Session Number: Plenary Session 1
Time: Monday, 25 August, AM

Paper Prepared for the 30th General Conference of
The International Association for Research in Income and Wealth

Portoroz, Slovenia, August 24-30, 2008

A Study of Changing Income Distribution in Kazakhstan Using a New Social Accounting Matrix and Household Survey Data

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Abstract

Since the collapse of the Soviet Union in 1991, the successor states have all been moving – albeit at different speeds and in different ways – towards some form of market-type economy. The transition process has been accompanied by major disruption of much existing production, and by large changes in living standards and income distribution. After experiencing deep post-communist recessions, almost the whole region is now growing quite rapidly. But measuring these large and rapid changes is difficult and uncertain due to poor data quality, frequent changes in statistical methodology, and other problems.

This paper develops a framework for building a Social Accounting Matrix (SAM) for Kazakhstan based on the UN 1993 System of National Accounts and Input-Output tables. A highly aggregated macro-SAM is constructed first, mostly using National Accounts data. At the second stage, a disaggregated micro-SAM is built using macro-SAM aggregates and Input-Output tables. To reconcile the Input-Output tables with the National Accounts, we use cross entropy and least squares methods of adjustment. This procedure also allows us to eliminate various inconsistencies in the final SAM. Third, using household survey data, we introduce several household types into the model (essentially, cohorts defined according to their income levels) to enable us to study income distribution and trends in it during Kazakhstan's transition. Finally, we integrate all these elements into a CGE model for Kazakhstan, enabling us to explore the probable impact of rising oil exports on Kazakhstan's income distribution and various inequality measures.

All the data used in the paper are relatively easy to obtain from national statistical agencies and the methods developed herein could be applied to building detailed SAMs and associated CGE models for other developing and transition economies where the quality and availability of data is often a problem.

JEL Classification: C67, C81, D31

Keywords: social accounting matrix, income distribution, Kazakhstan, transition economies, input-output tables, household surveys

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1. Introduction

While it was one of the constituent republics of the former Soviet Union, income distribution in Kazakhstan was not much studied, and nor were much data published to facilitate such a study. At that time, most incomes were simply wages, supplemented, especially in the countryside, by own production of food. There were some social benefits such as pensions and childcare support, but there was no private income from profits or dividends since virtually all production was state owned. Senior officials and the political elite had access to various forms of non-monetary income, taking the form of publicly provided dachas, official cars (and drivers), access to special shops where goods in short supply were available, and so on. Hence if all such incomes and benefits were measured correctly, the 'true' income distribution was undoubtedly far more unequal than a simple Gini coefficient based on the official wage distribution would have implied.

Since its independence in 1991, when the Soviet Union ceased to exist as a political entity, Kazakhstan's economic fortunes have fluctuated massively. The 1990s were an especially turbulent decade, with a burst of inflation that exceeded 1000% in each of the years 1992-4, declining rapidly thereafter as the government, having introduced a new currency, the Tenge, regained effective control over the macro-economy. The inflation, however, largely wiped out the savings that many people had accumulated during the Soviet period. Meanwhile, partly as a result of the disruption to normal commercial relations that accompanied the break up of the Soviet Union, officially measured real GDP fell to a low point of 61.4% of its 1990 level in 1995. Growth then resumed, initially very slowly, but from the year 2000 Kazakhstan's economy has grown at 9% p.a., sometimes even faster. By 2006, the country's real GDP had reached 125% of its pre-transition level of 1989 (EBRD, 2007). Recent growth has been stimulated both by increased production and exports of oil and gas, and by a domestic construction boom, the latter including the establishment of a new capital at Astana, 800km to the north of the old, Soviet-era capital, Almaty.

As for living standards in Kazakhstan, these must have declined catastrophically in the early transition years, though possibly not quite as severely as the official figures imply. For until 1996, reported personal consumption fell even further than GDP as a whole, then only rising slightly up to 2000. Only since 2001 has consumption growth taken off, rising at a faster rate than GDP for all of the last five years (2003-7). In purchasing power parity (PPP) terms, Kazakh GDP per head in 2006 in current US dollars was around $8800; this compares with the EU-25 average of about Euros 23,400 in 2005 (Eurostat, 2008), and in World Bank terms it confirms Kazakhstan's position as an upper middle income country.

Incomes and consumption might now be growing rapidly, but what does this imply for the evolution of income distribution in Kazakhstan? With growth rather heavily focused around a few sectors, are its benefits similarly concentrated, or is the general population enjoying improving living standards? These are the questions that we start to explore in this paper, using recent input-output tables, a fairly aggregated and a more detailed social accounting matrix (SAM), and several years of household expenditure survey data. Putting all these elements together in the framework of a multi-household CGE model for Kazakhstan, is quite difficult and we only present a single illustrative scenario in this paper. We mostly dwell on methodological and data issues, plus the presentation of some initial, preliminary findings.

To provide a wider context for our work, we now briefly review what is known about the income distribution changes occasioned by the process of transition from plan to market. The World Bank first systematically reviewed the process of transition from plan to market in its *World Development Report* for 1996, World Bank (1996). Chapter 4 of this report (esp. Figure 4.1 and Table 4.1, pp.68-9) shows that Gini coefficients everywhere increased in the transition countries, though in Central Europe they still remained below the late 1980s OECD average of around 35%. Russia and the Kyrgyz Republic, however, both had Gini coefficients close to the OECD average in 1987-8, i.e. before transition, but inequality increased rapidly in the early transition years, with Gini coefficients exceeding 45% by 1993. The poverty headcount also appears to have risen sharply in both countries.

A far more detailed analysis of the impact of transition on inequality and poverty was provided by Milanovic (1998), some findings from which are summarised in Milanovic (1999). From these sources, it appears that income inequality did not rise as dramatically in Kazakhstan as elsewhere, the Gini coefficient derived from the distribution of per capita income starting at 26% in 1987-8, and only reaching about 33% by 1993-5. Over the same period, the poverty headcount went up from 5% to 65% of Kazakhstan's total population. The most significant factor explaining increased inequality was increased inequality in the wage distribution. Non-wage income and social benefits apparently contributed little to changes in equality in these early transition years. IMF (2000, chapter III) shows that at least in the late 1990s, Kazakhstan was near the top of the ranking of CIS countries in terms of reform progress and GDP recovery, and although many people remained in poverty, the country was doing better than many others in the CIS. It should be remembered, too, that most official data did not reflect fully the informal economy, and this must have kept many families above the poverty line during this difficult period.

Hölscher (2006) studied income distribution in the Czech Republic, Hungary, Poland and Russia. He found that the first three countries experienced only quite modest increases in inequality, and that their development paths have been heavily influenced by their progress towards EU accession (achieved in May 2004) and the constraints of adopting EU policies and institutions. No such constraints applied to Russia, and income inequality there rose massively and remains high even now that the country has achieved solid rates of growth since 2000. In terms of this comparison, we would naturally place Kazakhstan somewhat closer to Russia.

The connections between inequality and growth are not well understood and are much debated, as was apparent in the diverse papers in Cornia (2004). Specifically for the transition economies, the connections are explored in depth in Sukiassyan (2007), who finds that 'the effect of inequality on growth is negative, strong, and rather robust'. Initial conditions and economic policy are found to exert a significant effect on growth rates. Interestingly, though, Kazakhstan was not one of the countries exhibiting a significant link between inequality and growth; moreover, as an economy well endowed in energy resources (mostly oil and gas), its recent rapid growth offers a striking contrast to the general view that resource-rich countries tend to grow more slowly and have higher inequality than countries lacking resources (e.g. see Sachs and Warner, 1995). Thus for Kazakhstan, there remains a good deal to explain.

A useful start to explaining Kazakhstan's experience was made by Verme (2006), who used household expenditure surveys for 2001 and 2002 produced by the National Statistical

Agency. Surprisingly, this paper finds that despite GDP growth approaching 10%, real per capita consumption measured from the household surveys only increased by 0.7% between 2001 and 2002. Nevertheless, measuring poverty using the Foster-Greer-Thorbecke (FGT)[1] class of indicators, with P(0) being the headcount measure, P(1) measuring the poverty gap and P(2) the severity of poverty, Verme shows that all three measures recorded a decline in poverty. In addition, the estimated Gini coefficient declined from 29.4% in 2001 to 28.1% in 2002. Growth between 2001 and 2002 was found to be strongly pro-poor, with the growth of real income highest for the poorest decile of the population, this growth rate declining monotonically as one shifts through higher income deciles of the population; for the highest three deciles, average real incomes actually fell. In the course of our own study, we shall endeavour to discover how far this pattern of growth and income distribution change has been sustained to more recent years.

2. Household Survey Data and Measures of Changing Income Distribution

2.1 The basic data

The Kazakhstan Household Budget Survey (KHBS) is a valuable source of information on household incomes and expenditures; this papers employs KHBS data for the five years, 2001 through 2005. Each survey covers about twelve thousand individuals, the sample being designed to be representative at the regional level, and is compiled on a yearly basis. In 2001, a completely new methodology was introduced and this has been followed up to the present. This means that from 2001 onwards the surveys are highly comparable across years. However, successive annual surveys do not constitute a panel dataset, since no attempt is made to monitor the same individuals each year. The survey is in six parts:

1. Annual questionnaire, which includes housing conditions; availability of land, livestock and machinery; brief education and employment information.
2. Annual health module.
3. Annual expanded education module.
4. Annual household demographic card.
5. Quarterly questionnaire of the households' expenditures and income. It also includes quarterly employment statistics.
6. Quarterly diary of expenditures, filled in by respondents only for 14 days of the quarter in 2001-2003 and for 1 month in 2004-2005.

The raw primary household survey data come in dbf-format (i.e. Xbase or dBase datafile format) and are not at all organised in a user-friendly manner. It required considerable manipulation of the raw data to assemble consistent time series of income and expenditure. The number of households taking part in the survey decreases every quarter, so for this paper we only used data for those households taking part in all four quarterly interviews. Table H1 shows the final household sample size for each year.

(table H1 about here)

Household income is assembled by quarter from the following generic categories: transfers and other assistance; income from farming activity; income from own-production of goods and services; income from employment; and social benefits. For the purposes of the SAM

[1] These poverty indicators are defined in the Annex.

construction we keep separate the income from sales of real estate, credit and borrowed money; these items need to be excluded from current income for consistency with Kazakhstan National Statistical Agency (KNSA) methodology. To ease tractability we aggregate income items into five categories:

1. Social benefits – pensions, scholarships, social benefits, housing assistance, etc.
2. Inter-household transfers – assistance from family and friends, borrowed money from family and friends, alimony payments.
3. Capital income – entrepreneurial income and profits, such as income from sale of own production of goods and services, etc.
4. Labour income – salaries including payments in kind, other employment-related payments such as redundancy payments.
5. Transfers from firms (property income) – dividends from shares/securities, sales of real estate, sales of personal or domestic property, loans.

Table H2 below shows the income structure of the representative household by source of income and years. We note that the share of capital income almost doubled over the period 2001-2005, at the expense of social benefits and wages.

(table H2 about here)

Table H3 shows the resulting income shares for households broken down by income deciles and rural and urban types. In 2002, the poorest ten percent (decile 1) only received 3% of total income and the richest ten percent (decile 10) received about 27%, a pattern that also holds for other years of the sample.

(table H3 about here)

Total household expenditures consist of the following major blocks: diary items, which included food and drink and other non-food, frequently purchased goods; clothes, textiles and footwear; home appliances, furniture and other household goods; public utilities; education; health; transport; transfers and assistance; and other expenditures.

Since respondents filled in the diary only for 14 days in 2001-2003 and for 1 month in 2004-2005, to get quarterly expenditure we follow KNSA and multiply by 6.5 and 3 accordingly. Again, following KNSA and to avoid double counting, we do not include expenditures on farming activity and on own-production of goods and services (parts 9 and 10 of the quarterly questionnaire). The resulting file has about 600 expenditure items, which for presentation purposes and construction of the SAM we aggregate into 25 blocks. In table H4 the expenditure structure for the representative household is presented.

(table H4 about here)

2.2 Poverty and inequality

It is well known that incomes are often under-reported by respondents and are generally a less reliable source of data about poverty and inequality than expenditure data. Hence it is quite common to measure poverty using expenditure rather than income statistics, and we shall follow this established practice here. To calculate poverty statistics in a meaningful way, we ideally need expenditures per capita rather than per household. However, by simply dividing household expenditures by the number of people in the household we would ignore scale economies in consumption, which could be quite significant. Accordingly, per capita expenditure is calculated using the Kazakhstan National Statistical Agency's equivalence scale; this is shown in Table H5 (see OECD, nd, for a short discussion of equivalence scales).

(table H5 about here)

Kazakhstan is a massive country in terms of land area (similar to the whole of Western Europe) and different regions differ economically in many significant respects relevant for measuring features of the income/expenditure distribution. For our poverty statistics, therefore, we use region-specific poverty lines calculated by the KNSA. These are shown, in nominal Tenge per month, in Table H6.

(table H6 about here)

There are two major mineral-producing regions in Kazakhstan, namely Atirauskaya and Mangystauskaya, accounting for 42% and 24% respectively of total minerals production in 2002. Interestingly, these two regions have the highest poverty line among all regions. The numbers of the poor declined for all regions over the period 2001-2005. However, Atirauskaya region, where most of the oil industry was concentrated in 2005, still had the highest poverty headcount index following some years of high economic growth fuelled by oil production and the associated exports. The poverty headcount findings are shown in Tables H7 and H8.

(tables H7 and H8 about here)

In assessing poverty in Kazakhstan, the World Bank uses a poverty line of $2.15 per person per day (using purchasing power parity exchange rates for the Tenge); see, for instance, World Bank (2005a), and Mitra (2008). On this basis, the share of the population considered to be in absolute poverty in Kazakhstan fell from around 30% to just over 20% of the population between 2001 and 2003, and continued to fall thereafter. To make these findings comparable with our own, some adjustments have to be made. According to UNECE data, the PPP exchange rate for the Tenge was USD 1 = KZT 63.13. Using this rate, the 2005 poverty line in Almaty, KZT 6647 was equivalent to USD 105.3 per month. Taking an average of 30.5 days per calendar month, this gives a daily poverty line of USD 3.45. However, international data on poverty do not usually allow for household size and economies in consumption, which might explain why international poverty estimates for Kazakhstan tend to give higher figures than domestic calculations.

KHBS contains an interesting question that asks respondents to estimate their income according to their own subjective satisfaction scale. From Table H9, below, one can see that the percentage of people who were completely dissatisfied with their income went down from 22 to 9 percent over 5 years. Other answers also suggest that at least to some degree the growth has been pro-poor, with the percentage of people who 'can find the way out' (in other words, they can manage) increasing from 32 to 47 percent.

(table H9 about here)

Turning now to inequality measures, we calculate several entropy-difference based indicators of income inequality[2], and these are shown in Table H10.

(table H10 about here)

The Gini coefficient measures average income inequality, with GE(*k*) being more sensitive to the top/bottom of the income distribution the more positive/negative *k* is. We can observe that the Gini coefficient did not change significantly over five years of economic boom conditions in Kazakhstan, suggesting perhaps that there was a proportional increase in welfare for rich and poor alike. However, the corresponding regional inequality statistics show that in mineral-rich regions inequality went down substantially whereas it remained flat or even rose in most other regions. Hence in the mineral rich regions, growth has been relatively pro-poor. These findings are shown in Table H11.

(table H11 about here)

3. Social Accounting Matrix for Kazakhstan using Household Data[3]

In this section, a SAM for Kazakhstan is constructed in four stages. First, an aggregated SAM is compiled using National Accounts data and other sources. Second, using Kazakhstan's Household Budget Survey discussed above, we disaggregate the single representative household in the aggregated SAM by income-based deciles and type of settlement (urban and rural). National Accounts provide the basic data for the construction of a macro-SAM, with almost all the necessary information, albeit highly aggregated. Therefore, at the third stage, Input-Output (I-O) tables and household data are reconciled with the macro-SAM using cross entropy and least squares methods of adjustment. At this stage the SAM will be balanced and all inconsistencies between different data sources will be smoothed out. The same adjustment technique can also be used for updating the SAM when parts of the data (often I-O tables) are not available for more recent years. Finally, some of the detailed structure of the SAM has to be sacrificed in order for it to be consistent with the requirements of a CGE model for Kazakhstan. Accordingly, the necessary adjustments will be discussed at stage four of this section..

3.1 The aggregated (macro-) SAM

The idea behind a social accounting matrix is to present a double entry framework of national accounts in a matrix form, where each entry is recorded only once and represents at the same time a receipt and an expenditure. Columns in a SAM record expenditures and rows record receipts. The SAM requires that in each account total income equals total expenditure, that is column sums must be equal to the corresponding row sums. Unlike in an I-O table, the production account in the SAM consists of two parts – activities and commodities. The activities account represents transactions by establishments and along the columns it is essentially the value of domestic output as in I-O. Commodities, on the other hand, represent goods and services which are produced or consumed and record total consumption or production of those products. The separate treatment of activities and commodities accounts facilitates the handling of several issues to do with international trade. Domestic consumption is the composite of imported and domestically produced commodities, whereas only domestically produced goods are exported. Thus, the commodities account depicts the

[2] These inequality indicators are defined in the Annex.
[3] This section draws heavily on a draft chapter of Alexander Naumov's PhD thesis.

total consumption of composite goods, while in the activities account only domestic production is portrayed. Another advantage of this treatment is that it allows for a single activity to produce more than one commodity, often the case in reality.

The macro-SAM is largely based on National Accounts statistics and references to cell entries refer to "Part 4. Integrated economic accounts of Kazakhstan" in the "National Accounts of the Republic of Kazakhstan 2001-2005" published by the Statistical Agency of Kazakhstan in 2007. Kazakhstan's system of national accounts is based on the conventions and methodology of the 1993 United Nations System of National Accounts. The schematic macro-SAM for 2002 is shown in Table A1(a) and the actual numbers in Table A1(b).

(tables A1(a) and A1(b) about here)

The entries of the macro-SAM are listed below by expenditure accounts, i.e. by columns of the SAM. Tables A1(a) and (b) have seventeen individual accounts, which balance as they should; they are:

Production: Commodities and Activities (Com and Act in the table);
Factors: Capital and Labour (K and L in the table);
Institutions include transactions of Firms, Households and Government (F, H and G in the table);
Taxes comprise: taxes on final consumption, export duties, taxes on capital, taxes on intermediate consumption, import tariffs and direct taxes (TC, TE, TK, TI, TM, TY in the table, respectively);
Investment (or capital account) – Investments/Savings and Inventories (I/S and Inven in the table)
Rest of the World account (R in the table);
Statistical discrepancy (D in the table).

3.2 Disaggregating the household sector

Using the Kazakhstan Household Budget Survey for 2002 (KHBS02), we introduce several household types into the National Accounts based SAM introduced above. The general idea is to take micro-level KHBS02 data, aggregate them according to the required level of household breakdown (e.g. urban/rural, or income deciles), scale them up to levels broadly consistent with the national level in the macro-SAM, and use some adjustment procedures to reconcile all the accounts in the SAM with their macro-aggregates from national accounts. Since a consistent macro-SAM has already been constructed, the information we need from KHBS02 is the composition of those aggregates by household types, while keeping the aggregates unchanged.

To disaggregate households by income deciles and type of settlement, we first need to match sections of the survey questionnaire with the household SAM accounts. The income account is relatively straightforward to match with the Household Budget Survey, since most of the entries, one way or another, are reflected in the survey questionnaire. Expenditure is much less clear cut, and needed to be dealt with in an *ad hoc* manner in places. Whenever we could not match a SAM category with the KHBS, we used the total level of that entry from the macro-SAM and broke it down by household types using shares from the closest available category. The resulting macro-SAM, disaggregated by household type (income deciles) is shown in Table A2.

(table A2 about here)

3.3 Reconciliation of I-O tables and household data with the macro-SAM

After a detailed macro-SAM has been constructed, the data from I-O tables can be used to build a disaggregated micro-SAM. Kazakhstan's published I-O tables have 61 sectors, which is considered fairly substantial by international standards. However, there is a major problem with the quality of the I-O data in Kazakhstan. Even when an I-O table is fully balanced, its aggregates are not always consistent with corresponding aggregates in the National Accounts. In Kazakhstan, the National Accounts form one of the most reliable sources of economic data, and are often quoted by officials and academics. Therefore, consistency between the I-O data and the National Accounts is not only desirable for the construction of the micro-SAM, but would provide the most reliable representation of the country's economic accounts.

Both the issue of balancing the micro-SAM as well as reconciling it with the National Accounts can be addressed effectively using the Cross Entropy (CE) method of estimating a SAM. In essence, we assemble the initial micro-SAM using whatever information there is, without requiring equality between corresponding rows and columns – this typically gives us an unbalanced micro-SAM. The estimation algorithm then uses all this information to find a balanced micro-SAM which is 'close' to our initial, unbalanced micro-SAM, while also being consistent with the national accounts. An alternative method of adjustment uses a least squares type of algorithm (LS). The technical details of the CE and LS methods are discussed in the Annex.

Before using the I-O tables some adjustments to the published version were needed for them to be usable and compatible with the macro-SAM; these reduced the number of sectors to 57, among other things.

The optimization program for the CE adjustment method cannot accept negative entries in the SAM due to its use of logarithmic functions. To get round this difficulty, if a cell has a negative value we add this amount both to itself (thus making it zero) and to its counterpart entry in the mirror row and column. This procedure does not change the initial balancing of rows and columns identity, and after the SAM has been re-balanced the negative entries are returned to their original positions[4]. The statistical discrepancy is allocated to the investment column (gross fixed capital formation) during the balancing exercise.

The balancing algorithms were implemented using GAMS software. To compare the cross entropy (CE) difference measure with squared residuals (LS), the latter was used first as the minimand, producing a minimum value of 0.115. Then the entropy function (3) was minimised and the estimated SAM was substituted into the sum of squared residuals (8) for N_{ij} (equation numbers refer to the Annex). This enabled us to find the sum of squared residuals implied by the SAM estimated using the cross entropy method. The value appeared to be very close and only slightly higher at 0.116. However, when entropy difference is minimised the algorithm converges only after about 5-10 minutes of computing time, whereas in the case of squared residuals, the convergence takes just a few seconds. Therefore, while producing a similar outcome the least squares method is faster and is less likely to collapse the algorithm.

[4] We did experiment with some alternatives to this procedure, notably adding amounts that made the negative cell values positive. This made a very small difference to the results of the adjustment process, insufficient to lead us to revise the calculations reported here.

3.4 Adjusting the SAM for a CGE model of Kazakhstan

The SAM, constructed using the procedure described above, can be readily used as a modelling and analytical tool. However, before it can be regarded as a proper dataset for a standard CGE model, some further modifications need to be made. Unfortunately, often some degree of detail has to be sacrificed (depending on the structure of the model), in order to reconcile a SAM with the available CGE framework. Accordingly, this section describes all steps that need to be followed to convert a SAM as above into a CGE model dataset.

First, there can be negative entries in the capital row and investment column. To deal with these the following procedure was used: if there are negative entries in the capital row, this entry made the same but positive and the same value was added to corresponding entry in investment column. Negative entries in investment column were made equal to zero and the same value was added to the corresponding entry in the capital row. Both items were originally calculated as residuals in the compilation of the National Accounts, thus this adjustment does not change any "real" data. Since savings of institutions are a residual of the income and expenditure balance, negative savings in the household account for the most part represent under-reported income. Without any additional knowledge about the source of underreported income, negative household savings were substituted with zeroes and the corresponding difference was first subtracted from firms' savings and added to firms' transfers to households to maintain the balance of rows and columns.

Next, we assume that only households and firms receive capital income, and all labour income goes to households. Therefore, government's receipts of capital income (entry – (Government; Capital)) was made equal to zero and allocated as transfers from household to government. Labour income from the rest of the world and labour income to the rest of the world (entries – (Labour; Rest of the World) and (Rest of the World; Labour)) were deleted and also allocated to household labour income. The difference was added/subtracted to/from household transfers with the rest of the world. Inventories are usually not dealt with explicitly in the CGE models and therefore they are aggregated with the investments/savings account. Intra-institutional transfers (household – household, government – government) would cancel each other out in the model, hence these entries were made equal to zero. This does not alter the SAM identities.

Within the basic SAM framework, exports are treated as part the commodity account. Most CGE models, on the other hand, have exports in the production account (activities) since total domestic output is usually expressed as a transformation function between exports and supply to the domestic market. Hence, exports are shifted from the activity account to the commodity account and the gross domestic output (entry Activity; Commodity) is adjusted accordingly. Export duties are similarly moved from commodities to activities.

The structure of the resulting SAM for 2002, ready for CGE use, is shown in Table A3. For ease of presentation, the disaggregation by households and by sectors has been suppressed.

(table A3 about here)

4. Changing Income Distribution – An Integrated CGE Approach

4.1 Overview

In this section we put all the above elements together in the context of a Computable General Equilibrium (CGE) model for Kazakhstan[5]. The country's economy has grown rapidly since 2001, and this is generally agreed to be due to the revenues from oil exports. These in turn have partly resulted from a large increase in the volume of oil exports, and more recently from the high prices on this commodity. However, how much exactly the oil industry contributes to the country's economic growth is unclear and has never been studied properly. Another important question is how oil revenues are distributed among the population. Is there a pro-poor spill-over effect in Kazakhstan's growth process, or perhaps the opposite, perhaps only the rich benefit from the windfall of oil revenues? We address these questions in two stages.

First, we isolate the five-year average annual impact of the oil industry on the economy. This will show how much of the total economic development that occurred can be attributed to the oil industry. In the second stage, we take the change in each household group's real income and consumption demand which occurred due to oil industry development and multiply the corresponding micro-household survey expenditure data by this change. We then see how that change affects poverty and inequality measures. This second stage is a simplified version of the method first developed by Adelman and Robinson (1978) and it is quite commonly applied in CGE-based studies of poverty and inequality.

The basic model belongs to the 1-2-3 class of CGE models and makes use of assumptions that are largely considered standard in the CGE literature. Employing these assumptions has several important implications for this study. Firstly, it makes it easier to trace the forces that lay behind a particular outcome and hence facilitates the tractability of results. Secondly, the model as a whole is flexible enough to incorporate features specific to Kazakhstan's economy.

The model is static in the sense that no inter-temporal decision making is involved. All industries are assumed to be perfectly competitive, meaning zero (super-normal) profit is earned by the firms. The small country assumption ensures that Kazakhstan is treated as a price taker on the world market, implying that Kazakhstan's import and export decisions do not affect the prevailing international prices.

There are ten household cohorts defined according to their income levels. Consumption demands are defined by the linear expenditure system (LES) with a subsistence consumption vector that each household has to achieve before they enjoy any additional consumption. Income elasticities of demand are imposed from the outside, whereas the subsistence levels for each household group are calibrated based on their consumption and income structure. The magnitude of the subsistence level can determine to what extent the consumption of a particular good is demand- or supply-side driven. Larger (smaller) shares make demand less (more) responsive to variations in prices or income.

[5] This section draws on some results from a draft chapter of Alexander Naumov's PhD thesis. Detailed model description and simulation results are available from the authors on request.

4.2 Simulations

To isolate the impact of the oil industry we exogenously increase exports of oil by the real annual average experienced over the period 2001-2005. Over these years, Kazakhstan's oil exports grew at a rate of 18 percent per year on average. Such an exogenous increase in oil exports represents the demand shock, which in turn spills over to the rest of the economy.

Since we want to measure the medium-term average annual impact on the economy, we assumed that those sectors which provide services to the oil industry would be able to acquire the new capital and labour needed to increase production for the domestic market at the prevailing prices. This is not an unreasonable assumption, given that five years in the context of a rapidly developing economy like Kazakhstan could be considered as medium- to long-run, and hence definitely sufficient for capital accumulation. To implement this we assume sector-specific capital demand, and make capital accumulation demand driven, constrained by the sector-specific capital prices which are the weighted average of the prices of capital goods used by the different industries. Total labour supply is fixed, but the amount available for production could vary as workers move in and out of unemployment according to the wage curve, which is essentially a Phillips curve type of relationship.

4.3 Results

The simulated annual increase of oil exports by 18 percent resulted in a 12.9 percent increase in the production of this commodity, according to our model. For comparison, over the period 2001-2005 real oil production grew by an average of 11.5 percent annually.

Kazakhstan's real GDP grew by an impressive 10 percent annually over the same period. The simulated oil industry shock resulted in real GDP growth of 4.3 percent. Hence we conclude that the oil industry accounted for slightly less than half of the country's economic growth in the period 2001-2005, either directly (via the direct increase in production) or indirectly (via inter-industry linkages and other effects).

Two main industries that benefit from the expansion of the oil sector are financial services and construction which supply intermediate inputs to the sector; but heavy industries such as the mining of minerals other than oil lose out, as they do not provide much input into oil production and essentially compete for the same resources. Table A4 shows the main findings by sector.

(table A4 about here)

Table A5 then shows how the consumption demands of each household type (expenditure cohorts H1 to H10, H1 being the poorest group) changed in the new equilibrium resulting from the simulated oil price shock. It can be seen that the growth of real income is slightly higher for the lower income cohorts than for the higher ones; to this extent, the oil price shock is modestly pro-poor in its expected impact on incomes. But the utility results shown as the last row of the same table tell a different story. For utility is based on consumption for each cohort, and consumption rises least for low-income households, most for the better off ones. In consumption terms, therefore, the oil shock does not have a pro-poor impact.

(table A5 about here)

Next we multiply the 2002 micro-household data by the calculated changes in consumption to find how the poverty and inequality indicators are affected. To do this, we use the results presented in Table A5 so that the consumption changes are classified by type of good and by household income group. The same approach was used to estimate the changes in income inequality resulting from the assumed oil industry growth.

The income structure is different for each household type, for example the poorest 10 percent (cohort H1) derive most of their income from social benefits, while the richest derive most income from wages. Therefore the income of each household group in the model changes according to the importance of a particular income source rather than as a result of explicit mechanisms. We observe that although the poorest households had the largest increase in real income, this did not translate into an equivalent increase in consumption. Table A6 shows detailed poverty and inequality statistics for the base period, which is 2002 in the CGE simulation, and for S1 – after applying the simulated changes. Although inequality changes very little, the poverty measures show a modest decline. For instance, the 4.3 percent GDP growth resulting from the simulated increase in oil exports gives rise to a 1.1 percentage point reduction in the estimated poverty headcount.

(table A6 about here)

5. Conclusions

This paper first of all made use of detailed household survey data for Kazakhstan for the years 2001-2005 to measure and track changes in income distribution and poverty in the country, using a variety of indicators widely used in other studies. The poverty headcount has declined in all parts of the country over the period studied, while measures of inequality have also somewhat improved.

We then developed a Social Accounting Matrix (SAM) for Kazakhstan. A highly aggregated macro-SAM was constructed, mostly using National Accounts data. At the second stage, a disaggregated micro-SAM was built using macro-SAM aggregates and Input-Output tables. To reconcile the Input-Output tables with the National Accounts, we used cross entropy and least squares methods of adjustment. Third, using the consolidated household survey data for 2001-2005, we introduced several household types into the model (essentially, cohorts defined according to their income levels) to enable us to study income distribution and trends in it during Kazakhstan's transition. The resulting SAM, decomposed by household types (10 cohorts) and sectors of production (57) demonstrated the feasibility and consistency of the adjustment methods employed herein.

Last, we integrated all the above elements into a CGE model for Kazakhstan, enabling us to explore the probable impact of rising oil exports on Kazakhstan's income distribution and various inequality measures. Inequality changed very little as a result of the 'oil shock', but there was a small decline in the poverty headcount.

References

Adelman, I. and Robinson, S. (1978), *Income Distribution Policy in Developing Countries: A case study of Korea,* Oxford: Oxford University Press.

Atkinson, A.B. (2007), "The Long Run Earnings Distribution in Five Countries: 'Remarkable Stability,' U, V or W?", *Review of Income and Wealth,* Series 53(1), pp.1-24

Cornia, Giovanni Andrea (ed) (2004), *Inequality, Growth and Poverty in an Era of Liberalization and Globalization*, UNU-WIDER and UNDP, Oxford: OUP

EBRD (various years), *Transition Report*, London: European Bank for Reconstruction and Development

Eurostat (2008), *Europe in Figures: Eurostat Yearbook 2006-7,* Luxembourg: Eurostat (esp. chapter 6 on the economy)

Guriev, Sergei and Rachinsky, Andrei (2006), "The Evolution of Personal Wealth in the Former Soviet Union and Central and Eastern Europe", *Research Paper No*.2006/120, Helsinki: UNU-WIDER

Hölscher, Jens (2006), "Income Distribution and Convergence in the Transition Process – A Cross-Country Comparison," *Comparative Economic Studies*, vol.48(2), pp.302-325

IMF (2000), *World Economic Outlook: Focus on Transition Economies*, October 2000, Washington, DC: International Monetary Fund

Milanovic, Branko (1999), "Explaining the Increase in Inequality during Transition", *Economics of Transition*, vol.7(2), pp.299-341

Milanovic, Branko (1998), *Income, Inequality and Poverty during the Transition from Planned to Market Economy*, Washington, DC: The World Bank

Mitra, Pradeep (2008), *Innovation, Inclusion and Integration: From Transition to Convergence in Eastern Europe and the Former Soviet Union*, Washington, DC: The World Bank

OECD (nd), 'What are Equivalence Scales?', *Social Policy Division*, Paris: OECD

Rao, D.S. Prasada and Tang, Kam Ki (2006), "Estimating Income Inequality in China using Grouped Data and the Generalized Beta Distribution", *Research Paper No*.2006/134, Helsinki: UNU-WIDER

Robinson, S.; Cattaneo, A.; and El-Said, M. (2001), 'Updating and Estimating Social Accounting Matrix Using Cross Entropy Methods', *Economic Systems Research,* vol.13(1).

Sukiassyan, Grigor (2007), "Inequality and Growth: What does the Transition Economy Data Say?" *Journal of Comparative Economics*, vol.35(1), pp.35-56

Verme, Paolo (2006), “Pro-Poor Growth during Exceptional Growth. Evidence from a Transition Economy,” *European Journal of Comparative Economics*, vol.3(1), pp.3-14

World Bank (2005a), *Growth, Poverty, and Inequality: Eastern Europe and the Former Soviet Union*, Washington, DC: The World Bank

World Bank (2005b), *Poverty Manual*, Washington, DC: The World Bank

World Bank (1996), *From Plan to Market. World Development Report 1996*. Washington, DC: The World Bank

Annex

A1. Poverty measures

The Foster-Greer-Thorbecke measures of poverty are defined as follows (World Bank, 2005b, ch.4):

The measure of order *n*, P(*n*) = $\frac{1}{N}\sum\left(\frac{G_i}{z}\right)^n$, where G_i is the *poverty gap* for household/ individual *i*, *z* is the poverty line. $G_i = \max(y_i - z, 0)$.

Then P(0) is the standard headcount measure of poverty, P(1) is a measure of the poverty gap, and P(2) is a measure of the severity of poverty.

A2. Inequality indicators

Entropy difference based indicators of inequality are defined as follows:

The measure of order *k*, GE(*k*) = $\frac{\nu_k \mu^{-k} - 1}{k(k-1)}$, where $\nu_k = \int y^k dF(y)$. *F(y)* is the distribution function of incomes, *y*, and μ is the mean of *y*. This formulation is only defined when k ≠ 0 or 1. For these values, the entropy indicators are defined thus:

GE(0) = $\log \mu - \int \log y.dF(y)$ and GE(1) = $\frac{\mu}{\int y \log y.dF(y)} - \log \mu$.

A3. CE and LS methods for reconciling a SAM with national accounts data

The CE method for SAM estimation was first used by Robinson *et al*. (2003). The idea behind it is very intuitive and can be outlined as follows. Starting with an unbalanced SAM, we want to find a balanced SAM that would minimise some entropy or disorder measure between the two matrices. In the words of Robinson *et al*. (2001, p. 59), 'The Cross-Entropy measures reflect how much the information we have introduced has shifted our solution away from the inconsistent prior…'. More formally, suppose that $\boldsymbol{T}$ is the matrix of SAM flows and $\boldsymbol{y}$ is the vector of total row and column sums, so that:

$$y_j = \sum_i T_{ji} = \sum_i T_{ij} \tag{1}$$

where first and second subscripts refer to the row and column numbers respectively. As with the standard fixed coefficients I-O model, the SAM coefficient matrix ***N*** could be constructed as:

$$N_{ij} = \frac{T_{ij}}{y_j} \tag{2}$$

Entropy measure I is then written as:

$$I = \sum_{i,j} N_{ij} \ln\left(\frac{N_{ij}}{\bar{N}_{ij}}\right) \tag{3}$$

This measure of entropy was originally applied to measuring the "cross entropy" distance between two probability distributions (Robinson *et al*., 2001). The problem is to find a new matrix, ***N***, which minimizes the cross entropy difference between the given matrix of coefficients $\bar{\boldsymbol{N}}$ and the new estimated matrix, and which satisfies some *a priori* given constraints. Thus:

$$\min_{N} I = \sum_{i,j} N_{ij} \ln\left(\frac{N_{ij}}{\bar{N}_{ij}}\right) = \sum_{i,j} N_{ij} \ln \ N_{ij} \ - \sum_{i,j} N_{ij} \ln \ \bar{N}_{ij} \qquad (4)$$

Subject to:

$$\sum_{j} N_{ij} y_j = y_i \qquad (5)$$

$$\sum_{j} N_{ij} = 1, \ \ 0 \le N_{ij} \le 1 \qquad (6)$$

$$F^k \ T \ = x^k \qquad (7),$$

where the last constraint represents all the additional information that one wants to incorporate into the estimated SAM, such as GDP, value added, etc. In this case the last constraints are used to reconcile the national accounts with I-O aggregates.

Alternatively, instead of minimizing the cross entropy difference, one could use a variety of other measures of disorder. More familiar in economics, perhaps, is the least squares method of parameter estimation (LS). In the current framework, rather than minimizing the entropy function we minimize the sum of squared deviations in percentage terms *S* of estimated matrix ***N*** from an initially known matrix $\bar{\boldsymbol{N}}$:

$$S = \sum_{i,j} \frac{\left(N_{ij} - \bar{N}_{ij}\right)^2}{\bar{N}_{ij}} \qquad (8)$$

It should be noted, that in both cases (cross entropy difference or sum of squared residuals) the emphasis is on minimizing the structural distortion from the original SAM, that is the distance from the matrix of coefficients, rather than flow values. The results of applying both measures of distortion will be compared when balancing the SAM for Kazakhstan.

Tables and Charts

Table H1. Households taking part in all four quarterly interviews

Year	#
2001	11761
2002	11565
2003	11639
2004	11650
2005	11490

Table H2. Income share by source of income for the representative household

	Social benefits	Inter-household transfers	Capital income	Labour income	Transfers from firms (property income)	Total income
2001	22%	5%	9%	63%	1%	100%
2002	20%	5%	8%	65%	1%	100%
2003	19%	6%	8%	66%	2%	100%
2004	16%	6%	17%	59%	2%	100%
2005	16%	5%	17%	59%	3%	100%

Table H3. Income distribution in 2002 by source of income and household type

Income deciles\types	Social benefits	Inter-household transfers	Capital income	Labour income	Transfers from firms (property income)	Total income
Total Household	20%	5%	8.5%	65%	1.5%	100%
1	57%	8%	5%	29%	0%	3%
2	43%	9%	8%	39%	0%	4%
3	42%	8%	7%	43%	0%	5%
4	37%	7%	7%	48%	0%	6%
5	33%	6%	8%	52%	0%	7%
6	26%	5%	8%	60%	0%	9%
7	21%	5%	9%	65%	0%	10%
8	15%	5%	9%	70%	1%	12%
9	12%	4%	9%	75%	1%	16%
10	6%	4%	9%	78%	4%	27%
Urban	18%	5%	4%	71%	2%	69%
Rural	25%	4%	18%	53%	1%	31%

Source: Own calculations based on Kazakhstan Household Budget Survey 2002 (KHBS02) data.
*Note: Components may not add up to totals due to rounding.

Table H4. Structure of expenditure of the representative household.

	2001	2002	2003	2004	2005
Agriculture and related services	3.2%	3.1%	3.1%	3.5%	3.4%
Coal, other solid fuels	1.5%	1.4%	1.4%	1.5%	1.7%
Food and Drink, Tobacco	51.7%	49.5%	46.9%	41.2%	39.8%
Clothes and Shoes	6.8%	7.2%	8.2%	9.6%	9.7%
Furniture, Textiles, Home appliances, Cleaning, Home products	4.3%	4.7%	4.9%	5.1%	5.4%
Personal goods, tv, computers, etc.	1.3%	1.5%	1.7%	2.0%	1.9%
Books, newspapers, magazines	0.7%	0.7%	0.7%	0.7%	0.7%
Cars and other transport equipment	0.5%	0.6%	0.8%	1.4%	1.2%
Gasoline and fuels	2.4%	1.6%	1.3%	1.3%	1.3%
Other personal usage goods	3.9%	4.2%	4.3%	3.6%	3.5%
Electricity, gas, heat and water, central heating	6.6%	6.5%	6.3%	6.3%	6.0%
Construction and housing repair	0.5%	0.7%	0.8%	1.1%	1.3%
Car repair and maintenance services	0.1%	0.2%	0.2%	0.3%	0.3%
Repair of personal goods services	0.3%	0.4%	0.4%	0.4%	0.3%
Hotels and Restaurants	1.9%	1.9%	2.0%	2.2%	2.2%
Transport	2.9%	3.0%	3.2%	3.6%	3.7%
Post, Internet, Telecommunications	1.4%	1.5%	1.7%	2.2%	2.7%
Financial and legal services, including rent and insurance	0.2%	0.2%	0.3%	0.4%	0.4%
Personal services	0.8%	1.0%	1.1%	1.4%	1.5%
Education	2.0%	2.4%	2.5%	3.2%	3.5%
Health and medical services	2.3%	2.3%	2.4%	2.5%	2.4%
Public utilities - sewage, water disposal, etc.	0.9%	0.9%	0.9%	0.9%	0.8%
Amusement and recreational services	0.5%	0.5%	0.6%	0.7%	0.7%
Other (pets, plants, related services)	0.6%	0.4%	0.5%	0.5%	0.5%
Inter-household transfers	2.6%	3.2%	3.6%	4.6%	5.2%
Tax on land and real estate	0.1%	0.2%	0.1%	0.1%	0.1%

Table H5. KNSA expenditure equivalence scale for households of different size

# of people in the household	Equivalent to
1	1
2	1.69
3	2.16
4	2.81
5	3.767
>5	3.767

Table H6. Regional poverty lines in current KZT per person per month

	2001	2002	2003	2004	2005
Akmolinskaya	4723	4872	5132	5505	5998
Aktubinskaya	4580	4979	5298	5675	6340
Almatinskaya	4446	4622	4973	5189	5865
Atirauskaya*	5365	6045	6383	6903	7392
West-Kazakhstanskaya	4236	4876	5188	5180	5781
Jambilskaya	3755	3956	4453	4694	5217
Karagandiskaya	4875	4937	5180	5244	5835
Kostanayskaya	4296	4515	4637	4971	5588
Kizilordinskaya	3977	4198	4661	5208	5720
Mangistauskaya*	6047	6453	6932	7174	7844
South-Kazakhstanskaya	3685	3819	4258	4691	5246
Pavlodarskaya	4583	4790	4967	5143	5705
North-Kazakhstanskaya	4616	4732	4955	5224	5759
East-Kazakhstanskaya	4568	4638	4872	5364	6082
Astana (city)	4635	4777	5294	5603	6223
Almaty (city)	4974	5212	5727	6035	6647

*Mineral-rich regions

Table H7. Poverty headcount index by region

	2001	2002	2003	2004	2005
Akmolinskaya	0.23	0.19	0.14	0.13	0.12
Aktubinskaya	0.18	0.14	0.09	0.07	0.08
Almatinskaya	0.27	0.24	0.16	0.08	0.08
Atirauskaya*	0.23	0.25	0.15	0.19	0.15
West-Kazakhstanskaya	0.26	0.25	0.10	0.08	0.12
Jambilskaya	0.30	0.16	0.12	0.04	0.05
Karagandiskaya	0.19	0.11	0.08	0.06	0.04
Kostanayskaya	0.24	0.20	0.17	0.15	0.11
Kizilordinskaya	0.15	0.21	0.14	0.19	0.05
Mangistauskaya*	0.23	0.12	0.06	0.05	0.03
South-Kazakhstanskaya	0.20	0.12	0.10	0.08	0.07
Pavlodarskaya	0.15	0.18	0.07	0.08	0.06
North-Kazakhstanskaya	0.17	0.20	0.15	0.14	0.12
East-Kazakhstanskaya	0.20	.17	0.15	0.15	0.10
Astana (city)	0.04	0.02	0.00	0.01	0.01
Almaty (city)	0.05	0.02	0.01	0.01	0.01
Kazakhstan	0.20	0.16	0.11	0.09	0.07

*Mineral-rich regions

Table H8. Poverty headcount index by region and type of settlement

	2001		2002		2003		2004		2005	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Akmolinskaya	0.16	0.29	0.13	0.25	0.08	0.21	0.07	0.19	0.08	0.15
Aktubinskaya	0.14	0.26	0.07	0.26	0.03	0.19	0.03	0.14	0.03	0.16
Almatinskaya	0.23	0.29	0.16	0.28	0.05	0.22	0.04	0.10	0.05	0.10
Atirauskaya*	0.19	0.31	0.19	0.35	0.13	0.20	0.13	0.31	0.10	0.24
West-Kazakhstanskaya	0.22	0.30	0.12	0.39	0.05	0.15	0.02	0.15	0.03	0.20
Jambilskaya	0.26	0.35	0.13	0.20	0.07	0.16	0.03	0.04	0.05	0.05
Karagandiskaya	0.18	0.24	0.10	0.15	0.06	0.23	0.04	0.23	0.03	0.15
Kostanayskaya	0.14	0.38	0.12	0.33	0.07	0.32	0.05	0.30	0.03	0.22
Kizilordinskaya	0.09	0.29	0.08	0.47	0.07	0.28	0.08	0.41	0.02	0.11
Mangistauskaya*	0.13	0.87	0.06	0.55	0.03	0.30	0.01	0.30	0.00	0.17
South-Kazakhstanskaya	0.13	0.26	0.06	0.16	0.06	0.14	0.05	0.11	0.04	0.09
Pavlodarskaya	0.10	0.26	0.07	0.38	0.03	0.15	0.03	0.17	0.02	0.14
North-Kazakhstanskaya	0.09	0.24	0.08	0.29	0.05	0.22	0.07	0.19	0.04	0.18
East-Kazakhstanskaya	0.15	0.30	0.12	0.26	0.10	0.25	0.07	0.29	0.04	0.21
Astana (city)	0.04		0.02		0.00		0.01		0.01	

Table H9. Percentage of sample satisfied with their monthly income

	2001	2002	2003	2004	2005
not satisfied at all	22%	17%	13%	11%	9%
not satisfied	38%	36%	35%	33%	32%
we can find a way out	32%	38%	42%	44%	47%
satisfied	9%	9%	11%	12%	12%
fully satisfied	0.4%	0.3%	0.3%	0.2%	0.3%

Table H10. Entropy-difference income inequality parameters for Kazakhstan

	GE(-1)	GE(0)	GE(1)	GE(2)	Gini
2001	0.253	0.208	0.216	0.304	0.351
2002	0.257	0.213	0.222	0.302	0.357
2003	0.225	0.190	0.195	0.250	0.338
2004	0.222	0.188	0.196	0.254	0.337
2005	0.215	0.185	0.192	0.250	0.334

Table H11. Regional Gini coefficients

	2001	2002	2003	2004	2005
Akmolinskaya	0.366	0.339	0.317	0.337	0.332
Aktubinskaya	0.344	0.346	0.352	0.354	0.349
Almatinskaya	0.289	0.292	0.293	0.281	0.285
Atirauskaya*	0.430	0.429	0.403	0.368	0.345
West-Kazakhstanskaya	0.311	0.316	0.279	0.300	0.299
Jambilskaya	0.284	0.265	0.249	0.254	0.252
Karagandiskaya	0.337	0.342	0.322	0.336	0.329
Kostanayskaya	0.346	0.333	0.323	0.304	0.316
Kizilordinskaya	0.262	0.291	0.315	0.302	0.319
Mangistauskaya*	0.358	0.338	0.279	0.287	0.299
South-Kazakhstanskaya	0.261	0.276	0.286	0.294	0.291
Pavlodarskaya	0.318	0.310	0.254	0.291	0.310
North-Kazakhstanskaya	0.346	0.298	0.294	0.298	0.292
East-Kazakhstanskaya	0.350	0.345	0.315	0.325	0.315
Astana (city)	0.370	0.389	0.341	0.355	0.345
Almaty (city)	0.331	0.365	0.353	0.353	0.343

*Mineral-rich regions

Table A1(a). Schematic Macro SAM for Kazakhstan – accounts description

	Production		Factors		Institutions			Taxes						Investments		RoW	Discrepancy	
	Com	**Act**	**K**	**L**	**F**	**H**	**G**	**TC**	**TE**	**TK**	**TI**	**TM**	**TY**	**I**	**Inven**	**R**	**D**	**Total**
Com		Interm. demand				Final Cons.	Final Cons.							Fixed capital investments	Changes in inventories	Exports	Statistical discrepancy	**Final demand**
Act	Gross Output																	**Domestic output**
K		Capital																**Capital income**
L		Labour														Labour compens.		**Labour income**
F			Firm's Capital income		Inter-firm transfers	Transfers	Transfers									Transfers		**Firms' income**
H			Househ.'s capital income	Househ.'s labour income	Transfers	Inter-hous. transfers	Social benefits									Remitt.		**Househ. income**
G			Givern.'s capital income		Transfers	Social contribution	Inter-gov. transfers	Ind. taxes on final cons.	Export duties	Taxes on capital	Taxes on Interm. cons.	Import tariffs	Direct taxes			Transfers		**Govern. income**
TC	Ind. taxes on final cons.																	**Taxes on final c.**
TE	Export duties																	**Export duties**
TK		Taxes on capital																**Taxes on capital**
TI		Taxes on Interm. cons.																**Taxes on interm. cons.**
TM	Import tariffs																	**Import tariffs**
TY					Direct taxes	Direct taxes												**Direct taxes**
Sav					Corporate saving	Household's saving	Gov. saving									Current account		**Savings**
Inven														Changes in inventories				**Change In stocks**
R	Imports			Foreign labour income	Income To Rest of W	Transfers abroad	Transfers abroad											**Foreign currency outflow**
D														Statistical discrepancy				**Statistical discrep.**
Total	**Gross domestic supply**	**Gross domestic output**	**Capital expendit.**	**Labour expendit.**	**Firms' expenditure**	**Househ. expenditure**	**Govern. expenditure**	**Taxes on final cons.**	**Export duties**	**Taxes on capital**	**Taxes on interm. consum.**	**Import tarrifs**	**Direct taxes**	**Gross Investments**	**Change in stocks**	**Foreign currency inflow**	**Statistical discrepancy**	

Table A1(b). 2002 Macro-SAM for Kazakhstan (in millions of Kazakh Tenge)

	Production		Factors		Institutions			Taxes						Investments		RoW	Discrepancy	
	Com	**Act**	**K**	**L**	**F**	**H**	**G**	**TC**	**TE**	**TK**	**TI**	**TM**	**TY**	**I**	**Inven**	**R**	**D**	**Total**
Com		3925515				2205940	434999							907126	123334	1781690	71150	**9449754**
Act	7542054																	**7542054**
K		1964842																**1964842**
L		1429195														595		**1429789**
F			1145140		50408	88889	19226									36435		**1340099**
H			780237	1418652	145882	40675	102963									65257		**2553666**
G			39465		57492	179793	48065	78690	81049	110459	112043	0	259668			0		**966724**
TC	78690																	**78690**
TE	81049																	**81049**
TK		110459																**110459**
TI		112043																**112043**
TM	0																	**0**
TY					182194	77474												**259668**
Sav					719935	-39106	313544									107236		**1101610**
Inven														123334				**123334**
R	1747961			11137	184188	0	47927											**1991213**
D														71150				**71150**
Total	**9449754**	**7542054**	**1964842**	**1429789**	**1340099**	**2553666**	**966724**	**78690**	**81049**	**110459**	**112043**	**0**	**259668**	**1101610**	**123334**	**1991213**	**71150**	

Source: Authors' calculations based on Kazakh National Accounts data.

Table A2. Disaggregated household, macro-SAM, 2002.

	Production		Factors		Firms	Household – Total	Household by income deciles									
	Com	**Act**	**K**	**L**	**F**	**H**	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Commodities		3925515				2205940	101429	126069	152323	161632	182247	204825	230382	266351	314903	465779
Activities	7542054															
Capital		1964842														
Labour		1429195														
Firms			1145140		50408	88889	267	239	404	865	1291	805	1555	2006	5190	76267
Household			780237	1418652	145882	40675										
H1			16493	17615	438		55	70	104	117	151	169	192	262	343	597
H2			26684	30719	393		81	102	151	170	220	246	280	381	499	869
H3			37446	52057	664		97	123	182	206	266	297	338	460	602	1049
H4			41688	55935	1419		85	108	159	180	233	260	296	402	527	918
H5			47757	81326	2119		97	123	181	205	265	296	336	457	599	1043
H6			74326	109938	1321		102	129	191	216	279	312	354	482	631	1100
H7			74936	147694	2553		107	136	200	227	293	327	372	506	663	1155
H8			103074	188108	3292		123	156	230	260	336	376	427	581	761	1327
H9			134330	261577	8518		143	181	267	302	391	436	496	675	884	1540
H10			223504	473682	125166		203	257	380	429	555	620	705	959	1256	2189
H_Urban			268963	1066092	132930											
H_Rural			511274	352560	12952											
Government			39465		57492	179793	4737	6985	9194	10908	13093	15545	18471	22396	28699	49764
Tax on cons.	78690															
Tax on exports	81049															
Tax on capital		110459														
Tax on interm.		112043														
Tax on imports																
Tax on income					182194	77474	2041	3010	3962	4700	5642	6699	7959	9651	12367	21444
Investments					719935	-39106	-62729	-63029	-58962	-59878	-51741	-23999	-15474	11770	59765	225172
Inventories																
Foreign sector	1747961			11137	184188	0										
Discrepancy																
Total	**9449754**	**7542054**	**1964842**	**1429789**	**1340099**	**2553666**	**46839**	**74659**	**108966**	**120538**	**153521**	**207214**	**246691**	**317338**	**427686**	**850213**

	Governm.	Taxes						Investments		Foreign sec.	Discrepancy	
	G	**TC**	**TE**	**TK**	**TI**	**TM**	**TY**	**I**	**Inven**	**R**	**D**	**Total**
Commodities	434999							907126	123334	1781690	71150	**9449754**
Activities												**7542054**
Capital												**1964842**
Labour										595		**1429789**
Firms	19226									36435		**1340099**
Household	102963									65257		**2553666**
H1	6928									3305		**46839**
H2	9054									4811		**74659**
H3	9368									5810		**108966**
H4	13249									5081		**120538**
H5	12942									5777		**153521**
H6	11745									6088		**207214**
H7	11128									6394		**246691**
H8	10942									7345		**317338**
H9	9420									8526		**427686**
H10	8187									12119		**850213**
H_Urban	63458									48380		**1609980**
H_Rural	39504									16876		**943686**
Government	48065	78690	81049	110459	112043	0	259668			0		**966724**
Tax on cons.												**78690**
Tax on exports												**81049**
Tax on capital												**110459**
Tax on interm.												**112043**
Tax on imports												**0**
Tax on income												**259668**
Investments	313544									107236		**1101610**
Inventories								123334				**123334**
Foreign sector	47927											**1991213**
Discrepancy								71150				**71150**
Total	**966724**	**78690**	**81049**	**110459**	**112043**	**0**	**259668**	**1101610**	**123334**	**1991213**	**71150**	

Table A3. SAM modified according to the requirements of the CGE model

	Com	Act	K	L	H	G	TC	TE	TK	TI	TM	TY	Invest	R	Total
Com		3925515			2205940	434999							1101610		**7668064**
Act	5841413													1781690	**7623103**
K		1964842													**1964842**
L		1429195													**1429195**
H			1964842	1429195		122189									**3516225**
G					276750		78690	81049	110459	112043	0	259668		0	**918658**
TC	78690														**78690**
TE		81049													**81049**
TK		110459													**110459**
TI		112043													**112043**
TM	0														**0**
TY					259668										**259668**
Savings					680830	313544								107236	**1101610**
R	1747961				93038	47927									**1888926**
Total	**7668064**	**7623103**	**1964842**	**1429195**	**3516225**	**918658**	**78690**	**81049**	**110459**	**112043**	**0**	**259668**	**1101610**	**1888926**	

Table A4. Simulation results: Impact on macro-variables, by sector

	K	L	X	XD	XDD	C	E	M
1. Agriculture	1.5	-0.7	1.8	1.0	1.6	2.4	-0.4	7.9
2. Forestry	1.7	-0.5	1.8	1.3	1.4	3.0	-0.1	5.8
3. Fishery	2.0	-0.2	1.9	1.9	1.9	3.1	0.7	5.3
4. Mining of coal, lignite and peat	0.9	-1.3	0.4	-0.7	0.2	1.4	-2.7	9.5
5. Crude oil extraction	13.3	10.8	7.6	12.9	9.6	0.0	18.0	-3.5
6. Other mining	-2.5	-4.6	-3.4	-3.7	-3.6	2.5	-5.4	1.7
7. Food, clothing, tobacco	1.9	-0.2	3.3	1.1	1.1	3.5	-0.4	5.9
8. Fuels and chemicals	2.3	0.1	3.2	1.7	1.9	4.0	1.0	4.5
9. Metals and metal products	-3.1	-5.1	2.2	-4.1	-1.7	1.5	-5.8	11.9
10. Other manufacturing	-0.5	-2.6	4.0	-2.0	-1.4	4.2	-3.6	5.2
11. Electricity, gas and water	3.4	1.1	2.0	1.9	1.9	2.9	0.5	6.4
12. Construction	5.5	3.3	5.5	4.4	4.4	3.5	2.8	9.6
13. Trade	2.9	0.7	2.9	2.4	2.9	2.8	1.1	8.6
14. Hotels and restaurants	4.6	2.3	3.5	3.5	3.5	3.1	0.0	0.0
15. Transport	3.4	1.2	2.8	2.4	2.4	3.4	1.0	6.5
16. Post and communications	3.7	1.5	3.2	2.7	2.8	3.0	1.1	8.2
17. Financial services	7.0	4.7	7.0	6.1	6.2	3.1	4.3	11.9
18. Public and other services	6.5	4.2	5.0	4.8	4.9	2.5	2.6	12.2

Source: Authors' calculations
Note: Figures in the table show percentage changes
Column headings:

K – capital demand;
L – labour demand;
X – total demand for commodities;
XD – total domestic production;
XDD – domestic production sold on the domestic market;
C – final consumption;
E – exports;
M – imports.

Table A5. Simulation results: Changes in household consumption demands

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
1. Agriculture	0.6	1.0	1.5	1.6	2.0	2.7	2.9	3.2	3.3	3.2
2. Forestry	1.2	1.6	2.1	2.2	2.5	3.3	3.5	3.8	3.8	3.7
3. Fishery	1.3	1.8	2.3	2.3	2.7	3.5	3.7	4.0	4.0	3.9
4. Mining of coal, lignite and peat	-0.3	0.1	0.6	0.7	1.1	1.8	2.0	2.3	2.3	2.2
5. Crude oil extraction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6. Other mining	0.8	1.2	1.7	1.8	2.2	2.9	3.1	3.4	3.5	3.3
7. Food, clothing, tobacco	1.6	2.1	2.6	2.6	3.0	3.8	3.9	4.3	4.3	4.2
8. Fuels and chemicals	2.0	2.4	2.9	3.0	3.4	4.1	4.3	4.6	4.7	4.6
9. Metals and metal products	-0.4	0.1	0.5	0.6	1.0	1.7	1.9	2.2	2.2	2.1
10. Other manufacturing	2.0	2.5	3.0	3.0	3.4	4.2	4.4	4.7	4.7	4.6
11. Electricity, gas and water	1.1	1.5	2.0	2.1	2.4	3.2	3.4	3.7	3.7	3.6
12. Construction	1.2	1.6	2.1	2.2	2.6	3.3	3.5	3.8	3.9	3.8
13. Trade	0.7	1.2	1.6	1.7	2.1	2.8	3.0	3.3	3.4	3.3
14. Hotels and restaurants	0.8	1.3	1.8	1.8	2.2	3.0	3.1	3.5	3.5	3.4
15. Transport	1.3	1.7	2.2	2.3	2.6	3.4	3.6	3.9	4.0	3.8
16. Post and communications	0.9	1.4	1.9	1.9	2.3	3.0	3.2	3.6	3.6	3.5
17. Financial services	1.0	1.4	1.9	2.0	2.4	3.1	3.3	3.6	3.7	3.5
18. Public and other services	0.3	0.8	1.3	1.3	1.7	2.5	2.6	3.0	3.0	2.9
Real Income	3.0	3.0	2.8	2.8	2.6	2.8	2.5	2.6	2.5	2.5
Utility	1.5	2.0	2.5	2.6	3.0	3.8	4.0	4.4	4.4	4.2

Source: Authors' calculations
Note: Figures in the table show percentage changes.

Table A6. Simulation results: Impact on poverty and inequality measures

		Base (2002)	S1
Inequality	GE(-1)	25.7	25.6
	GE(0)	21.3	21.2
	GE(1)	22.2	22.1
	GE(2)	30.2	30.1
	Gini	35.7	35.6
Poverty	P(0)	15.6	14.5
	P(1)	3.8	3.5
	P(2)	1.4	1.3

P(0) – headcount index
P(1) – poverty gap
P(2) – poverty severity

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