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THE IMPACT OF ALTERNATIVE DEVELOPMENT STRATEGIES ON GROWTH AND DISTRIBUTION: SIMULATIONS WITH A DYNAMIC MODEL FOR EGYPT

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ABSTRACT

Addressing longer-term issues of economic development in Egypt, the paper employs a dynamically recursive computable general equilibrium (CGE) model to assess the outcomes associated with two types of development approaches over the period 1998-2012. One is a targeted sector development approach, and the second is a more broad-based development approach. Under the first development approach technological advancement is separately targeted to three sectors: agriculture, food processing, and textiles. Each sectoral choice is intended to represent alternative development strategies which we label (i) agricultural-demand-led industrialization (ADLI); (ii) food-processing-based (FOOD); and (iii) textile-based industrialization (TEXTILE). Under the second approach a more broad-based development strategy is adopted where the same technological advancement is equally distributed among the three sectors and takes place simultaneously. We refer to it as (BAL) – a sectorally balanced industrialization strategy. Results focusing on the pattern of growth and measures of income inequality – the Theil and Atkinson measures – from the four strategies are compared to a benchmark growth path, which we label (BASE). The analysis was carried out under two cases; one where the ease of transforming output between domestic markets and export markets is low for all production sectors including agriculture, and another where we assume perfect transformability for agriculture. In the first case, the TEXTILE strategy is pro-growth and more egalitarian, while ADLI generates a combination of more rapid growth and increasing inequality. For the second case, ADLI strategy dominates in terms of rapid growth and reduced inequality. The results indicate that, when agricultural exports remain relatively low, promoting the Egyptian textile sector is a win-win scenario in terms of rapid growth and equity. In addition, adopting policies that maintain agricultural prices leads to rapid growth and a general improvement of the distribution of income among households. A crucial policy objectives for achieving rapid and egalitarian growth for the Egyptian economy is the ability to secure improved access to international textile markets and the successful expansion of agricultural exports.

Keywords: Atkinson inequality index, CGE, Egypt, growth, income distribution, SAM, Theil index.

JEL Classification: C68, D31, D33, D58, O47, O53

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EXECUTIVE SUMMARY

Egypt is facing the challenge of addressing longer-term issues of economic development. Assuming the Egyptian economy continues to follow its growth path, the following paper analyzes the economywide growth and distribution effects of alternative development strategies in Egypt. Emphasizing rapid economic growth and a lessening of income disparities underlying each strategy, the paper attempts to answer the question: which development strategy, if any, should be pursued?

The paper employs a dynamic computable general equilibrium (CGE) model to help assess the outcomes associated with two types of development approaches over the period 1998-2012. One is a targeted sector development approach, and the second is a more broad-based development approach. Under the first development approach technological advancement is separately targeted to three sectors: agriculture, food processing, and textiles. Each sectoral choice is intended to represent alternative development strategies which we label (i) agricultural-demand-led industrialization (ADLI); (ii) food-processing-based (FOOD); and (iii) textile-based industrialization (TEXTILE). Under the second approach a more broad-based development strategy is adopted where the same technological advancement is equally distributed among the three sectors and takes place simultaneously. We refer to it as (BAL) – a sectorally balanced industrialization strategy that combines all three. Results focusing on the pattern of growth and measures of income inequality – the Theil and the Atkinson measures – from the four strategies are compared to a benchmark growth path, which we label (BASE).

The general equilibrium model captures the economywide effects underlying each development strategy, and serves as a framework for analyzing the impact of a shock on growth and income distribution by linking the macro aspects of the economy to a finely disaggregated household module. In the model there are two groups of households, rural and urban, where each group is subdivided by quintiles of their within-group distribution. The impact of an exogenous shock on growth and income distribution is analyzed through its effect on factor wages and employment – the "functional" distribution of income – which in turn affects the incomes of the various household groups given their initial structure of factor ownership – the "size" distribution of income. In addition, the income inequality measures used are decomposable and welfare based. Decomposability allows tracing the source of change in total inequality, i.e. how much is due to changes in inequality 'between' rural and urban households and how much is due to changes 'within' rural or urban households. A welfare based inequality measure is also useful as it is easily incorporated in a welfare function where changes in welfare are attributed to changes in mean income and changes in inequality.

Starting from a 1996/97 social accounting matrix (SAM) for Egypt, two sets of four simulations – in addition to the BASE – are conducted using the Egypt CGE model. The first set assumes a relatively low elasticity of transformation for all production sectors, including agriculture, between domestic and export markets. This implies that local producers cannot easily shift output between the two markets as a result of a change in relative prices. In a second set of simulations, the same four development strategies were repeated but under the assumption of perfect transformability for the agriculture sector between domestic and export markets – producers can shift supply at no cost. For the BASE simulation real GDP is assumed to grow at an annual rate of 5 percent, where lagged endogenous capital growth, an exogenous 2.8 percent annual labor force growth rate, and a 1.3 percent rate of increase in total factor productivity (TFP) growth across all sectors are the source of the 5 percent growth. The four simulations (ADLI, FOOD, TEXTILE, and BAL) are based on an exogenous increase in TFP for one or more sectors. The increases in the rate of TFP growth was scaled according to the share of each sector in total value added in the base year to make the shock comparable in aggregate impact and to provide a basis for comparing the results across all four simulations.

The analysis was carried under two cases; one where the ease of transforming output between domestic markets and export markets is low for all production sectors including agriculture and another where we assume perfect transformability for agriculture. In the first case, the TEXTILE strategy is a win-win approach in terms of rapid growth and equity, while for ADLI, growth targeted towards agriculture is accompanied by worsening inequality, a reflection of the sensitivity of rural incomes to agricultural terms of trade arising from the expansion in agriculture production, which cannot be sold abroad. The expansion in agriculture production negatively affects rural incomes since shares of agriculture exports are initially small and excess supply ends up in domestic markets causing a significant price decline, which outweigh the gains from productivity. Once the assumption of low CET is replaced by perfect transformability for agricultural exports, the results are changed in favor of ADLI. The ability to supply all increased output to world markets at fixed prices prevents the agricultural terms of trade from falling and hence improves rural incomes and inequality, while achieving higher GDP growth rates.

Three policy implications can be derived for the case of Egypt based on the above findings:

- When agricultural exports remain in relatively low, expansion in agriculture production adversely affects rural incomes and leads to more inequality in the distribution of income. Promoting the Egyptian textile sector is a win-win scenario in terms of rapid growth and equity
- Adopting policies that maintain agricultural prices in the context of a strategy designed to improve rural incomes prevents the gains from "leaking" to the urban sector, and the net effect is rapid growth and a general improvement of the distribution of income among households.
- In the first case, the analysis assumes that exports of the Egyptian textile sector are unconstrained and have unlimited access to international markets. Also in the second case, it is assumed that Egypt can expand agricultural exports without limits and with no impact on world prices. However, constraints on access to international markets (the EU market in particular for the case of agriculture) may stand in the way of a rapid expansion of exports. Hence, securing improved access to international textile markets and the successful expansion of agricultural exports are crucial policy objectives for achieving rapid and egalitarian growth for the Egyptian economy.

I. INTRODUCTION*

After having stabilized its macroeconomy, Egypt is facing the challenge of designing a second generation of reforms that address longer-term issues of economic development. Assuming the Egyptian economy continues to follow its growth path, we consider the impact of an exogenous improvement in technological progress under two types of development strategies. One is a targeted sector development strategy: technological innovation is concentrated in one sector that leads the economy along its new growth path and, through intersectoral linkages, the benefits spread to other sectors of the economy. The second is a more broad-based development strategy, where the same technological advancement is equally distributed among a number of sectors simultaneously.

In this paper we employ a dynamic computable general equilibrium (CGE) model to help assess the outcomes associated with the two development approaches over the period 1998-2012. The model is solved for 1997 (the base year for the database), annually for 1998 through 2000, and then every two years thereafter until the year 2012. Intertemporal linkages drive growth in the model. These linkages involve capital accumulation, labor-force growth, and total factor productivity (TFP) growth, which are updated in a dynamic (between-period) module, using lagged endogenous variables (from solutions in previous periods) for the capital stock and exogenous trends for the labor force and TFP. Under the first development approach three sectors are separately targeted: agriculture, food processing, and textiles. Each sectoral choice is intended to represent alternative development strategies which we label (i) agricultural-demand-led industrialization (ADLI); (ii) food-processing-based (FOOD); and (iii) textile-based industrialization (TEXTILE). Under the second approach a more broad-based development strategy is adopted where the same technological advancement is equally distributed among the three sectors and takes place simultaneously. We refer to it as (BAL) – a sectorally balanced industrialization strategy that combines all three. An initial growth path assumed for the Egyptian economy, which we label (BASE), is used as a benchmark for comparing the outcomes from the alternative development strategies. For each development strategy, the analysis is focused on the pattern of growth and on two measures of income inequality: the Theil and the Atkinson measures.

The sectoral choice underlying each development strategy reflects common suppositions in development economics as well as characteristics specific for the Egyptian economy. Under the ADLI strategy, agricultural income growth among rural households results from cost-reducing technological changes, as emphasized by Adelman (1984). A large proportion of that income growth is spent on the consumption of domestically produced, labor-intensive manufactured goods and services – a demand boost to nontraded manufactured goods that eventually result in higher savings (as a

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result of higher wages) to finance the economy's industrialization. Hence, the agricultural sector provides the steam for development (Mellor, 1995). Under the FOOD strategy, the food processing sector, which represents a large share of Egypt's manufacturing sector, can provide the basis for large output increases in the entire economy, given its relatively strong production linkages. Textile is another significant manufacturing sector. Under the TEXTILE strategy, this sector's potential for export expansion and high value added make it a good candidate to assume a leading role. Emphasizing rapid economic growth and a lessening of income disparities along both approaches – targeted and broad-based development strategies – the question is: which development strategy, if any should be pursued?[1]

The remainder of this paper is organized as follows: section II presents the structure of the CGE model and its database, while section III is concerned with how inequality is measured. Section IV is devoted to the model simulations and results. Section V concludes and discusses policy implications.

II. The Model

CGE models may be defined as economywide models whose solutions depict a simultaneous general equilibrium in all markets of the economy. A large number of CGE models have been applied to the analysis of policy issues in developing countries. CGE models are particularly useful when there is a need to capture links between different sectors, links between the micro and macro levels, and the effect of changes in policies and external shocks on sectoral structure, household welfare, and income distribution. In the context of the current paper, the model is employed as a framework to account for the general equilibrium effects, linking the macro aspects of the economy to a finely disaggregated household module. It also traces the impact of an exogenous shock on growth and income distribution through its effect on factor wages and employment – the functional distribution of income – which in turn affect the incomes of the various household groups given their initial structure of factor ownership – the size distribution of income.

The CGE model of the Egyptian economy used in this study follows the standard model developed at IFPRI (Löfgren *et al.* 2001) and makes use of the Social Accounting Matrix (SAM) for 1996/97 developed by Löfgren and El-Said (2001). It is in the tradition of models of developing countries described in Dervis et al. (1982), and Robinson (1989). The following sections will discuss the SAM and model disaggregation, the model specification of production technology, institutions, macro balances, and the model dynamics.

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[1] While attempting to assess the impact of alternative development strategies on growth and equity, the paper abstracts from the prescription of specific policies that the government may undertake in adopting any of these strategies.

A. The SAM database and model disaggregation

An Egyptian SAM for 1996/97 is used as the main database for the CGE model. A SAM is a comprehensive system for organizing economic data for a specified time period.[2] As a snapshot of the economy, a SAM captures the circular flow of incomes from product markets through factor payments to households and back to product markets through expenditures on final goods. It is in the form of a square matrix, and each cell in a SAM represents a payment from a column account to a row account. Following the conventions of double-entry bookkeeping, the total receipts (income) and expenditure of each account must balance (equal row and column sums). A typical SAM includes accounts for production (activities), commodities, factors of production, and institutions. The extent of disaggregation that is needed for the SAM depends on the type of analysis the CGE model is designed to answer. For example, relatively disaggregated household accounts are desirable in order to analyze income distribution issues, while a large degree of sectoral disaggregation is useful for analyzing the impact of structural adjustment on resource allocation by sector. Table 1 displays the disaggregation of production sectors (activities/commodities), factors, and institutions in the Egyptian SAM used in this paper. The SAM distinguishes between 14 activities, 4 factors, 10 household groups (5 rural and 5 urban, disaggregated by quintile), 5 government accounts (including direct and indirect tax, tariff, and subsidy accounts), and one account for the rest-of-the world (ROW). Among the 14 activities, 6 are agricultural, and the remaining 8 are disaggregated into the major types of industrial and service sectors. All activities use capital and labor, while land is agriculture specific. Factors employed in agriculture are sectorally mobile among agricultural activities but are assumed to be agriculture specific.

<< Table 1 >>

B. Production activities

The production technology is represented by nested CES (constant-elasticity-of-substitution) and Leontief (fixed-coefficient) functions. Domestic output in each sector is a CES function of value added and an intermediate input aggregate. Value added is a CES function of primary factors, while intermediate input use is determined by sector-specific fixed input-output coefficients multiplied by sectoral activity levels. It is assumed that land is mobile between the crop sectors and that agricultural labor and nonagricultural labor each has a distinct market. Profit-maximizing behavior of producers determines factor demand. The model solves for long-run equilibria in that all four factors (agricultural labor, nonagricultural labor, capital, and land) are assumed to be sectorally mobile. Wages and rental rates adjust to equate supply and demand in the four factor markets.

[2] For SAMs and SAM-based modeling, see Pyatt and Round (1987), Robinson and Roland-Holst (1988), and Reinert and Roland-Holst (1997). The disaggregated SAM is too large to be reproduced here, but is available from the authors upon request.

Each production sector is assumed to produce differentiated goods for the domestic and export markets, where imperfect transformability using a CET (constant-elasticity-of-transformation) function determines the sectoral output allocation between the two markets.[3] Subject to this transformation function, producers maximize revenue from sales. Similarly, domestic products are differentiated at the sectoral level. The composite good that is used by domestic demanders is a CES aggregate of imports and domestic products. Domestic demanders minimize the cost of obtaining a given amount of this composite good. Such product differentiation permits two-way trade and gives some realistic autonomy to the domestic price system (de Melo and Robinson 1981). Figure 1 depicts the physical flow of sectoral output to domestic and exports markets and the aggregation of a composite commodity from domestic and imported sources.

<< Figure 1 >>

It is assumed that Egypt is a small country in world markets, facing infinitely elastic export demands and import supplies at world prices that are fixed in foreign-currency. The domestic prices of imports depend on the world price, the exchange rate, and the tariff rate. Similarly, the domestic prices of exports are determined by the world price, the exchange rate, and the export tax or subsidy.

C. Institutions: Households, Government, and the Rest of the World (RoW)

In the base year, both rural and urban households receive about 89 percent of their incomes from factor earnings. Transfers from the government and the rest of the world (fixed in foreign currency) make up for the rest. Compared to rural and urban high-income groups, the poor in rural areas depend more heavily on labor incomes from agriculture. In addition to factor income, households receive. Total household income is used to pay direct taxes, save, and consume. Direct taxes and savings are fixed shares of household income. Consumption demand is determined by the linear expenditure system (LES).

Government revenue consists mainly of taxes – direct taxes from households, indirect taxes from domestic activities, and import tariffs. Apart from transfers to households, the government uses its income to buy goods, save, and pay consumer subsidies (fixed shares of consumer prices). In the model, the macro closure specified that the base-year quantities of disaggregated government demands be scaled (up or down) to assure that the total value of government consumption is a fixed share of total absorption. Government savings is the residual difference between government receipts and spending.

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[3] The CET function is relaxed in one of the simulations in section IV, where imperfect transformation of production is replaced by the assumption of perfect transformability for agricultural output between the two markets.

The rest of the world interacts with Egypt through commodity trade and transfers with domestic institutions (which add to or deduct from the incomes these institutions).

D. Macroeconomic balances

"System constraints" are constraints that have to be satisfied by the economic system, but are not considered in the optimizing decision of any micro agent (Robinson 1989). These include three macroeconomic balances (associated with the accounts for the government, the rest of the world, and savings-investments) and supply-demand balances in the product and factor markets. The "closure rules" of the model indicate the mechanisms on the basis of which the model satisfies these constraints.

As mentioned, government savings is the flexible variable that clears the government balance. For the rest of the world (Egypt's current account balance), foreign savings (the current account deficit) are fixed and the real exchange rate is flexible and adjusts to clear the balance. Investment spending is specified as fixed share of total absorption. After spending on stock accumulation, the rest of investment value is allocated to fixed capital formation. Households, government, and the rest of the world generate savings. The savings shares for the different household groups are scaled to generate total savings that equals total investment. Thus, the macro closure rule assumes that savings is investment driven. In conjunction with this closure specification, we assume a "balanced" macro closure, where both aggregate investment and government spending are specified as fixed shares of nominal absorption. Such a specification maintains unchanged absorption shares for household consumption, investment, and government spending in response to shocks affecting total absorption.

On the micro level, the system constraints apply to markets for commodities and factors. As noted, in the commodity markets, domestic production is supplied to export markets (where demand is infinitely elastic at exogenous world prices) and domestic sales. On the demand side of the market, domestic demands are made up of household consumption, investment demand, government consumption, and intermediate input use. In the context of cost minimization, this demand is split between imports (with infinitely elastic supplies at exogenous world prices) and domestic output. On the domestic markets, flexible prices assure that quantities demanded and supplied are equal.

In the factor markets (for agricultural labor, non-agricultural labor, capital, and land), flexible wages clear the markets in a setting where aggregate employment is fixed and each factor is mobile across the demanding activities.

E. The dynamic module

In a time-recursive, dynamic, CGE model, a two-stage dynamic formulation is used to handle the dynamic linkages. According to this approach, in the first stage, a within-period static CGE model is solved for a new equilibrium. In the second stage, a between-period model provides the necessary intertemporal linkages to update variables that drive growth in the static first stage model. These linkages involve capital accumulation, labor-force growth, and total factor productivity (TFP) growth, and are updated using lagged endogenous variables for the capital stock (on the basis of previous investment and depreciation, interpolating for the inter-period years from the first stage model solution), while total supply of labor and total factor productivity (TFP) by activity are all updated exogenously (Dervis et al., 1982: 173-4). The within-period static Egypt model is solved for 1997 (the base year for the database) and annually for 1998 through 2000, and then every two years thereafter until the year 2012.

III. Measuring inequality

We are interested in measuring changes in inequality in the distribution of incomes among households for each of the four development strategies relative to the BASE. Underlying each simulated growth path is a different set of income distributions among the different household groups. In the model there are two groups of households, rural and urban, where each group is subdivided by quintiles of their within-group distribution. The distribution of incomes across all households for each group is described by the mean of the distribution of incomes for each quintile.[4] We consider four different development strategies, where each strategy generates a growth path that the Egyptian economy follows over the model time horizon. Employing two measures of relative inequality, the Theil and the Atkinson measures, we compare and rank the evolution of relative inequality embodied in each distribution.

Technically the Theil entropy measure of income inequality is an entropy distance measure between actual household income share and the income share a household would have earned under perfect equality. That is, the Theil statistic measures the degree of disorder – entropy – of the income distribution compared to an even distribution where each household earns an equal share of income. A useful property of the Theil measure is that it is perfectly decomposable. Total inequality is unambiguously the sum of "between-group" inequality (within each of the rural or the urban household classes) and "within-group" inequality (between rural and urban as two distinct household groups) (Shorrocks, 1980; p. 625).

The Theil entropy measure of inequality can be written as:

$$I(y;n) = \sum_{i=1}^{N} \left(y_i / Y \right) \cdot \log\left(\frac{y_i / Y}{1/N} \right) \qquad (1)$$

[4] The implication of this representative household assumption is that when we say that the income of the rural first quintile grew by x percent, it is meant that the first moment of the distribution of income among households in the first quintile has grown by x percent. That is we make no reference to any "churning" that might have occurred to the incomes of households in the first quintile; higher moments are assumed constant, with no change assumed in the within-group relative distribution.

where $i = 1...N$ households whose income share is given by (y_i/Y) such that $\sum_{i=1}^{N}(y_i/Y) = 1$ for $(y_i/Y) \geq 0$.[5] An $I = 0$ implies that all household groups have the same per capita income – that is, the household groups' income and population shares are all pairwise equal (Theil, 1971, p. 645; and Theil 1967, p. 91). Equation (1) can be decomposed to equal the sum of the contribution of "within-group" inequality and "between-group" inequality as follows:

$$I(y;n) = \sum_{g=1}^{G}\sum_{i=1}^{N_g}\left(y_i^g/Y\right)\cdot I(y^g;n_g) + \sum_{g=1}^{G}\sum_{i=1}^{N_g}\left(y_i^g/Y\right)\cdot \log\left(\frac{y_i^g/Y}{N_g/N}\right)$$
$$= I_w + I_b \tag{2}$$

where N_g is the number of households in a partition g = 1,…,G subgroups of households such that $\sum_{g=1}^{G} N_g = N$. In this case, the source of a fall in *I*, which implies reduced inequality, can be traced to a reduction in inequality between two groups of households – urban and rural – and a reduction in inequality within each class of households (e.g. rural quintiles).

A different approach to measuring relative inequality is that pioneered by Atkinson (1970) where one chooses a welfare function that initially assigns a society's degree of aversion to inequality in order to arrive at a value for an inequality statistic. Following Deaton (1997, pp. 133-171), we define a linear social welfare function (SWF) in mean income and relative inequality as follows:

$$W = m\cdot(1-I) \tag{3}$$

where $W =$ social welfare, $m=$ mean income, and $I =$ an inequality measure that ranges from zero to one. In such a formulation, a state of perfect equality, that is $I = 0$, implies that social welfare will equal mean income m, the maximum value attainable for social welfare. For $I > 0$, social welfare declines, whereby a society's aversion to inequality determines by how much it falls. That is to say changes in welfare are attributed to changes in mean income and changes in inequality, where the latter can be seen as the cost of inequality – the amount by which social welfare deviates from its maximum value – that varies positively with society's aversion to inequality. In addition, adding a welfare dimension to inequality measurements avoids interpreting an increase (fall) in a measure of inequality as a decrease (rise) in welfare. A case where inequality is rising while social welfare is increasing is possible. For example when all incomes in a distribution increase, but the increase in the incomes of the rich members is more than that of the poor, inequality increases but overall welfare might increase as mean income rises.

[5] The Theil indexas difned in (1) range in the interval [0, ln N]. The index can be modified to range in the interval [0, 1] as $N \to \infty$ using the following transformation: $I^* = 1 - e^{-I}$ (Sadoulet and de Janvry, pp. 21).

The Atkinson measure of relative inequality is consistent with the social welfare approach described above. The measure is defined as follows:

$$I = 1 - \left(\frac{1}{N} \sum_{i=1}^{N} \left(\frac{y_i}{m} \right)^{1-e} \right)^{\frac{1}{(1-e)}} \qquad \text{for } e \neq 1 \tag{4}$$

and

$$I = 1 - \prod_{i=1}^{N} \left(\frac{y_i}{m} \right)^{\frac{1}{N}} \qquad \text{for } e = 1 \tag{5}$$

where e measures the degree of relative aversion between mean income and total inequality. A higher e implies a higher degree of society's aversion to inequality (Cowell 1995; pp. 36-47).

For the results reported in the paper, we begin by computing mean income and inequality embodied in a distribution and then computing social welfare from equation (3). The results are computed for $e = 0.5$, 1.0, and 2.0.[6]

IV. Initial Structure of the Economy, Model Simulations, and Results

Having discussed the model features and how we measure inequality, this section discusses the initial structure of the economy as captured in the SAM, the simulations conducted using the model, and the results obtained.

A. Stucture of the Economy

The data contained in the SAM provide a snapshot of the economy in 1996/97, which is the initial starting point for the model. Given our focus on income distribution among different household groups, we are interested in the amount of income earned by each household and how it was earned. The SAM provides the information needed to answer both questions. The former is what is referred to as the "functional" distribution of income – the returns to factors – and the latter is the "size" distribution of income – how the factor returns are distributed among households. Figure 2 provides a schematic

[6] For more information on the different inequality measures, their properties, and related topics in the analysis of income distribution see: Atkinson (1970), Bourguignon (1979), Cowel (1979), Shorrocks (1980) and (1984).

representation of this relationship.[7] Tables 2-6 highlight the structure of production, the extent and distribution of factor employment by sector, and the size distribution of income given the factor ownership of the household groups as captured in the SAM for Egypt. That is the actual mapping of factor incomes from production activities, and the mapping of household incomes from factor incomes.

Table 2 shows the structure of production and trade patterns for the Egyptian economy in the 1996/97 base SAM. Agricultural sectors make up 14.1 percent of total output, while the shares of industry and services in total output are 36.9 percent and 49.0 percent, respectively. The bulk of exports rests in the services sector, mainly because of the Suez Canal. Oil exports are also significant: about 52.8 percent of total production is exported. The agricultural sector export shares are very small and do not exceed 1 percent of total exports. Imports are concentrated in the industry sectors, but a significant share of agricultural final demands are imported (imports for food crops –mainly wheat – are 36 percent of final demand).

<< Figure 2 >>

<< Table 2 >>

Tables 3 and 4 look in more detail at the mapping of factor incomes from production activities. Factors sell their services to production sectors and in return receive wages, profits, and rent. Summing to 100 across a row, Table 3 lists the share of each factor in value-added by production sector. The numbers reflect the extent of factor usage or intensity by sector. For example, 26.9 percent of value-added in food crops accrues to agricultural labor, while 12.4 and 60.6 percent accrue to capital employed in agriculture and land, respectively. Note that column totals give the factor aggregate share in total factor income earned from all sectors; that is, the factor income share in GDP at factor cost.

<< Table 3 >>

Table 4 lists the distribution of total income for a factor by sector. The numbers read down a column give the share of factor income by source and add up to 100 percent. Row totals represent the share of each sector in total factor incomes; that is the contribution by sector to GDP at factor cost.

<< Table 4 >>

Tables 5 and 6 provide disaggregated information on income distribution among the household groups. Table 5 provides information on the share of a factor of production

[7] The contribution of transfers from the government and the rest of the world to total household income is small, and since we do not consider any tax and transfer programs in the analysis to follow, we will not discuss them here

in a particular household income. For example, 20.6 percent of the factor income of the lowest rural quintile comes from the provision of labor in the agriculture sector and 24 percent from non agricultural labor. The remaining 55.4 percent are received from agricultural capital and land.

<< Table 5 >>

Table 6 considers the distribution of specific factor income among all household groups. Summing to 100 percent down a column, 81.5 percent of agricultural labor income accrues to rural households, whereas the remaining income goes to urban households. Such mapping of factor income to households influences the distribution of income between household groups (rural and Urban in our case) and within each group. For example, policy changes that affects nonagricultural labor income is likely to influence the distribution of income between rural and urban households since 73.4 percent of that income accrues to urban households. Similarly, a policy change that affects land rents will alter the distribution of income within rural households in favor of the top two rural quintiles who own 58.7 percent of total land returns.

<< Table 6 >>

Tables 2-6 trace the relationship between the structure of production, the distribution of factor incomes, and the allocation of factor incomes by the household groups as captured in the SAM. This relationship provides a framework for analyzing the impact of an exogenous shock on growth and income distribution. In the following subsections we discuss the model simulations and their results.

B. Model Simulations[8]

Two sets of four simulations – in addition to the BASE – are conducted using the Egypt-CGE model. Each individual simulation provides a growth path for the Egyptian economy during the period 1998-2012. The first simulated path is our BASE where the real GDP grows at an annual rate of 5 percent. The sources of the 5 percent growth in real GDP are (i) lagged endogenous capital growth; (ii) an exogenous 2.8 percent annual labor force growth rate[9]; and (iii) a 1.3 percent rate of increase in TFP growth across all sectors (see Table 7).[10] This base trend represents our benchmark reference path to which the remaining four simulated strategies are compared.

<< Table 7 >>

[8] The GAMS software is used to implement the model. For more information on GAMS see Brooke et al. (1998).
[9] Authors calculations based on World Bank (1999) labor force data.
[10] For the BASE growth path, the rate of increase in TFP is a residual adjusted to achieve the 5 percent real GDP growth.

The four simulations implemented to examine the economywide effects of alternative development strategies for Egypt are based on the promotion of agriculture (agricultural-demand-led industrialization or ADLI); food-processing (food-processing-based or FOOD); textiles (textile-based industrialization or TEXTILE); and balanced promotion of all three sectors (balanced strategy or BAL), where the latter portrays a more broad-based development strategy. Implementation of the four development strategies involves an exogenous increase in TFP for one or more sectors.[11] The impact of TFP promotion can be interpreted as progressive downward shifts in the supply curve, or an upward shift in the production function for the relevant sectors. To establish a basis for comparing the results across all four simulations – that is for each growth path – the increases in the rate of TFP growth was scaled according to the share of each sector in total value added in the base year to make the shock comparable in aggregate impact. The idea is that a sector with a high share in total value added would get a smaller "kick" in TFP relative to the TFP "kick" a sector with a smaller share in total value added would get. For example, in 1997 the shares of agriculture, food processing, and textiles to total value added are 17.7, 3.1, and 5.7 percent , respectively (see Table 2). A scaled TFP "kick" implied a sector specific annual percentage increase in TFP as indicated in Table 7 under ADLI, FOOD, and TEXTILE, respectively. For the broad-based strategy, BAL, the exogenous increase in TFP under each one of the sector specific strategies was scaled down so that the aggregate impact is equally divided among all three sectors.

The four simulations were carried out under the assumption of a relatively low elasticity of transformation for all production sectors, including agriculture, between domestic and export markets (see Table 2 for the elasticity values). This implies that local producers cannot easily shift output between the two markets as a result of a change in relative prices. In a second set of simulations, the same four development strategies were repeated but under the assumption of perfect transformability for the agriculture sector between domestic and export markets – producers can shift supply at no cost. The results are especially senstive to how agriculture is treated. The degree of transformability for agriculture between local markets for domestic consumption and international marktes for exports has significant growth and distributional implications. We will elaborate on this further in the following subsection where the results are discussed.

C. Simulation Results

We present the results for both sets of simulations. The first set is conducted under the assumption of a low elasticity of transformation for all sectors, while the second set is implemented under the assumption of perfect transformability of agricultural output.

Case 1. Low elasticity of transformation

BASE Strategy. For the BASE strategy, Egypt's real GDP continues to grow at its current trend rate of 5 percent during the 2000-2012 period. Table 8 shows the changes

[11] TFP growth in one or more sectors could be the result of an additional exogenous flow of investment, or improvements in infrastructure, or improved support services, or any combination.

in the sectoral structure of production and foreign trade under the BASE strategy for the same period. In terms of production, there are relatively small changes. The share of agriculture and industry in total output decreases by around 2.8 percentage points, while the share of services increases by about 5.6 percentage points. With respect to exports, the agricultural share of exports, initially small relative to the rest of the economy, falls. At the same time, industry records a significant decrease in export share, mainly from the oil sector, which is assumed not to continue growing at the same rate as the rest of the economy. On the other hand, services' export share increases from 65.7 percent to 78.9 percent ot total output. For imports, agriculture share of total imports declines, mainly from a drop in food crops imports. There is a modest change for industry (a percentage point) while there is almost no change for services. Overall, there are modest changes in the structure of production and the pattern of trade (with the exception for oil output and exports).

<< Table 8 >>

In terms of growth and distribution, the BASE simulation results indicate a combination of a rapid and steady rate of GDP growth and nearly unchanged relative inequality (see the path of for BASE strategy in figures 3 and 4). Table 9 shows the rate of growth in selected national accounts data, as well as factor and household incomes, while Table 10 reports results for the inequality measures. Even though inequality in the distribution of incomes among households remains almost unchanged, the gap between rural and urban incomes decreased, while within-group inequality among both the rural and the urban households increases over time. Thus a high average GDP growth rate under the BASE strategy ends up affecting all household mean incomes over time – both the rich and the poor gain from growth under the BASE strategy – leaving total inequality unchanged.

<< Figures 3 and 4>>

<< Tables 9 and 10>>

Alternative Development Strategies. Here we examine the results for the other simulated strategies: ADLI, FOOD, TEXTILE, and BAL. We look at the implications for growth and income distribution of faster TFP growth in one or more designated sectors (see Table 7). By construction, GDP growth relative to the BASE is higher under each one of the alternative strategies. However, each strategy implies a different "faster" rate of growth and a different pattern of income inequality (see Figures 3 and 4). The question that interests us is: which strategy is pro growth and at the same time more egalitarian? Judging from Tables 9 and 10, the results indicate that the TEXTILE strategy fulfills this objective. The annual rate of GDP growth is the highest, and total inequality falls relative to other strategies including the BASE; the TEXTILE strategy dominates. A further inspection of the results indicates that none of the other strategies can be consistently ranked with our criteria of both rapid growth and more equality in the distribution of income. For example, the BAL strategy reports the second highest rate of GDP growth (5.32 percent) but ranks third after FOOD in terms of inequality as indicated by the rate of change in the Theil and Atkinson measures reported in Table 10 (0.13 percent vs. –0.04 percent for Theil index and similarly for the Atkinson measure under all the considered values for e) and the path of inequality in Figure 4 (BAL above FOOD). The same pattern is repeated for ADLI where it ranks third in terms of growth but reports the highest inequality in the distribution of income.

An interesting result is the one obtained under ADLI, where growth is accompanied by an increase in inequality. Targeted growth toward agriculture results in a worsening of rural incomes and more inequality within rural households and between rural and urban household groups. This result is consistent with earlier findings by Adelman and Robinson (1978) for the case of Korea. This result is explained by the rapid and steady decline in the agriculture terms of trade (see the path for ADLI in Figure 5) where it drops to 85 in 2012 (compared to 100 in 2000). Rural household incomes are strongly influenced by changes in agricultural terms of trade (compare the path for TEXTILE and ADLI in Figure 5 and the reported growth rates for household incomes in Table 9) which in turn is extremely sensitive to changes in agriculture production. Thus with productivity gains under ADLI (more is produced with the same factor usage) the expansion in agriculture production ends up adversly affecting rural incomes and benefiting urban households through lower food prices and/or increased demand for nonagricultural goods. Such an outcome of deteriorating rural incomes, increased inequality, and slower growth remains likely unless ADLI is accompanied by other policies that support agricultural prices.

<< Figure 5>>

The first set of experiments were carried under the assumption of a low elasticity of transformation between domestic and export markets. For agriculture, this implies that it is difficult for exports to be a vent for excess agricultural supply under ADLI (increased production has to be absorbed domestically leading to significant price declines, outweighing the gains from productivity). In the following section, we relax this assumption and consider the case of perfect transformability for agriculture.

Case 2. Perfect transformability of agricultural exports

BASE Strategy. For the BASE strategy, we continur to assume that Egypt achieves a 5 percent annual GDP growth over the period 2000-2012. The structure of production and trade for the BASE strategy under perfect transformability does not differ much from that under Case 1. In terms of production, Table 11 shows that the structure of production declines around 2 percentage points for agriculture and 3 percentage points for industry, while the share of services increases by about 5 percentage points. As expected, given the assupmtion of perfect transformability for agriculture output between domestic and exports, the share of agriculture exports expands, mainly coming from rice exports. A similar pattern under Case 1 is reported for industry and services – a decrease in total exports for industry, mainly from the oil sector, and an increase in the share for services. For imports, the same pattern generated under Case 1 holds for industry and services – a minor increase and decrease, respectively. Compared to Case 1, agriculture imports as a share of total imports does not report the same decline as a result of increased specializaton in agricultural production. Overall, there are even more modest changes in the structure of production and the pattern of trade as compared with Case 1. As noted, the only exception is for agriculture exports.

<< Table 11>>

Tables 12 and 13 parallel Tables 9 and 10 reported under Case 1. They report the rate of growth in selected national accounts data, as well as factor and household incomes, and inequality embodied in the distribution of household incomes. Contrary to Case 1, where absolute incomes for all quintiles were increasing with unchanged inequality, growth is more egalitarian in this case. Judging from the results, rural incomes grow faster than urban incomes (Table 12) and between-group inequality is the driving force behind the fall in the Theil index (Table 13).

<< Tables 12 and 13>>

Alternative Development Strategies. Replacing the assumption of low elasticity of transformation with the assumption of perfect transformability for agriculture changes both growth and distribution results. The answer to the question of which strategy is pro growth and at the same time more egalitarian is changed. Now the ADLI strategy dominates the TEXTILE strategy both in terms of GDP growth and equity. Figures 6 – 8 not only reflect this but also indicate that all strategies are inequality-reducing (Figure 7) and confirm that preventing the agricultural terms of trade from falling is pro-equity (Figure 8). An attempt to rank the remaining strategies suggests that BAL strategy is second to ADLI since it fares as well as TEXTILE in terms of growth but involves improved inequality (-0.29 percent vs. -0.14 percent). Ranking FOOD and TEXTILE is not as simple since the latter involves more growth while the former is more effective in terms of reducing inequality as noted by the Theil index. However, given the welfare notion associated with the Atkinson measure TEXTILE would be ranked ahead of FOOD strategy.

<< Figures 6, 7, and 8 >>

V. Conclusion

Using a dynamically recursive CGE model, the paper explores the economywide growth and distribution effects of alternative development strategies for Egypt. The analysis was carried under two cases; one where the ease of transforming output between domestic markets and export markets is low for all production sectors including agriculture and another where we assume perfect transformability for agriculture. In the first case, the TEXTILE strategy is a win-win approach in terms of rapid growth and equity, while ADLI is a mix of growth and deteriorating inequality. For ADLI growth targeted towards agriculture implies worsening inequality, a reflection of the sensitivity of rural incomes to agricultural terms of trade arising from the expansion in agriculture production, which cannot be sold abroad. In this case, under ADLI the expansion in agriculture production negatively affects rural incomes since shares of agriculture exports are initially small and excess supply ends up in domestic markets causing a significant price decline, which outweigh the gains from productivity.

In the second case, when the assumption of perfect transformability is used for agricultural exports, the results are changed in favor of ADLI. The ability to supply all increased output to world markets at fixed prices prevents the agricultural terms of trade from falling and hence improves rural incomes and inequality, while achieving higher GDP growth rates. That is, adopting policies that maintain agricultural prices in the context of a strategy designed to improve rural incomes prevents the gains from "leaking" to the urban sector, and the net effect is rapid growth and a general improvement of the distribution of income among households.

It is implied in the second case that Egypt can expand its agricultural exports without limits and with no impact on world prices. However, constraints on access to international markets may stand in the way of a sufficiently rapid expansion of exports. If world markets (the EU market in particular) cannot absorb Egyptian exports, the terms-of-trade effects would be much more adverse under ADLI (Case 1). Even if we are back to Case 1, the analysis assumes that exports of the Egyptian textile sector are unconstrained and have unlimited access to international markets. The assumed ease of export expansion is a factor contributing to the high growth rates experienced under TEXTILE strategy. Hence, the results obtained lead us to conclude that securing improved access to international textile markets and promoting the expansion of agricultural exports and market access are crucial for achieving rapid and egalitarian growth for the Egyptian economy.

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Table 1. Disaggregation of the benchmark Egyptian SAM for 1996-97

Activities/commodities (14)

Food crops	Livestock	Electricity
Rice	Food processing	Construction
Fruits and Vegetables	Oil	Public administration
Other food	Textiles	Other services
Cotton	Other industry	

Factors (4)

Agricultural labor	Capital
Nonagricultural labor	Land

Institutions (12)

Households (rural and urban, both disaggregated by quintile)
Government
Rest of the world

Table 2. Structure of the Economy in 1996-97

Sector	Output (X)	Value added (VA)	Final Demand (Q)	Exports (E)	Imports (M)	Export/ Output (E/X)	Import/ final demand (M/Q)	Elasticity of Transformation
Agriculture					(%)			
Food crops	2.2	3.3	3.2	0.0	8.0	0.0	36.0	1.25
Rice	0.7	1.0	0.7	0.1	0.0	1.8	0.0	1.25
Fruits and	2.8	4.1	2.8	0.0	0.3	0.1	2.1	1.25
Other food	3.7	5.1	3.6	0.4	0.2	1.4	0.9	1.25
Cotton	0.7	1.1	0.7	0.0	0.0	0.0	0.0	1.25
Livestock	4.0	3.1	4.0	0.0	1.1	0.0	4.6	1.25
Total	14.1	17.7	15.0	0.5	9.5			
Industry								
Food	11.7	3.1	11.6	1.8	3.2	1.9	4.9	0.50
Oil	4.4	6.6	3.3	18.4	9.2	52.8	39.0	1.25
Textiles	7.8	5.7	7.0	7.2	1.9	11.6	4.3	0.50
Other	13.0	9.3	21.5	10.3	63.0	10.0	47.3	0.50
Total	36.9	24.7	43.3	37.7	77.3			
Services								
Electricity	1.6	1.8	1.5	–	–	–	–	2.00
Construction	7.7	5.3	7.5	–	–	–	–	2.00
Public	5.9	7.9	5.6	–	–	–	–	0.50
Other	33.8	42.6	27.0	61.8	13.2	23.0	6.7	2.00
Total	49.0	57.6	41.7	61.8	13.2			
Total	100.0	100.0	100.0	100.0	100.0			

Table 3. Share of factor in value-added by production sector (%)

	Labor		Capital	Land	Total
	Agricultural	Nonagricultural			
Agriculture					
Food crops	26.9	–	12.4	60.6	100
Rice	27.2	–	16.3	56.5	100
Fruits and Vegetables	34.4	–	13.7	51.9	100
Other food	21.1	–	16.3	62.6	100
Cotton	45.8	–	9.5	44.7	100
Livestock	19.6	–	80.4	–	100
Industry					
Food processing	–	23.3	76.7	–	100
Oil	–	4.2	95.8	–	100
Textiles	–	43.5	56.5	–	100
Other industry	–	21.5	78.5	–	100
Services					
Electricity	–	26.9	73.1	–	100
Construction	–	31.5	68.5	–	100
Public administration	–	100.0	–	–	100
Other services	–	28.6	71.4	–	100
Total	4.8	27.7	59.2	8.4	100

Table 4. Distribution of factor income by sector (%)

	Labor		Capital	Land	Total
	Agricultural	Nonagricultural			
Agriculture					
Food crops	18.5		0.7	23.7	3.3
Rice	5.9		0.3	7.0	1.0
Fruits and Vegetables	29.7		1.0	25.4	4.1
Other food	22.6		1.4	38.0	5.1
Cotton	10.6		0.2	5.9	1.1
Livestock	12.7		4.2	–	3.1
Industry					
Food processing	–	2.6	4.0	–	3.1
Oil	–	1.0	10.7	–	6.6
Textiles	–	8.9	5.4	–	5.7
Other industry	–	7.2	12.3	–	9.3
Services					
Electricity	–	1.7	2.2	–	1.8
Construction	–	6.1	6.2	–	5.3
Public administration	–	28.5	–	–	7.9
Other services	–	44.0	51.4	–	42.6
Total	100	100	100	100	100

Table 5. Share of factor of production in household income by source (factor endowment)*

	Labor		Capital	Land	Total
	Agricultural	Nonagricultural			
Rural households (by quintile)		(%)			
1	20.6	24.0	42.2	13.2	100.0
2	17.4	23.1	45.1	14.4	100.0
3	10.9	21.5	50.8	16.8	100.0
4	6.6	16.2	57.8	19.4	100.0
5	4.4	13.5	61.5	20.6	100.0
Urban households (by quintile)					
1	3.3	53.4	41.7	1.6	100.0
2	3.0	50.9	44.6	1.6	100.0
3	2.4	45.6	50.4	1.6	100.0
4	1.3	33.8	63.3	1.6	100.0
5	0.8	27.6	70.1	1.6	100.0

* Only factor income; excludes transfers

Table 6. Distribution of factor incomes to households

	Labor		Capital	Land
	Agricultural	Nonagricultural		
Rural households (by quintile)		(%)		
1	18.0	3.6	3.1	6.6
2	20.0	4.6	4.4	9.4
3	16.7	5.6	6.6	14.6
4	12.7	5.4	9.4	21.2
5	14.1	7.4	16.7	37.5
Total rural	81.5	26.6	40.2	89.3
Urban households (by quintile)				
1	3.0	8.4	3.2	0.8
2	3.9	11.5	5.0	1.2
3	4.4	14.6	7.9	1.7
4	3.4	15.0	13.9	2.4
5	3.8	23.9	29.8	4.6
Total urban	18.5	73.4	59.8	10.7
Total	100.0	100.0	100.0	100.0

Table 7. Total factor productivity (TFP) growth under alternative growth strategies (2000 – 2012)

	Dynamic-base (BASE)	Agricultural demand-led Industrialization (ADLI)	Food processing-based (FOOD)	Textile-based industrialization (TEXTILE)	Balanced (BAL)
All agriculture sectors	1.3	***3.1***	1.3	1.3	***1.9***
Food processing	1.3	1.3	***11.4***	1.3	***4.7***
Textiles	1.3	1.3	1.3	***6.8***	***3.2***
Other industrial and service sectors	1.3	1.3	1.3	1.3	1.3

Table 8. Structure of production and trade under dynamic-base (BASE) strategy (%)

	Case of low CET*					
	Production		Exports		Imports	
	2000	2012	2000	2012	2000	2012
Agriculture						
Food crops	2.0	1.3	–	–	7.5	6.7
Rice	0.7	0.4	0.1	0.0	–	–
Fruits and Vegetables	3.5	2.6	0.3	0.1	0.2	0.2
Other food	2.7	2.2	0.0	0.0	0.3	0.3
Cotton	0.7	0.7	–	–	–	–
Livestock	3.7	3.2	–	–	1.0	0.8
Total	13.3	10.4	0.4	0.1	8.9	8.0
Industry						
Food processing	10.9	8.8	1.6	0.7	3.0	2.7
Oil	4.0	2.7	14.4	4.7	9.7	11.2
Textiles	8.0	8.0	7.3	5.2	1.9	2.0
Other industry	13.5	14.2	10.6	10.4	63.6	63.3
Total	36.4	33.7	33.9	21.0	78.2	79.2
Services						
Electricity	1.6	1.7	–	–	–	–
Construction	8.0	8.6	–	–	–	–
Public administration	5.7	5.1	–	–	–	–
Other services	35.0	40.5	65.7	78.9	12.9	12.8
Total	50.3	55.9	65.7	78.9	12.9	12.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

* CET = Constant elasticity of transformation

Table 9. Simu lation results of alternative development strategies (annual growth rate in percent, 2000-2012)

	Case of low CET*				
	Dynamic-base (BASE)	Agricultural demand-led industrialization (ADLI)	Food processing-based (FOOD)	Textile-based industrialization (TEXTILE)	Balanced (BAL)
Real GDP	5.00	5.26	5.21	5.40	5.32
Consumption	5.02	5.41	5.25	5.42	5.40
Government consumption	3.54	3.31	3.60	3.83	3.57
Investment	5.16	5.10	5.30	5.55	5.32
Exports	5.69	5.84	5.89	6.17	5.98
Imports	5.26	5.40	5.45	5.71	5.54
Factor income					
Agricultural Labor	5.62	3.04	5.75	7.41	5.36
Nonagricultural Labor	4.76	5.45	4.89	4.96	5.17
Capital	5.08	5.72	5.18	5.34	5.49
Land	6.08	3.37	6.20	7.74	5.73
Household income (annual growth rate in percent, 2000-2012)					
Rural:					
1	5.04	4.72	5.16	5.80	5.22
2	5.05	4.79	5.17	5.78	5.24
3	5.07	4.92	5.18	5.73	5.28
4	5.11	5.00	5.21	5.74	5.33
5	5.13	5.05	5.24	5.75	5.36
Urban					
1	4.79	5.31	4.90	5.09	5.16
2	4.81	5.34	4.93	5.11	5.19
3	4.84	5.39	4.96	5.14	5.22
4	4.91	5.48	5.02	5.19	5.30
5	4.95	5.53	5.05	5.23	5.34

* CET = Constant elasticity of transformation

Table 10. Simulation results of alternative development strategies (annual growth rate in percent, 2000-2012)

	Case of low CET*				
	Dynamic-base (BASE)	Agricultural demand-led industrialization (ADLI)	Food processing-based (FOOD)	Textile-based industrialization (TEXTILE)	Balanced (BAL)
Theil's inequality measure (% change 2000-2012)					
Total change	-0.03	0.65	-0.04	-0.38	0.13
Due to within-group inequality	0.11	0.27	0.10	0.02	0.15
Due to between-group inequality	-0.14	0.37	-0.14	-0.40	-0.02
Atkinson's total inequality measure (% change 2000-2012)					
$e = 0.5$					
Inequality	0.05	0.54	0.05	-0.18	0.17
Welfare	4.98	5.20	5.09	5.44	5.28
$e = 1.0$					
Inequality	0.06	0.52	0.06	-0.15	0.17
Welfare	4.97	5.15	5.08	5.46	5.26
$e = 2.0$					
Inequality	0.07	0.46	0.06	-0.11	0.16
Welfare	4.96	5.08	5.07	5.47	5.24

* CET = Constant elasticity of transformation

Table 11. Structure of production and trade under dynamic-base (BASE) strategy (%)

	Case of perfect transformability					
	Production		Exports		Imports	
	2000	2012	2000	2012	2000	2012
Agriculture						
Food crops	1.9	1.3	–	–	7.7	7.1
Rice	1.1	1.4	2.9	6.0	–	–
Fruits and Vegetables	3.4	2.6	0.0	0.0	0.2	0.2
Other food	2.6	2.1	0.0	0.0	0.3	0.3
Cotton	0.7	0.7	–	–	–	–
Livestock	3.8	3.1	–	–	1.0	0.9
Total	13.5	11.2	2.9	6.0	9.2	8.5
Industry						
Food processing	10.9	8.6	1.4	0.6	3.1	2.8
Oil	4.0	2.7	14.2	4.5	9.7	11.2
Textiles	7.9	7.7	6.8	4.4	1.9	2.0
Other industry	13.5	14.3	10.6	10.1	63.3	62.8
Total	36.3	33.3	33.0	19.6	78.0	78.8
Services						
Electricity	1.6	1.7	–	–	–	–
Construction	8.0	8.7	–	–	–	–
Public administration	5.8	5.1	–	–	–	–
Other services	34.8	40.0	64.1	74.4	12.8	12.7
Total	50.2	55.5	64.1	74.4	12.8	12.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

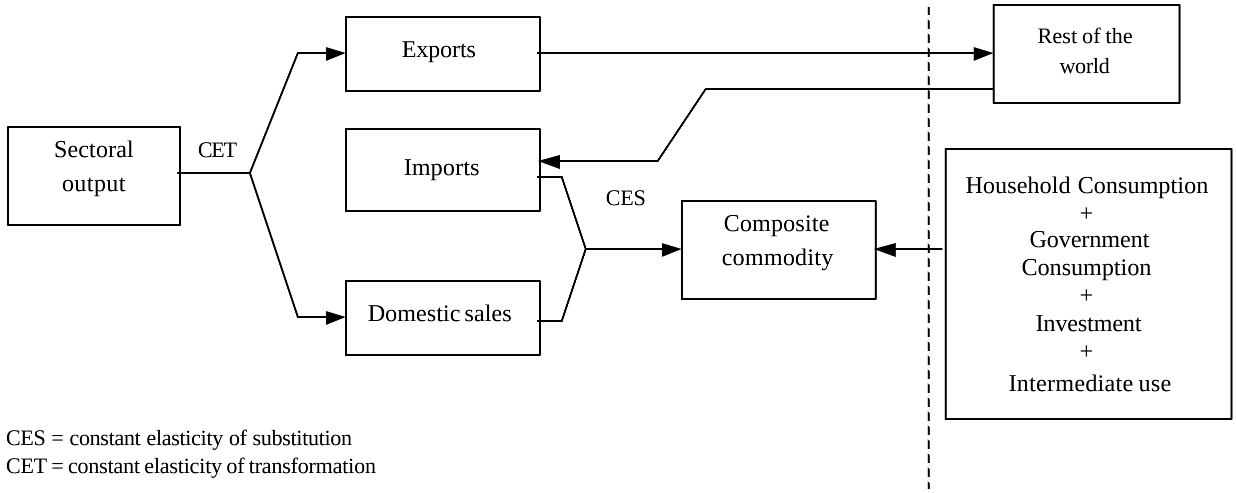
Table 12. Simulation results of alternative development strategies (annual growth rate in percent, 2000-2012)

	Case of perfect transformability				
	Dynamic-base (BASE)	Agricultural demand-led industrialization (ADLI)	Food processing-based (FOOD)	Textile-based industrialization (TEXTILE)	Balanced (BAL)
Real GDP	5.00	5.50	5.20	5.35	5.36
Consumption	5.01	5.51	5.24	5.41	5.40
Government consumption	3.56	3.82	3.59	3.66	3.71
Investment	5.19	5.73	5.32	5.40	5.48
Exports	5.73	6.42	5.92	6.09	6.13
Imports	5.30	5.95	5.48	5.63	5.67
Factor income					
Agricultural Labor	6.20	7.71	6.19	6.60	6.85
Nonagricultural Labor	4.73	5.07	4.88	5.14	5.03
Capital	5.04	5.33	5.17	5.51	5.35
Land	6.72	8.55	6.69	6.80	7.42
Household income (annual growth rate in percent, 2000-2012)					
Rural:					
1	5.26	6.06	5.33	5.63	5.69
2	5.26	6.04	5.33	5.63	5.68
3	5.25	5.99	5.33	5.62	5.66
4	5.28	6.00	5.36	5.64	5.69
5	5.30	6.02	5.38	5.66	5.71
Urban					
1	4.80	5.18	4.92	5.22	5.11
2	4.81	5.19	4.94	5.24	5.13
3	4.84	5.21	4.97	5.27	5.16
4	4.90	5.24	5.02	5.34	5.21
5	4.93	5.27	5.06	5.37	5.25

Table 13. Simulation results of alternative development strategies (annual growth rate in percent, 2000-2012)

	Dynamic-base (BASE)	Agricultural demand-led industrialization (ADLI)	Food processing-based (FOOD)	Textile-based industrialization (TEXTILE)	Balanced (BAL)
Theil's inequality measure (% change 2000-2012)					
Total change	-0.20	-0.56	-0.17	-0.14	-0.29
Due to within-group inequality	0.06	-0.03	0.07	0.08	0.04
Due to between-group inequality	-0.27	-0.53	-0.24	-0.22	-0.33
Atkinson's inequality measure (% change 2000-2012)					
$e = 0.5$					
Inequality	-0.05	-0.27	-0.03	-0.02	-0.10
Welfare	5.06	5.60	5.16	5.46	5.42
$e = 1.0$					
Inequality	-0.03	-0.22	-0.02	0.00	-0.08
Welfare	5.06	5.62	5.16	5.46	5.43
$e = 2.0$					
Inequality	-0.01	-0.16	0.00	0.01	-0.04
Welfare	5.06	5.63	5.16	5.45	5.43

Figure 1. Physical flows of commodities



CES = constant elasticity of substitution
CET = constant elasticity of transformation

Figure 2. Functional and size distribution of income

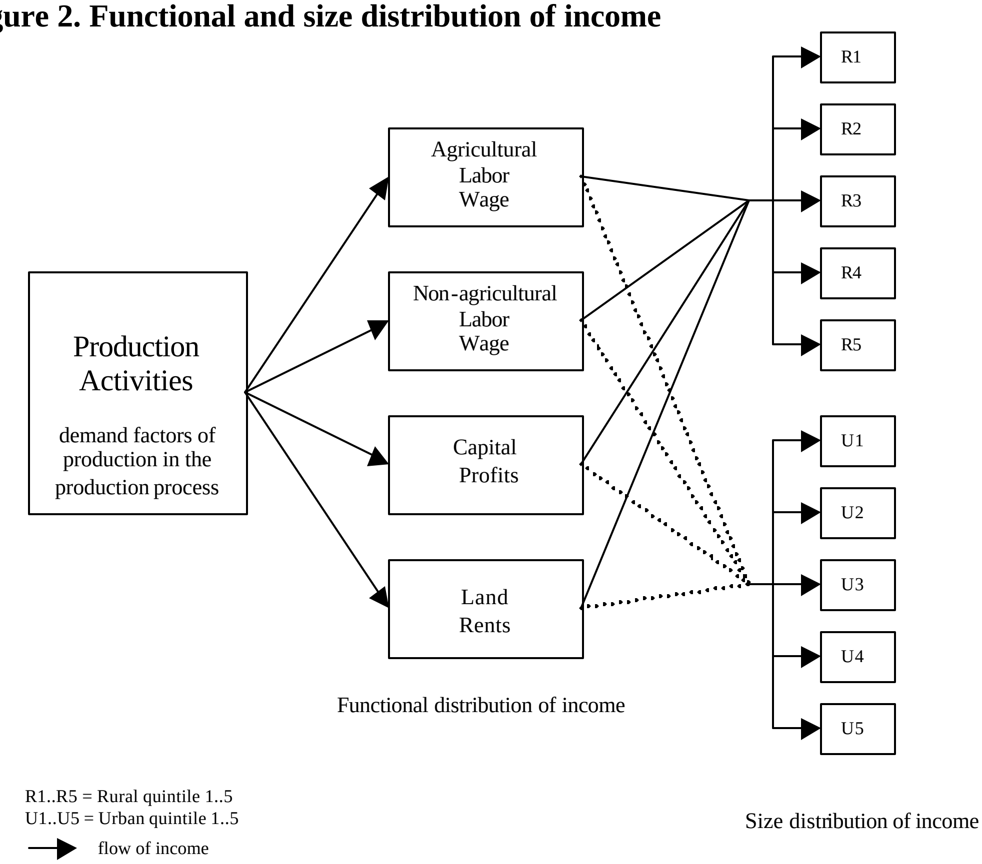


Figure 3 Real GDP growth rate under different strategies; case of low CET

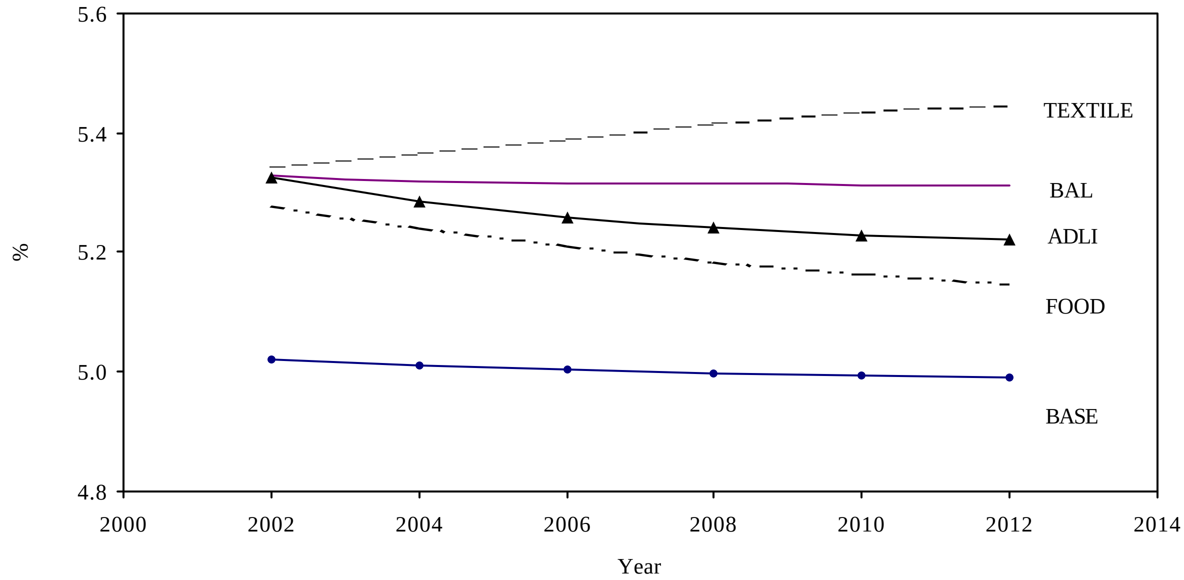


Figure 4 Theil entropy measure of income inequality; case of low CET (2000 = 100)

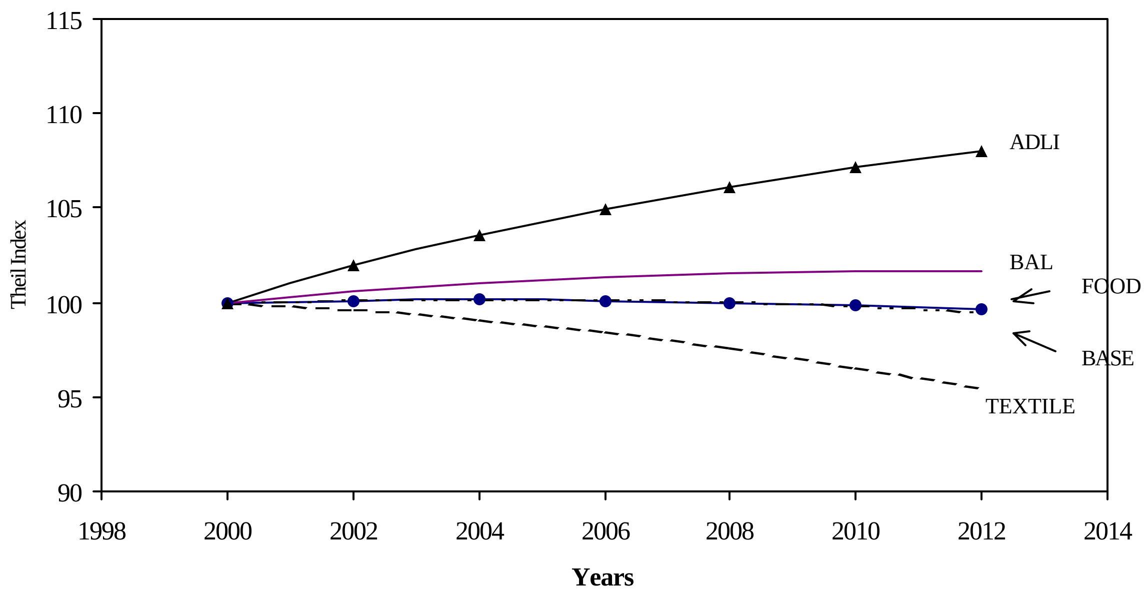


Figure 5 Agricultural terms of trade; case of low CET (2000 = 100)

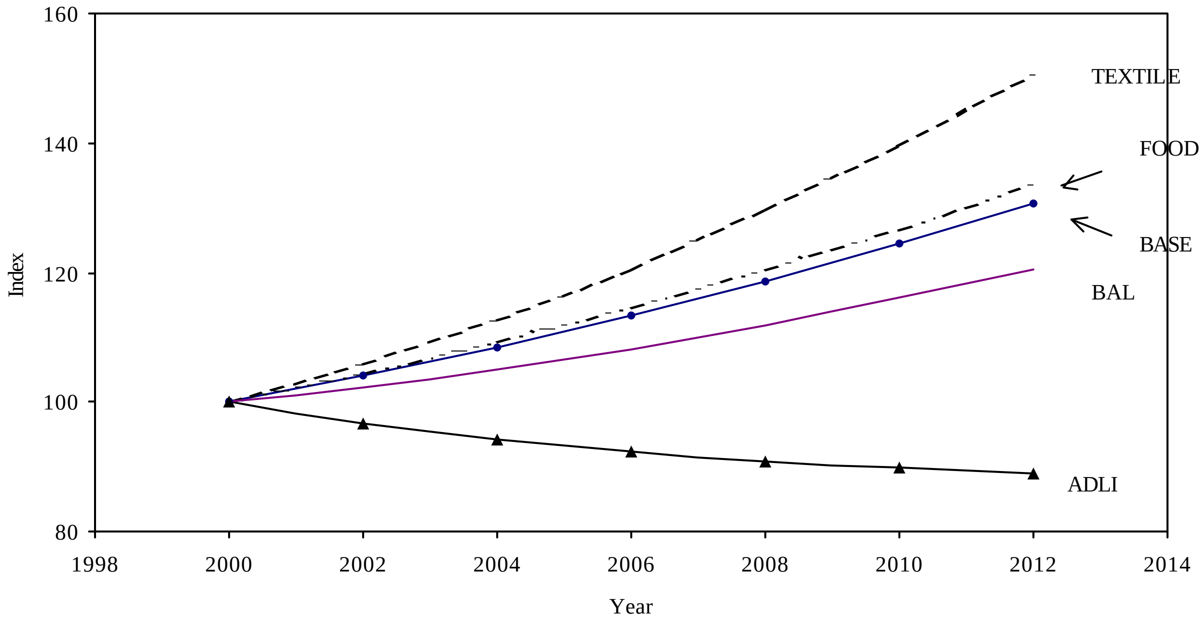


Figure 6 Real GDP growth rate under different strategies; case of perfect transformability

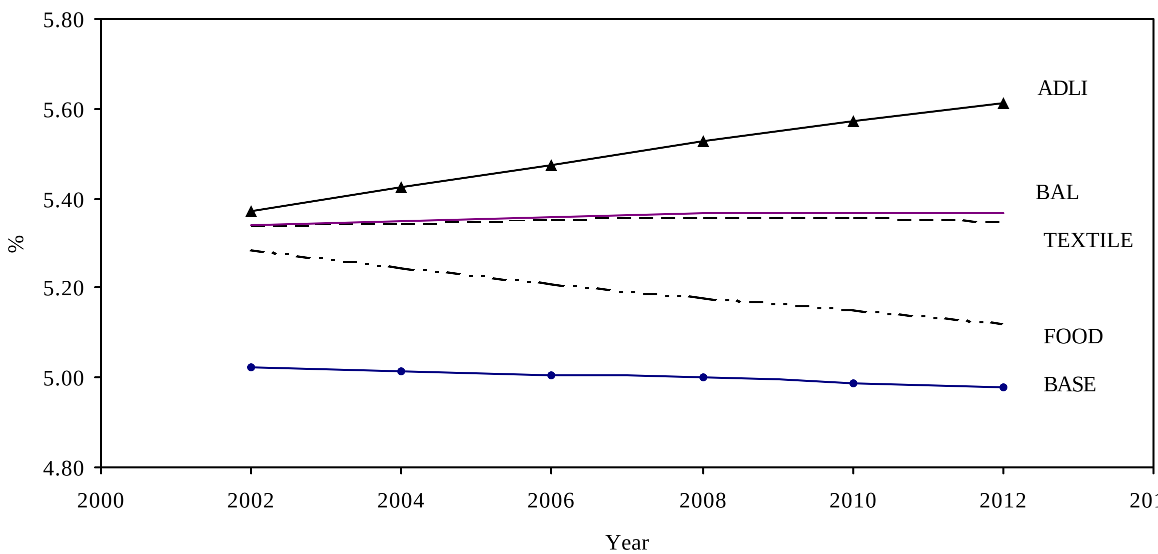


Figure 7 Theil entropy measure of income inequality; case of perfect transformability (2000 = 100)

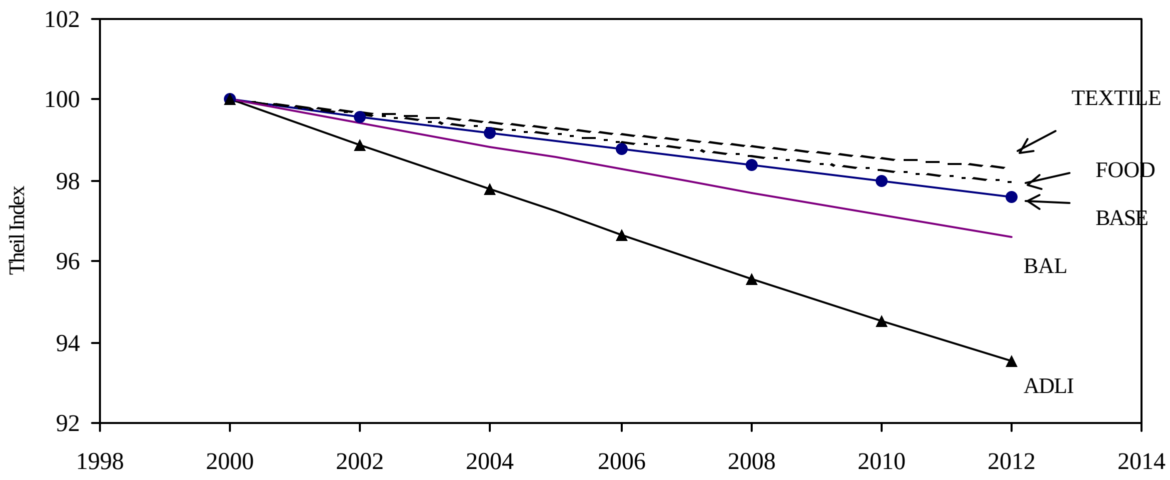
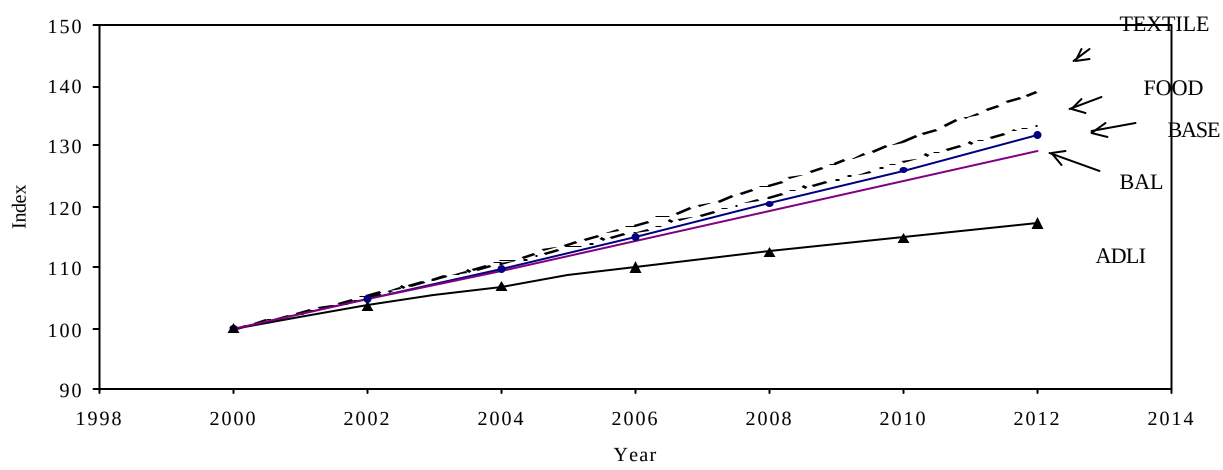


Figure 8 Agricultural terms of trade; case of perfect transformability (2000 = 100)



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