank Economic Review*, 15(2): 177-219.

Mankiw, G. N. (2010). *Macroeconomics*, Seventh Edition, Worth Publishers.

Lequiller, F. and Blades, D. (2014). *Understanding National Accounts*, Second Edition, OECD Publishing.

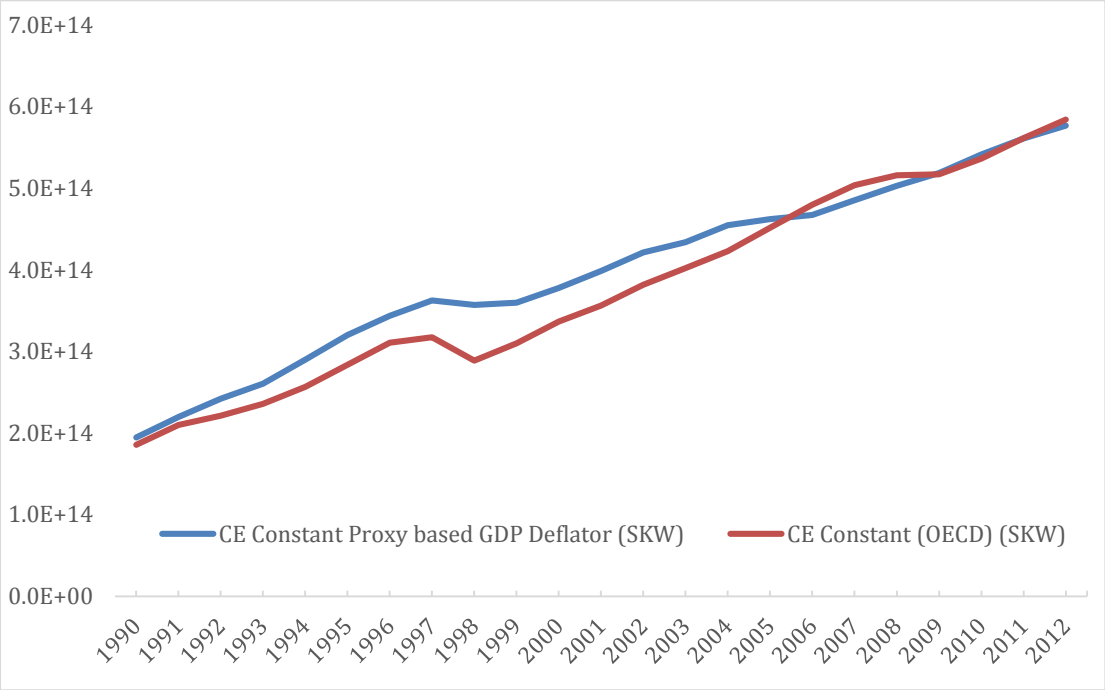
Ott, M. (2008). "National Income Accounts", In Henderson, D. R. (ed.). *Concise Encyclopedia of Economics*, Second Edition, Library of Economics and Liberty.

Romer, D. (2000). *Advanced Macroeconomics*, Second Edition, McGraw-Hill/Irwin.

Taylor, R. (2001). *Macroeconomics*, Third Edition, Houghton Mifflin Company.

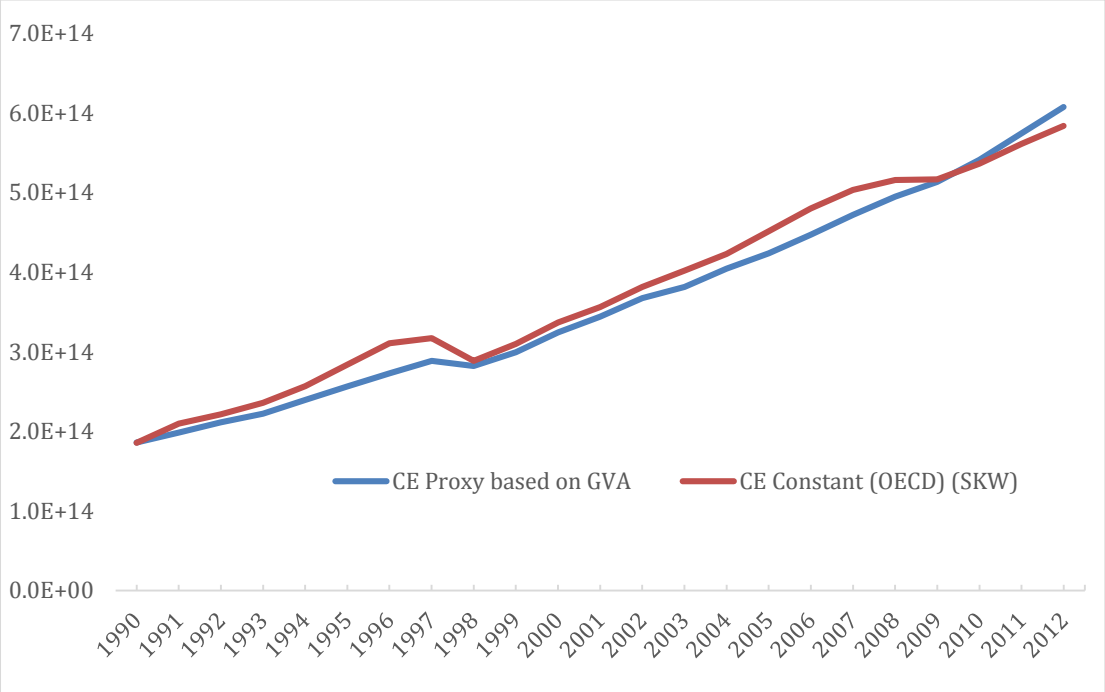
FIGURES

Figure-1A: Comparison of CE Estimates (Proxy based on GDP Deflator)



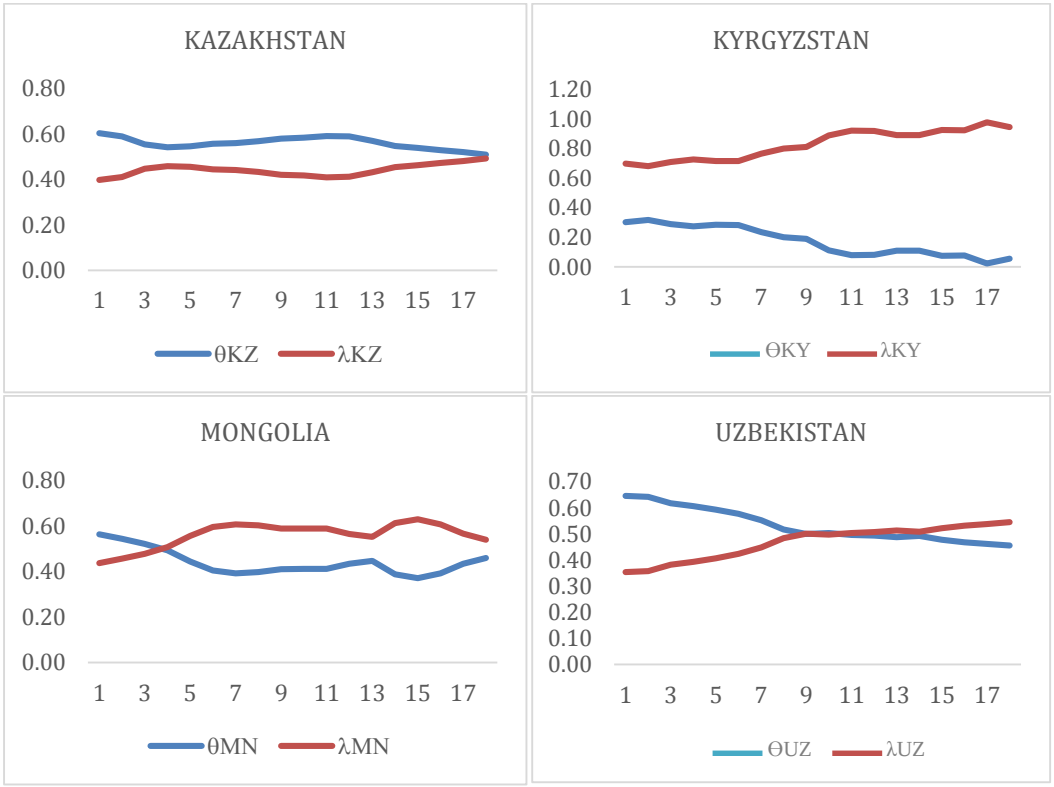
Sources: World Bank. World Development Indicators Online. http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators (accessed day / month / year); Authors' estimates.

Figure-1B: Comparison of CE Estimates (Proxy based on Real GVA Trend)



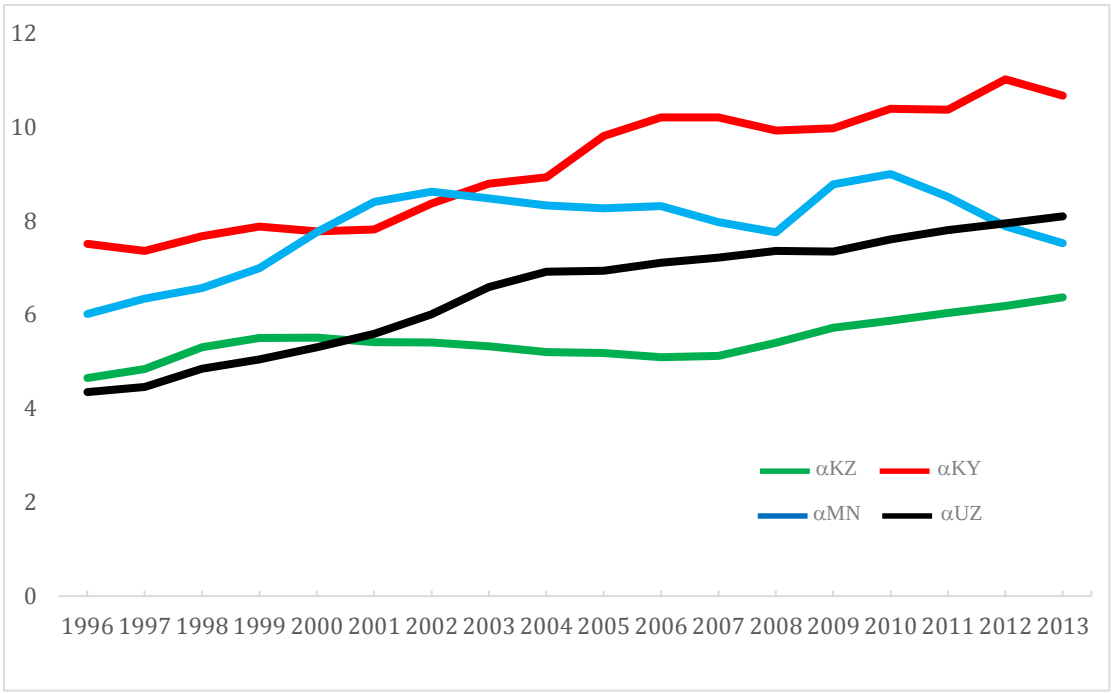
Sources: World Bank. World Development Indicators Online. http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators (accessed day / month / year); Authors' estimates.

Figure-2: Time-Trends of Factor Shares of Y



Sources: World Bank. World Development Indicators Online. http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators (accessed day / month / year); Authors' estimates.

Figure-3: Time trends of Total Factor Productivity Coefficient



Sources: World Bank. World Development Indicators Online. http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators (accessed day / month / year); Authors' estimates.

TABLES

Table-1: Average Wages in Central Asia

Country:	Average Annual Wage and Year
Kazakhstan	KZT 407,185 (*2005*)[3]
Kyrgyzstan	KGS 720,80.4 (*2009*)[4]
Mongolia	MNT 3,456,000 (*2009*)[5]
Uzbekistan	UZS 31,967,17.557 (*2011*)[6]

[3] http://www.tradingeconomics.com/kazakhstan/wages
[4] http://centralasiaonline.com/en_GB/articles/caii/features/2009/11/24/feature-07
[5] http://mad-research.com/mongolia/demographic-trends/employment-and-wages/
[6] http://www.uz.undp.org/content/uzbekistan/en/home/countryinfo/

Table-2: Factor-Utilization Coefficients as Point-Estimates

YEAR	KAZAKHSTAN			KYRGYZSTAN			MONGOLIA			UZBEKISTAN		
	θKZ	λKZ	αKZ	θKY	λKY	αKY	θMN	λMN	αMN	θUZ	λUZ	αUZ
1996	0.60	0.40	104.44	0.30	0.70	1818.25	0.56	0.44	408.17	0.65	0.35	77.56
1997	0.59	0.41	126.39	0.32	0.68	1565.46	0.54	0.46	568.29	0.64	0.36	86.00
1998	0.55	0.45	201.26	0.29	0.71	2148.75	0.52	0.48	712.63	0.62	0.38	126.89
1999	0.54	0.46	244.56	0.27	0.73	2630.51	0.49	0.51	1082.09	0.61	0.39	155.54
2000	0.54	0.46	246.92	0.28	0.72	2382.40	0.44	0.56	2350.88	0.59	0.41	200.79
2001	0.56	0.44	223.94	0.28	0.72	2478.31	0.40	0.60	4470.89	0.58	0.42	268.11
2002	0.56	0.44	222.14	0.23	0.77	4312.16	0.39	0.61	5534.33	0.55	0.45	406.06
2003	0.57	0.43	205.78	0.20	0.80	6565.71	0.40	0.60	4804.11	0.52	0.48	727.20
2004	0.58	0.42	181.88	0.19	0.81	7542.72	0.41	0.59	4121.21	0.50	0.50	1003.63
2005	0.58	0.42	177.84	0.11	0.89	18170.87	0.41	0.59	3887.14	0.50	0.50	1025.76
2006	0.59	0.41	162.30	0.08	0.92	27019.35	0.41	0.59	4091.77	0.50	0.50	1217.24
2007	0.59	0.41	166.71	0.08	0.92	26953.81	0.43	0.57	2898.03	0.49	0.51	1356.83
2008	0.57	0.43	221.66	0.11	0.89	20432.42	0.45	0.55	2324.16	0.49	0.51	1572.28
2009	0.55	0.45	304.16	0.11	0.89	21448.57	0.39	0.61	6499.63	0.49	0.51	1545.95
2010	0.54	0.46	354.29	0.07	0.93	32399.92	0.37	0.63	8089.89	0.48	0.52	2010.11
2011	0.53	0.47	416.83	0.08	0.92	31755.72	0.39	0.61	4966.46	0.47	0.53	2444.51
2012	0.52	0.48	484.93	0.02	0.98	60988.10	0.43	0.57	2655.98	0.46	0.54	2826.43
2013	0.51	0.49	582.67	0.05	0.95	43072.62	0.46	0.54	1843.88	0.46	0.54	3280.49

Source: Authors' estimates.

Table-3: Factor Contributions to Economic Growth

	KAZAKHSTAN	MONGOLIA	KYRGYZSTAN	UZBEKISTAN
Rate of Growth	0.075	0.062	0.043	0.07
Contribution of KM	0.041	0.064	0.013	0.021
Contribution of L	0.009	0.013	0.017	0.012
Residual	0.026	-0.015	0.013	0.037

Source: Authors' estimates.

Table-4: Changes in Income Distribution

	KAZAKHSTAN		MONGOLIA		KYRGYZSTAN		UZBEKISTAN	
	1993	*2010*	*1995*	*2008*	*1998*	*2011*	*1998*	*2003*
Income share of highest 20%	40.39	38.25	40.76	44.04	43.53	41.4	49.56	43.33
Income share of lowest 20%	7.49	9.45	7.37	7.1	7.16	7.68	3.91	7.44

Source: World Bank. World Development Indicators Online. http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators (accessed day / month / year).