Taxation and Economic Efficiency in Armenia

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Abstract

While the Armenian economy has been growing vigorously during the past three years, tax collections have failed to keep pace with gross domestic product. In this paper we introduce an analytic framework within which it is possible to evaluate factors influencing the efficiency cost of raising revenue from different tax bases. In the absence of a consistent set of economic accounts for Armenia, our general equilibrium model is calibrated to a variety of data sources which describe the economy in 2002. The Armenian economy presents a challenging setting for quantitative analysis of tax policy, as data are limited and the tax system is riddled with vexing sources of inefficiency. Given Armenia's relatively high rate of tax evasion and large informal economy, proportional increases of existing tax rates may be expensive. Tariffs and taxes on capital can raise revenue in the short run but these taxes are costly in the long run due to their distortion of incentives for investment. Value-added and income taxes can be costly sources of additional revenue due to their impact on the level of informality. Excise taxes are efficient but offer limited revenue potential. In the long-run, better enforcement of existing tax laws is essential.

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Contents

1 Introduction

While Armenian economic growth has been robust for the past few years, tax revenue collections have fallen short of expectations. Tax revenue as a fraction of GDP has fallen steadily, particularly through reductions in the collection of direct taxes. In total, tax revenues have fallen by more than 2.5% of GDP, with 1% due to reductions in personal income tax collections and 1.25% due to reductions in receipts from the profits tax.

While early stages in transition and development may be lead by the private sector, sustained development and reductions in poverty require public sector resources. Health, education and public infrastructure are all essential for sustainable development, and the provision of these goods and services demands an efficient and reliable tax system. Our analysis of tax policy options in Armenia is motivated by the ongoing need for public sector participation in the development process.

There are several recent studies of the Armenian tax system which have evaluated the prospects for tax reform from legal and structural viewpoints.[1] The present paper reports results from a computable general equilibrium (CGE) model which has been formulated to explore, from a quantitative perspective, the economic consequences of different types of tax reforms in Armenia. We use the model to consider the marginal cost of funds from direct and indirect tax instruments, and we also present a set of scenarios for increasing tax revenue by between one half and two percent of GDP.

Data discrepancies and omissions makes Armenian tax-policy analysis difficult. There presently does not exist a "post-Soviet" input-output table or any comprehensive source of economic data for Armenia. In the absence of a consistent and complete set of national economic statistics, our model is based on information from a variety of sources. Sectoral value-added, aggregate output shares, trade statistics and components of final demand are based on data from the Armenian National Statistics Service (NSS). Input-output coefficients in our model are based on a recent input-output tables from 1997 for Hungary and Poland. We use two alternative sources of these coefficients in order to evaluate the robustness of our results with respect to these inputs. Surprisingly, we find that our results are not overly-sensitive to the choice of surrogate production technology. The results are much more sensitive to benchmark tax rates and the elasticities of substitution which characterize tradeoffs between formal and informal goods and services.

Despite the data limitations inherent in this study, we still believe that policy decisions can be better informed by a roughly parameterized model than on the uncalibrated logic of economic theory. For example, the model can be used to assess how collections in tax revenue from one tax instrument are affected by changes in other tax rates. These types of assessments are particularly important in view of the high and growing level of informal activity.

[1] These studies include the "Tax White Paper", a survey on business opinions produced by the Armenian Chamber of Commerce, 2004, and the IMF Aide Memoire (2004)

With some effort on the part of statistical authorities, the input data for our model can be substantially improved, hence we regard the present set of results as preliminary. Despite this disclaimer, we believe that the general lessons which the model provides are informative and relevant. The standard "first-best" rules for taxation (low rates, broad base) which apply in many competitive economies, may be inappropriate in second best setting. Armenia clearly represents a second best economic environment, as is evidenced by the low collection rates of its principal taxes. Revenues from income and profits taxes are reduced by under-reporting of both labor and capital income.[2] VAT revenues appear to have a somewhat higher rate of compliance, but as of 2002, the relative efficiency of VAT collections is about half that of developed countries.

The Armenian NSS includes an estimate of *informal economic activity* as part of the officially tabulated GDP. According to this estimate, one third of the $2.9 billion Armenian GDP is produced within the informal sector. Labor and capital income from this sector are omitted from the tax base, and tax collections based on payments within the informal sector are low. Additionally, factor earnings from informal firms can more-easily evade VAT and profits taxes, or a portion of them.

Several international teams, including the IMF, USAID, and the World Bank, have assessed the Armenian tax system and made recommendations for tax reform. Although the foci of these analyses all differ, there are some common themes that arise in these studies:

- The tax revenues in Armenia are low relative to developed countries, and they are low even compared to most CIS countries. The IMF Fiscal Affairs Department (FAD) reports (2004) tax income to be 17.7% of GDP. Mostly alarming is the precipitous fall in tax collections between 1999 and 2003, during which time revenues fell from 20% to 17.2% of GDP over four years. Most of this decline resulted from rates of collection for income and profits taxes.

- Official tax policy in Armenia has conformed to IMF recommendations. The VAT has only two rates (20% and 0%), personal income taxes only have three rates (0%, 10% and 20%), and where import tariffs exist, the rate is a uniform 10%.

- Tax collection and administration are reported to be weakly enforced. Despite a clear and simple tax code, collections are low. This could imply either weak administration, some forms of corruption, or both.

- The tax system is perceived to be unfair. Residents in Yerevan do not believe that tax revenues are used for public goods and services. Small taxpayers believe that the rich individuals do not pay their share, while wealthy taxpayers complain that tax auditors are unpredictable and punitive.[3]

[2] Four of the largest firms in the country reported losses for two straight years, despite GDP growth of 15%.

[3] See the "Tax White Paper" a survey on business opinions produced by the Armenian Chamber of Commerce in 2004.

As is apparent from cursory study, the issues which surround tax policy in Armenia are wide ranging. Our analysis of these issues, however, focuses solely on economic welfare and the aggregate burden of tax collection. We implement a computable equilibrium model with which to assess the factors which determine how tax revenues respond to changes in tax rates.[4] The study is macroeconomic in nature and does not consider individual firms, organizations, or any legal interpretation of the tax code. Our model is based on a dual economy in which there coexist both formal and informal firms and markets. Firms operating in both the formal and informal sectors are assumed to maximize profits. Prices of goods and factors adjust so that supply equals demand in all markets.

Informal activity in our model is calibrated to information regarding the level of informality in different sectors. In our central cases we adjust sectoral shares of informal activity to target the NSS estimate that 30% of the aggregate Armenian economy is represented by informal activities. Informal production in the model are able to evade profits, wage and value-added taxes.

Our analysis demonstrates that rising levels of evasion produce a corresponding increase in the marginal cost of public funds. This implies that the cost-benefit test for public-funding health, education and infrastructure investments becomes increasingly more stringent as informality increases. In the present economy, an additional dollar of public expenditure costs the between \$1.30 and \$1.60. When we account for the long-run response of investment and capital stock to the perverse incentives introduced by the informal sector and the tax system, the marginal cost of funds might easily introduce a 100% premium on public expenditure. In view of the crucial role in economic development played by public expenditures and investments, there are potential dire consequences for the long-term health of the Armenian economy if the trend toward increasing levels of informal activity cannot be reversed.

Faced with the high efficiency costs of raising revenue, there are limited possibilities for raising significant revenue from any of the tax bases. In the short term, efficiency costs are smaller because capital is fixed and unable to escape, yet raising tax revenue remains costly due to the ability of firms and consumers to substitute untaxed, informal products for formal goods which are subject to tax.

In the long-term model, we find that tax policy has costly impacts on capital accumulation and economic growth. The existing profits, income and value-added taxes all tend to discriminate against investment in formal sectors, and the long-run perspective underscores the need for avoiding further discouragement of investment in these areas.

We find that the long-run efficiency cost of taxes on agricultural products is low because of existing profits and income taxes tend to discriminate against formal activities in manufacturing and industry. These taxes lead to under-investment in industry, an effect which is partially offset

[4] We do not deal with the distributional consequences of tax reform in the present analysis, although the extension of the present analysis to account for the impact of taxes on poverty would be quite interesting and surely important.

by a tax on agricultural income. As has been pointed out elsewhere, taxes on agricultural activity face administrative difficulties because most farmers are small-holders. These farmers would be exempt from income and profits taxes in any case, if revenues and income are low.

The marginal cost of public funds from any of the direct and indirect tax instruments are increased when a substantial fraction of the tax base is able to avoid payments, or when individuals are more willing to substitute informal goods and services for formal goods and services. These results provide strong support for tax policies which underscore the need to reduce tax evasion and informal activities organized primarily as a means of evading tax payments.

The remainder of this document is organized as follows. Section 2 presents the model formulation. Section 3 presents some stylized facts regarding the economic structure of Armenia as represented in our dataset. Section 4 compares the relative efficiency among each tax stream, and goes on to consider some tax proposals presented by the IMF in 2004. Section 5 offers a detailed review of how the results are impacted by using an alternative source of surrogate data for production technology. Section 6 concludes.

2 A General Equilibrium Model for Armenia

Our model represents Armenia as a small open economy with two types of economic activity: *formal activities*, which are subject to tax, and *informal activities* which are untaxed. The model portrays an Arrow-Debreu economy with constant returns-to-scale and perfect competition across all modes of production. As a small open economy, Armenia faces fixed relative prices for imports and exports. Producers maximize profits taking prices as given, and consumers maximize utility subject to a budget constraint that depends upon the value of their endowments, transfers from the government, and remittances from abroad. These assumptions imply that no producer earns above-normal profits and that consumers cannot increase consumption of all goods simultaneously. These are the basic economic concepts of economic scarcity and competition.

Following Mathiesen (1985), we formulate and solve the model as a complementarity problem with three types of equilibrium conditions: market clearance, zero profit, and income balance. Production technology and consumer preferences are characterized using the nested, constant-elasticity of substitution (CES) functional form. The model accommodates analysis of both the static and steady-state welfare effects through alternative representations of the capital stock.

The numerical equations are based on data derived from the 2002 Armenian national accounts together with reports provided by the International Monetary Fund (IMF), the United States Agency for International Development (USAID), the Global Trade Analysis Project (GTAP), and the World Bank. The present version of the model distinguishes 25 industries, the government, and a single, representative consumer. In each industry, in the reference equilibrium a given share of production is produced "informally"[5].

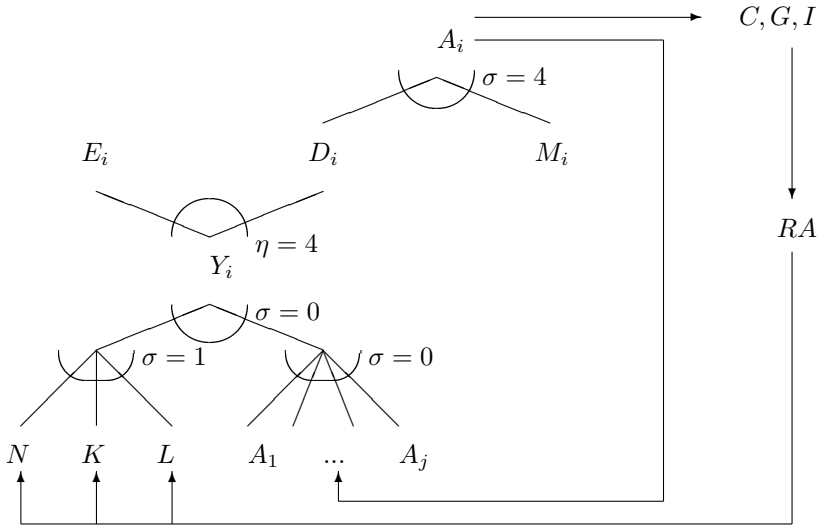
2.1 Economic Flows

The relationship between different sectors and consumers in the model is shown in Figure 1. Various aspects of the economy are depicted here, with the exception of taxes subsequently.

Production in sector i (Y_i) combines four primary factors: capital (K), skilled and unskilled labor (L_S and L_U), land N. Intermediate inputs are added to produce outputs for the domestic (D_i) and export (E_i) markets. An "Armington composite good" (A) is a combination of domestic goods D and imports M. Armington aggregate goods are the basic consumption commodity. They are consumed by industry as an intermediate input and they are also goods for final consumption, C, government consumption G, and or investment I. Consumers are endowed with factors of producton (L_S, L_U, K, N), which are sold to industry (Y). They are also the final consumers, who

[5]Our definition of the "informal market" in this analysis includes those economic activities that do not pay taxes. Part of this group are small farmers and businesses that do not have the capacity to calculate and pay their taxes; another part are those individuals or corporate entities who are explicitly evading government taxes by not reporting their activities. The latter represents illegal economic activities that do not generate taxable transactions.

Figure 1: Armenian production structure for formal and informal activities



Description of Flows

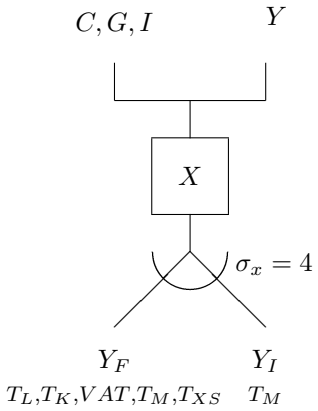
Symbol	Description
Y	Goods Production
D	Production sent to the Domestic market
A	Armington aggregate good – this activity combines domestic production with imports to produce an *Armington aggregate good* for intermediate use or final demand.
E	Production which is Exported
M	Imports
L	Labor inputs – labor is either skilled or unskilled
K	Capital input
N	Land Inputs
I	Fixed Investment demand. Combines goods from A to produce an investment good.
G	Government demand. Tax revenues purchase goods from A to produce the *government good*.
C	Final consumption demand. Final demand by households. Households sell labor and capital endowments to pay for final consumption.

N.B. *Imports for re-export* in the mineral products and precious stones sector have been omitted from this diagram.

use income from factor sales to purchase Armington goods (C via A), to invest (I), or to create government services (G).

For sectors, Y_i, appear in Figure 1 there are two associated activities: formal production (Y_i^F) and informal production (Y_i^I). The formal sector is subject to various taxes (VAT, profits, payroll and income taxes), while the informal sector pays only those taxes collected at the border (import tariffs). These activities produce goods that are consumed in final and intermediate demand. A schematic for the formal/informal consumption activity is presented in Figure 2.

Figure 2: Demand for Formal and Informal Goods



Key: Formally-produced goods are subject to all official taxes, while informally-produced goods prices incorporate only import tariffs. Goods from each type of production are imperfect substitutes in final and intermediate demand. Final demand and intermediate demand within each sector has a different share of informally-produced goods.

2.2 Algebraic Formulation

Our model is based on constant elasticity of substitution (CES) functions. CES functions are widely applied because they are globally regular, and can be defined by their zeroth, first, and second order properties. This means that the location (price and quantity), slope (marginal rate of substitution), and curvature (or convexity) completely characterize a CES production or consumption function. This permits a simplified representation of production technology and consumer preferences.

Using this general approach, the supply side of the Armenian model is as shown in Figure 1. We use σ to denote the elasticity of substitution for production inputs and η is the elasticity of transformation for outputs[6]. In the model, any choice for σ and η in each sector can be applied in order to reflect local expertise related to particular sectors.

[6]The values for σ and η in the central scenarios are shown in Figure 1

2.2.1 Production Functions

Production Inputs Goods are produced according to a nested Leontief-Cobb Douglas technology. Intermediate inputs and aggregate value-added enter at the top level:

$$Y_i = \min\left[\min_j\left(\frac{x_{ji}}{a_{ji}}\right), \frac{v_i}{b_i}, \frac{m_i^Y}{a_i^M}\right]$$

In this expression, x_{ji} represents intermediate inputs of good j from the domestic market and m_i^Y represents specialized imports for re-export in sector i.[7]

Value-added represents a Cobb-Douglas aggregation of unskilled labor (L_U), skilled labor (L_S) capital (K) and land (N):[8]

$$v_i = L_{Ui}^{\alpha_U} L_{Si}^{\alpha_S} K_i^{\beta} N_i^{\gamma}$$

in which constant returns to scale implies that $\alpha_F + \alpha_I + \beta + \gamma = 1$.

Production Outputs Each production sector Y produces two types of commodities: domestic goods D_i and goods for export E_i. These goods are assumed to be imperfect substitutes, and they have a constant elasticity of transformation. An algebraic formulation of this transformation function is written:

$$Y_i = g(D_i, E_i) = \left[\alpha_i^D D_i^{1+1/\eta} + (1-\alpha_i^D) E_i^{1+1/\eta}\right]^{1/(1+1/\eta)} \tag{1}$$

where α_i^D is the benchmark value share of domestic sales in total output for sector i and η corresponds to the model input `etrndx`.

Imports The model adopts an Armington representation of the import demand. Armington goods, A_i, are produced by combining domestic goods with imports from the same sector. These goods are treated as imperfect substitutes (e.g., autos from Russia versus autos from Japan), with an Armington elasticity, σ_{DM}, describing the degree to which these substitute in intermediate and final demand:

$$A_i = \left(\alpha_i^M M_i^{1-1/\sigma_{DM}} + (1-\alpha_i^M) D_i^{1-1/\sigma_{DM}}\right)^{1/(1-1/\sigma_{DM})}$$

Some confusion can arise trying to distinguish between production, Y_i, output (D_i,E_i) and the consumption good (A_i). The Armington aggregate good, A_i combines domestic output, D_i with imports, M_i. A_i is the good used as an intermediate input and also for final demand.

[7] The greatest sectoral imports in the base year data are for sector MNM (mineral products and precious stones), in which total imports equal $230 million. The MNM sector also generates the largest level of exports, equal to $269 million. We characterize imports in this sector as specialized intermediate inputs to the production sector through technology parameter a_i^M rather than as part of final demand. For all other sectors $a_i^M = 0$.

[8] The numerical model permits the more general CES functional form for valued-added based on model input `esubkl`. When this input is unity, value-added aggregates are Cobb-Douglas as shown here.

Trade Balance The shadow value of foreign exchange, ρ, adjusts to clear the market for foreign exchange, a good which is "produced" with exports and consumed by imports:

$$\sum_i \overline{p}_i^E E_i + B = \sum_i \overline{p}_i^M \left(M_i + a_i^M Y_i\right)$$

Holding all else equal, rising import demand will increase ρ, which reflects increased demand for external currency. The exogenous parameter B denotes a current account balance. Because this is a small-open economy, import and export prices $(\overline{p}_i^E, \overline{p}_i^M)$ are fixed exogenously.

2.2.2 Consumption, Investment and Government

Final Consumption A single representative agent (RA) is endowed with primary factors of production: capital, labor, and resources. The RA demands final goods for consumption. Investment and government output also demand final goods, but the level is exogenously specified, while private demand is endogenously-determined by utility maximizing behavior. The RA utility function is Cobb-Douglass as shown below:

$$U(A_i) = \prod_i A_i^{\alpha_i} \qquad \sum_i \alpha_i = 1$$

The RA maximizes utility subject to a budget constraint:

$$\max_{A_i} U(A_i)$$

s.t.

$$\textstyle\sum_i p_i A_i \leq p_K K + p_L L + p_N N + trn - I + B$$

In this problem, the RA maximizes the utility function subject to a budget constraint. The Armenian budget constraint is equal to the total value of factor endowments (K, L, N), plus any transfers from the government, minus the cost of investment, plus the net current-account balance. The current account balance for Armenia reflects sizeable cash remittances from abroad, amounting to US$175 million, a substantial sum in comparison with US$683 in goods and services exports.

Investment In the static formulation, investment demand is held constant at base-year levels. Investments are aggregated into a single, national investment pool, then distributed among production and government sectors according to base-year accounts. Investment funds come from households and government. The level of investment can be altered in the steady-state formulation, as is discussed in section 2.2.3.

Government Government purchases of goods and services are supported with tax revenue, capital earnings, and net foreign exchange transfers. The model tax system and total tax revenues are described below in section 2.4.

2.2.3 Steady-State Capital

A major drawback of tax policy analysis in a static model is that the capital stock is fixed and unresponsive to tax-induced changes in the net rate of return. Logically, the level of investment depends upon depreciation, interest rates and the rate of return to capital capital stock. Static CGE models fail to address the changes to investment and capital stock associated with changes in the tax code. We address these issues by including a *steady-state* model formulation. The steady-state model allows capital and investment to change in response to tax policy in a way which is consistent with a long-run analysis. The long-run equilibrium condition links the cost of capital with the return to capital:

$$p_{inv} = r_K$$

This equilibrium condition in the steady-state model is associated with an equilibrating variable, κ, which represents the level of the capital-stock. When the return to capital rises relative to the price of investment, κ increases to scale up investment and reflect this arbitrage condition. Thus, in the steady-state equilibrium, κ adjusts investment so that the cost of capital is consistent with the return to capital. This condition is equivalent to assuming "Tobin's q" is calibrated to unity in the reference equilibrium and returns to that value in the long-run.

2.3 Informal Market Activities

We treat *informal* products as close but imperfect substitutes for formal goods. Consumers and firms thus distinguish between formal and informal products, and choose between these goods on the basis of relative prices. Figure 2 (above) shows how formally and in-formally produced goods are combined to produce a good "X" that is consumed across all types of demand: final demand by consumers, investment, the government, and intermediate demand by firms. σ_x denotes the elasticity of substitution between each good type. In an economy where underground goods or services are qualitatively similar to formal products, or where informal activities are commonplace, there would be a high value of σ_x. As will be shown below, as the value of σ_x increases, so too does the cost of public funds.

2.4 Tax Structure

Production inputs are subject to five major types of taxes. Final consumption is taxed at rated vat_i. Labor income in the formal economy is taxed at rate t_F, and social security taxes are also imposed as a tax on labor income in the formal economy, applied at rate t_{pyrl}. The total tax rate on labor in the formal sector is then $t_L = t_F + t_{pyrl}$.

Capital earnings in the formal economy are taxed at rate t_K, imports pay tariffs at rate t_m, and land rents are taxed like capital returns, where a national rate for profits taxes is applied.

Differences in VAT, import, or formal/informal tax rates across sectors leads to efficiency costs which are captured in the model.

An important segment of the tributary system is the invoice-rebate feature available for the VAT. Under this system, value-added taxes paid for intermediate inputs can be reclaimed by the firm. In theory, the rebate eliminates the tax-distortion between intermediate inputs. This distinction is less clear in practice, because the paperwork required for collection is complicated and repayments are unpredictable. According to a 2004 survey of Armenian companies, both of these difficulties exist.

The tax-inclusive cost of production for formally-produced goods is then.

$$C_i = \sum_j p_j x_{ji} + p_L(1+t_L)L + (1+t_K)(rkK_i + r_i N_i) + \rho \bar{p}_i^M a_i^m$$

Tax-inclusive revenue value for Y is denoted as R_i:

$$R_i = p_i^D D_i + \rho \bar{p}_i^X X_i$$

In equilibrium, the tax-inclusive cost of production equals output value across all sectors ($R_i = C_i$), this represents the zero-profit equilibrium condition.

Import tariffs and value added taxes are included into the Armington commodity's unit cost function for formally-produced goods:

$$p_i = (1+vat_i)\left[\alpha_i^M \left(\frac{p_i^M(1+t_i^M)}{\bar{p_i}^M}\right)^{1-\sigma} + \left(\frac{p_i^D}{\bar{p_i}^D}\right)^{1-\sigma}\right]^{1/(1-\sigma)}$$

The benchmark tax rate applied on formal labor inputs (t_L) is based on direct tax payment by households in the SAM and gross payments to formal labor. The benchmark tax rate applied to private capital (t_K) is based on the direct tax payments by private firms and the gross payments to capital in all non-government sectors.

There is perfect arbitrage in factor markets, so there is a wedge between the marginal product of labor, capital and land in the formal and informal economies. One important aspect of the efficiency cost of taxation therefore corresponds to this difference in productivity. Any policy which leads to an increase in informal activity therefore exacerbates this inefficiency.

3 Armenia's economic structure

Our base-year statistics come from a variety of sources. We target the model to match official figures provided by the Armenian National Statistical Service (NSS). Although our figures do not match NSS figures to the exact Dram or Dollar, our benchmark represents more internally consistent accounting framework than is provided by the NSS. By combining information from disparate (official) sources, and by adjusting the data to match up with the equilibrium conditions, we have been able to uncover several inconsistencies in the Armenian national accounts.

The Armenian gross domestic product in 2002 was 1.36 trillion Armenian Drams. This is equal to US$2.3 billion at a market exchange rate of 573 dram per dollar. According to the CIA's "World Factbook" for 2003, Armenia's GDP in 2002 was US$12.13 billion a purchasing power parity basis. The official population, according to a 2001 Armenian census, is 3.0 million, so that annual GDP per-capita in 2002 was US$766 at market exchange rates.

Our model represents the economy through 25 sectors of production, trade, and consumption. The sectoral aggregation was tailored to highlight the most important industries and goods in the country (subject to the availability of data). Input-output coeffients for the model are drawn from the 1997 input-output table for Hungary which is part of the GTAP5.4 database (Hertel, 1997).[9] Table 1 describes the sectors which are in our model, and Table 2 ranks these sectors by output.[10]

Since 1997, Armenia has enjoyed strong economic growth, and over the period 2000-2003, the economy grew at an annual rate of 12%, inflation has remained low. Most small- and medium-sized enterprises are privatized, and the antiquated energy system inherited from the Soviet era has been modernized. The country's nuclear power station, Metsamor, produces sufficient electricity that Armenia is now a net electricity exporter. Armenia still depends upon imported oil and natural gas, all of which comes from Iran as a result of the conflict with the energy-rich neighboring state of Azerbaijan. Armenia maintains a large trade deficit which has been offset by remittances, international aid, and, to a lesser extent, foreign direct investment. Economic ties with Russia remain close, especially in the energy sector.

In 2002, the single largest industry was construction. Growth in this sector was driven mostly by charitable donations from American-Armenian diaspora such as the Lyndsey foundation. Food and agriculture represent almost 45% of the country's output. The remaining industry reflects the country's legacy from the Soviet era when metal-cutting machine tools, forging machines, electric motors, instruments, tires, and chemicals, gem cutting, and brandy-making were the major tradeable goods. Most heavy-industries have declined precipitously since 1990. Some of these activities have been replaced by high-technology manufacturing and software services. These sectors are still small, however, and they must compete on a global market for business and information-technology

[9] The Global Trade and Analysis Project (GTAP) develops a consistent and balanced trade database that includes 57 production sectors and 55 regions. For more information about the GTAP database, see `http://www.gtap.org`

[10] A more detailed description of the sectoral classification is included in Appendix A.

Table 1: Economic Sectors in the Armenian Model

Code	Description	Y_0 (million US$)
	Agriculture	
GRN	Wheat, potatoes, legumes	170.7
VFR	Vegetables, fruits, grapes	209.3
VOL	Vegetable oils and fats	1.4
MIL	Diary products	279.2
OMT	beef, pork, poultry	110.9
OCR	Other crops	140.1
	Industry	
ENR	Energy: Oil and Natural Gas	0
MIN	Mining and Quarrying	95.0
FOD	Food processing & beverages	381.0
TBC	Tobacco products	33.1
LMF	Light manufacturing and textiles	65.7
MTL	Metals and metal products	121.2
CRP	Chemicals rubbers and plastics	105.2
MNM	Mineral products and precious stones	311.7
MCH	Equipment, motor vehicles and optical	119.9
OMF	Other manufacturing	77.6
UTL	Electricity gas and water supply	146.5
	Services and Other	
CON	Construction	519.8
TRD	Retail & wholesale trade, catering	434.8
GOV	Governance, Defense, and public expnd	364.8
TRN	Transport and communication	248.9
OSR	Other services	221.2
DWE	Housing and dwellings	91.6
BNK	Banking lending and insurance	87.0

Source: Totals from National Statistical Service. Individual sectors: author's calculations. See appendix for data details.

Y_0 Base year (2001) sectoral output (millions of dollars).

Table 2: Base year production and trade statistics by sector for Armenia in 2002 (US$ million)

		Y0	VA	D0	E0	M0
CON	Construction	519.8	297.4	513.6	6.2	2.9
TRD	Retail & wholesale trade, catering	434.8	264.8	434.8		
FOD	Food processing & beverages	381.0	156.9	329.8	51.2	44.0
GOV	Governance, Defense, and public expnd	364.8	208.8	285.8	79.0	68.5
MNM	Mineral products and precious stones	311.7	40.4	52.5	259.2	212.3
MIL	Diary products	279.2	169.9	278.7	0.5	6.6
TRN	Transport and communication	248.9	140.3	166.9	82.0	141.1
OSR	Other services	221.2	213.6	211.3	9.9	0.8
VFR	Vegetables, fruits, grapes	209.3	127.6	203.7	5.6	24.0
GRN	Wheat, potatoes, legumes	170.7	104.1	170.4	0.3	50.8
UTL	Electricity gas and water supply	146.5	101.1	140.8	5.7	13.4
OCR	Other crops	140.1	85.4	135.1	5.0	19.5
MTL	Metals and metal products	121.2	59.8	76.4	44.8	55.7
MCH	Equipment, motor vehicles and optical	119.9	46.3	63.6	56.3	160.3
OMT	beef, pork, poultry	110.9	65.5	110.8	0.1	21.4
CRP	Chemicals rubbers and plastics	105.3	90.5	96.9	8.4	84.6
MIN	Mining and Quarrying	95.0	37.4	52.9	42.1	22.9
DWE	Housing and dwellings	91.6		91.6		
BNK	Banking lending and insurance	87.0	71.8	80.3	6.7	11.3
OMF	Other manufacturing	77.6	49.4	72.5	5.1	47.8
LMF	Light manufacturing and textiles	65.7	22.6	36.1	29.6	40.7
TBC	Tobacco products	33.1	12.7	29.5	3.6	28.6
VOL	Vegetable oils and fats	1.4	0.9	1.4	0.0	16.8
ENR	Oil & natural gas					151.4
	Total	4336.6	2367.0	3635.3	701.3	1225.4

Source: Author's calculations based upon total supply provided by the National Statistical Service of Armenia (2002).

Key:

Y0	Base year output
VA	Base year value-added
D0	Base year supply to domestic market
E0	Base year exports (fob)
M0	Base year imports (cif, net tariff)

services.

International trade statistics are presented in Tables 3 and 4. Armenia's open trade policy has been hampered by the closure of its borders with Turkey and Azerbaijan. All trade is shipped from the north through Georgia or from the south via Iran. Personal-imports of goods comprise an unknown but potentially significant portion of total imports.

In value terms, the largest import and export is jewlery, gems and cut stones (model sector MNM). The gem-cutting industry imports stones, adds value and re-exports the gems at a higher price. The key import sectors for final consumption are oil and gasoline, food and food products, and manufactures such as automobiles, machinery and computers.

Armenian exports are limited to processed gems and jewelery, precision instruments, tourism and related transportation, and some gold, precious stones and minerals. [11]

[11] While there exists a perception among Armenians that software is a major export industry, this claim is not supported by data from the National Statistics Service. NSS reports that computer-related services account for less than 1% of GDP. The statistic is believed to be low because most multinational corporations that purchase IT services in Armenia account for the business as a cost-center for the corporation. Lycos is one example. The company hired 60 programmers in 2004 at an average monthly salary of US$600. According to informal sources, computer and information service exports were US$9.9 million in 2002. We have not yet been able to introduce this sector in our database and model for lack of official statistics.

Table 3: Benchmark import statistics for Armenia in 2002 (US$ millions)

		M0	M0%	%-M	%VA
MNM	Mineral products and precious stones	212.3	17.3	79.8	13.0
MCH	Equipment, motor vehicles and optical	160.3	13.1	70.5	38.6
ENR	Oil & natural gas	151.4	12.4	100.0	
TRN	Transport and communication	141.1	11.5	45.8	56.4
CRP	Chemicals rubbers and plastics	84.6	6.9	46.5	86.0
GOV	Governance, Defense, and public expnd	68.5	5.6	19.3	57.2
MTL	Metals and metal products	55.7	4.5	42.2	49.4
GRN	Wheat, potatoes, legumes	50.8	4.1	23.0	61.0
OMF	Other manufacturing	47.8	3.9	39.5	63.7
FOD	Food processing & beverages	44.0	3.6	11.7	41.2
LMF	Light manufacturing and textiles	40.7	3.3	52.1	34.4
TBC	Tobacco products	28.6	2.3	48.0	38.3
VFR	Vegetables, fruits, grapes	24.0	2.0	10.6	61.0
MIN	Mining and Quarrying	22.9	1.9	30.2	39.3
OMT	Beef, pork, poultry	21.4	1.7	16.0	59.1
OCR	Other crops	19.5	1.6	12.6	61.0
VOL	Vegetable oils and fats	16.8	1.4	84.8	61.0
UTL	Electricity gas and water supply	13.4	1.1	8.7	69.0
BNK	Banking lending and insurance	11.3	0.9	12.4	82.5
MIL	Diary products	6.6	0.5	2.3	60.9
CON	Construction	2.9	0.2	0.6	57.2
OSR	Other services	0.8	0.1	0.4	96.6
TRD	Retail & wholesale trade, catering				60.9
TOTAL		1225.4	100.0		

Source: Aggregate values supplied by Armenian customs. Sectoral disaggregations are author's calculations based upon shares from the Armenian NSS.

Key:

M0	Base year imports
M0 %	Base year imports as % of total imports
%-M	Base year imports as % of domestic sales
% VA	Base year imports as a percent of sectoral value-added

Table 4: Export statistics for Armenia in 2002 (US$ millions)

		x0	x0(%)	%-x	%va
MNM	Mineral products and precious stones	259.2	37.0	83.2	13.0
TRN	Transport and communication	82.0	11.7	32.9	56.4
GOV	Governance, Defense, and public expnd	79.0	11.3	21.7	57.2
MCH	Equipment, motor vehicles and optical	56.3	8.0	47.0	38.6
FOD	Food processing & beverages	51.2	7.3	13.4	41.2
MTL	Metals and metal products	44.8	6.4	37.0	49.4
MIN	Mining and Quarrying	42.1	6.0	44.3	39.3
LMF	Light manufacturing and textiles	29.6	4.2	45.1	34.4
OSR	Other services	9.9	1.4	4.5	96.6
CRP	Chemicals rubbers and plastics	8.4	1.2	7.9	86.0
BNK	Banking lending and insurance	6.7	1.0	7.7	82.5
CON	Construction	6.2	0.9	1.2	57.2
UTL	Electricity gas and water supply	5.7	0.8	3.9	69.0
VFR	Vegetables, fruits, grapes	5.6	0.8	2.7	61.0
OMF	Other manufacturing	5.1	0.7	6.6	63.7
OCR	Other crops	5.0	0.7	3.6	61.0
TBC	Tobacco products	3.6	0.5	10.9	38.3
MIL	Diary products	0.5	0.1	0.2	60.9
GRN	Wheat, potatoes, legumes	0.3	0.0	0.2	61.0
OMT	Beef, pork, poultry	0.1	0.0	0.1	59.1
VOL	Vegetable oils and fats	0.0	0.0	0.0	61.0
TRD	Retail & wholesale trade, catering				60.9
TOTAL		701.3	1.0		

Source: National Statistical Service (2002) (reconciled by authors)

Key:

x0	Base year exports
x0 (%)	Base year exports as % of total exports
%-x	Base year exports as % of domestic production
% va	Base year exports (fob) as percentage of sectoral value-added

Table 5: Sectoral Value-Adde Ranked by Labor Intensity

		VA	LAB	LND	SKL	CAP
MIN	Mining and Quarrying	37.4	72.2		9.4	18.4
LMF	Light manufacturing and textiles	22.6	60.1		8.7	31.2
OMT	Beef, pork, poultry	65.5	53.7	33.9	0.7	11.6
OCR	Other crops	85.4	52.7	23.4	1.8	22.1
MTL	Metals and metal products	59.8	52.6		8.6	38.8
GRN	Wheat, potatoes, legumes	104.1	52.3	35.0	0.7	12.0
VFR	Vegetables, fruits, grapes	127.6	52.2	35.0	0.8	11.9
FOD	Food processing & beverages	156.9	51.2		9.4	39.4
MIL	Diary products	169.9	48.0	13.4	3.3	35.3
OMF	Other manufacturing	49.4	46.0		6.9	47.0
MNM	Mineral products and precious stones	40.4	42.8		6.7	50.4
TRD	Retail & wholesale trade, catering	264.8	42.5		7.0	50.5
VOL	Vegetable oils and fats	0.9	40.6	18.3	2.8	38.3
TBC	Tobacco products	12.7	40.0		5.6	54.4
CON	Construction	297.4	37.0		5.7	57.3
UTL	Electricity gas and water supply	101.1	34.4		14.3	51.3
MCH	Equipment, motor vehicles and optical	46.3	32.6		8.6	58.8
CRP	Chemicals rubbers and plastics	90.5	32.1		8.2	59.6
TRN	Transport and communication	140.3	30.2		9.6	60.2
GOV	Governance, Defense, and public expnd	208.8	25.0		39.8	35.1
BNK	Banking lending and insurance	71.8	22.0		19.5	58.5
OSR	Other services	213.6	12.4		11.0	76.6
TOTAL		2,367.0				

Source: Base shares from GTAP database. Some sectors were adjusted to reflect Armenia country-office staff calculations.

Key:

VA	Sectoral value-added at factor cost
LAB	Unskilled labor share of sectoral value-added (%)
LND	Land share of sectoral value-added (%)
SKL	Skilled labor share of sectoral value-added (%)
CAP	Capital share of sectoral value-added (%)

3.1 The informal economy

A portion of the officially reported economic statistics in Armenia comes from a survey of the informal economy. This portion of economic activity is not reported to the government, but represents a certain amount of economic production and consumption. Traditionally, informal economic activity was confined to small-plot farming, marketing, domestic services and street markets. The National Statistics Service estimates that in 1999 the informal economy represented 26% of total economic activity. The estimate for 2002 is said to have risen to 30%, but the official statistics are not yet available.

In order to identify the nature and size of these activities, the statistics office conducts a survey of 9,000 individuals. The questions they ask, and how they tabulate the value of informal output is not provided. Table 6 shows the share of informal activity and employment as estimated by the NSS for 1999. We use these data to calibrate levels of informal activity at the sectoral level, contingent on the assumed informal share of aggregate GDP.

Table 6: Estimated Level of Underground and Informal Activity

	Percentage	Corresponding Sectors in Model
Industry	28.7	min,fod,tbc,lmf, crp,mnm,mtl,mch,omf
Construction	46.1	con
Transport and communication	21.1	trn
Trade	75.5	trd
Agriculture	21.0	grn,v_f,vol,ocr,mil,omt
Other branches	27.1	enr,utl,bnk,gov,osr,dwe
GDP at market prices	28.9	

Source: National Statistical Service (1999)

We include the estimates from Table 6 in our model to identify the portion of production in each sectors which escapes taxation. This portion of the economy is legally obligated to taxes, but does not. Presumptive and simplified taxes have been introduced in part to capture economic activity from the informal market, the collections from these tax instruments are low and we have therefore omitted these taxes from the database and model.

3.2 Tax revenue

Total government tax revenues in 2001 were 242.3 billion Drams (US$422.8 million). Value added taxes were the largest revenue source, contributing 39.2% of total tax revenues (US$165.8 million). Excise taxes were 14.6% of total taxes, and payroll contributions to social security totaled 15.7% of revenue. These tax bases are followed distantly by enterprise taxes, income taxes and other taxes.

Table 7 shows tax collections for the major levies in Armenia during 2002, and Table 8 further disaggregates these collections by production sector.

Table 7: Armenian Tax Collections in 2002 (by source)

Tax Stream	Billion Dram	Million US$	%
Value Added Tax	95.0	165.8	39.2
Excise Tax	35.3	62.6	14.6
Profits Tax	17.4	30.3	7.2
Personal Income Tax	12.5	21.8	5.2
Payroll Taxes	37.9	66.1	15.7
Import Duties	9.8	17.1	4.0
Main Streams:	207.9	363.3	85.9
Other taxes (omitted from the model)			
Stamp Taxes	14.3	24.9	5.8
Environment and Property	5.4	9.4	3.7
Presumptive Tax	6.4	11.2	2.6
Simplified Tax	3.7	6.5	1.5
Other Streams:	29.8	52.0	13.6
Total:	237.7	415.7	99.5

Source: Table II.1, IMF Aide Memoire (2004)

Armenia's statutory tax code is straightforward. There exists a single VAT rate of 20%, a single tariff rate of 10%, and a single low profit tax (20%). Income taxes are 10% for 80,000 dram per month (US$139), or 20% if income is above 80,000 Dram. Excise rates are higher, but they are only applied to tobacco products, alcoholic beverages and petroleum.

Tax collections are more complicated, but we can review the trend in collections briefly. Profits tax collections have declined precipitously since 1999, as have income tax collections. Collections from profits taxes fell by 50% between 1999 and 2003, from 2.2% of GDP to 1.1%. Similarly, personal income taxes fell from 1.9% to 1.0% over the same period. The combined loss is 2.0% of GDP (US$58 million if considered in 2002). The trend is strange in light of the very strong economic growth over the same period, during which time GDP increased by approximately 30%. No other tax streams have risen to compensate for this loss, and total government revenues have declined as a proportion of GDP.

Table 8: Benchmark tax collections in 2002 by production sector (millions of US$ 2001)

		Y0	VAT	TK	TSS	TXS	TL	TM	TOTAL
ENR	Oil & natural gas	0	53.9			28.1			81.9
FOD	Food processing & beverages	381	17.5	1.6	3	10.0	1.6	3.0	37.1
TBC	Tobacco products	33	6.3	1.2	0	24.0	0.2	1.6	33.7
MCH	Equipment, motor vehicles and optical	120	16.3	0.4	0		0.2	3.5	20.7
OMF	Other manufacturing	78	12.8	2.5	3		1.2	0.9	20.0
GOV	Governance, Defense, and public expnd	365			13		5.8		18.4
TRD	Retail & wholesale trade, catering	435	8.1	1.8	6		2.6		18.2
UTL	Electricity gas and water supply	147	4.6	8.2	2		1.1		16.2
TRN	Transport and communication	249	4.0	3.7	5		2.1		14.4
CRP	Chemicals rubbers and plastics	105	10.9	0.4	0		0.2	0.5	12.3
CON	Construction	520	2.3	2.8	3		1.4		9.5
GRN	Wheat, potatoes, legumes	171	9.5						9.5
OMT	Beef, pork, poultry	111	4.2	2.1	0		0.2	1.9	8.8
LMF	Light manufacturing and textiles	66	4.7	0.5	0		0.2	1.4	7.2
MNM	Mineral products and precious stones	312	4.2	0.7	0		0.2	1.2	6.7
DWE	Housing and dwellings	92		0.5	4		1.9		6.7
MIN	Mining and Quarrying	95	2.5	3.2	0		0.2		6.2
VOL	Vegetable oils and fats	1	3.9					1.8	5.6
MTL	Metals and metal products	121	3.5	0.2	1		0.5		5.4
BNK	Banking lending and insurance	87		0.7	3		1.4		5.2
OCR	Other crops	140	2.1					0.5	2.6
MIL	Diary products	279	1.4	0.2	0		0.2	0.4	2.5
VFR	Vegetables, fruits, grapes	209							
OSR	Other services	221							
Total			172.6	30.5	46	62.1	21.1	16.7	348.8

Source: Official statistics from the Ministry of Finance, provided at the author's request.

Note: Exise taxes (TXS) have been changed. Collections reported in this table (Table 8) were taken from Table II.1, IMF Aide Memoire (2004).

Key:

Y0	Sectoral output
VAT	Value-added tax revenue
TK	Profits tax revenue
TSS	Payroll tax (social security) revenue
TXS	Excise tax revenue
TL	Wage (income) tax revenue
TM	Tariff revenue
TOTAL	Total tax revenues of the indicated sector.

4 Illustrative Simulations

Table 9 presents welfare-cost estimates of raising funds from six primary tax revenue streams. These calculations are based consider infra-marginal changes in rates, hence we label these estimates the "Average Cost of Funds" (ACF). The ACF measures the efficiency cost of raising an additional US$20 million from each of the primary tax streams.

Column R in this table presents 2002 base revenue (million dollars). ΔR indicates how much revenue is required as percentage of the associated tax base. Δt reports the required average percentage increase in tax associated rates. Columns labelled ACF-SR and ACF-LR report the average cost of funds in the short- and long-run models, where the economic cost is masured as the Hicksian equilvalent variation in welfare divided by the change in public expenditure. The long-run model considers the average cost of funds in an equilibrium period over which there is sufficient time for capital stocks (κ) to fully adjust. Column $\Delta\kappa$ reports the percentage change in Armenia's aggregate capital stock in the long-run equilibrium as a result of associated tax policy shock.

The ACF values provide a useful input to the public policy debate, specifically related to the cost-benefit calculus of public expenditures. When the ACF equals 1.4, this means that $1 of public funds costs the representative consumer $1.4. As the ACF increases, the requisite benefit through which a public project can be justified increases, and one would expect that as the ACF exceeds 1.5, fewer public expenditures are justifiable than is the case when the ACF equals 1.2.

Another consideration is the shadow economy and its role in tax revenue leakage. For some of the major taxes, it is reported that non-compliance is as high as 50%. The tax leakage in the shadow economy is parameterized by both the benchmark share (θ, shown in Table 6) and σ, the elasticity of substitution between legal goods and black-market (informal) goods of the same variety. θ is the economy-wide share of production occurring underground. Our default assumptions are $\theta = 30\%$ and $\sigma = 4$. [12] The average tax leakage, and the consequent average cost of funds, rises as each parameter rises. The *marginal cost of funds* increases more rapidly than the average and is most sensitive to σ.

Table 10 shows some of the "central" tax estimates by tax stream. The tax stream called INCOME TAX denotes taxes upon labor income, typically deducted from worker paychecks on a monthly basis. The PAYROLL tax stream represents additional payments for social security and pensions. The PROFITS tax is collections for firm profits, modeled as a tax on the return to capital.

Consider first the short-run results, as reported in the top half of Table 10. In all of the short-

[12] While data limitations related to input-output coefficients and the sectoral distribution of tax evasion seem to be sufficiently challenging obstacles to our analysis, the empirical specification of σ is perhaps an order of magnitude more difficult. This parameter indicates "willingness of buyers to substitute informal goods and services for formal goods and services". While we have not attempted to produce an econometric estimate of this value (which would be quite interesting), we have chosen a value which seems roughly consistent with recent changes in the level of informality, changes which might be interpreted as consistent with a high value of σ in many sectors of the economy.

Table 9: Cost of raising $\frac{1}{2}$% GDP (US$15 million) in tax revenues: a comparison of tax bases

	R	ΔR%	Δt%	ACF-SR	ACF-LR	$\Delta\kappa$
Short-run						
WAGE	19.1	78	118	1.3	1.6	0
PYRL	41.7	36	54	1.3	1.6	0
PROFITS	27.9	54	71	1.3	5.2	-4
TARIFF	16.7	90	129	1.4	2.5	-1
EXCISE	62.1	24	29	1.2	1.2	0
VAT	172.6	9	11	1.2	1.8	-1

Source: Authors' calculations.

Key:

R	2002 base revenue (million dollars).
ΔR	Revenue required as percentage of the original tax base.
Δt	Required percentage increase in tax rate.
ACF-SR	Average cost of funds in the short-run ($= -\Delta EV/\Delta G$)
ACF-LR	Average cost of funds after allowing sufficient time for capital stocks (κ) to adjust.
$\Delta\kappa$	Percentage change in Armenia's aggregate capital stock as a result of additional taxes.

run scenarios, the ACF is compared to raise an additional half percent of GDP, equal to US$15 million. In the short run, when capital and investment are fixed, labor and payroll taxes have the highest cost of funds, especially for high σ or θ. Armenia has seen θ increase for these two tributary systems over the past four years. Personal income taxes declined by 45% between 1999-2003, from 1.9% of GDP to 1.0%. A similar (less dramatic) trend can be seen for payroll collections (3.2% to 2.8%), and profits taxes (2.2% to 1.1%). This trend can be interpreted as a broad increase of θ and/or σ. The ACF when θ is high (40% of the economy) is 1.53 and 1.42 for labor-based taxes. Capital-based taxes have a lower ACF of 1.24. Conversely, consumption-based taxes such as the VAT and excise taxes have a much lower ACF when θ is large. ACF estimates in the last column of Table 10 for TARIFF, EXCISE, and VAT are 1.19, 1.14, and 1.30, respectively.

Turning to the bottom half of Table 10, recall that in the short run economy, when the shadow economy (θ) is small, capital (profit) taxes represent an attractive revenue source, with a low ACF. This all changes in the long-run. In the steady-state equilibrium we calibrate the model to an assumed equalization of the cost of capital and the rate of return. To the extent that increases in taxes directly or indirectly depress the rate of return to capital or increase the cost of capital replacement, the long-run impact of tax increases will be to reduce the level of the capital stock. This neoclassical growth mechanism can substantially increase the average cost of funds, as

Table 10: Sensitivity Analysis: The Average Cost of Funds

	$\sigma = 4$			$\theta = 0.3$			$\sigma = 8$
	$\theta = 0.2$	$\theta = 0.3$	$\theta = 0.4$	$\sigma = 2$	$\sigma = 4$	$\sigma = 8$	$\theta = 0.4$
Short-run							
INCOME TAX	1.24	1.29	1.36	1.24	1.29	1.40	1.58
PAYROLL TAX	1.24	1.29	1.36	1.24	1.29	1.40	1.58
PROFITS TAX	1.26	1.29	1.35	1.24	1.29	1.42	1.58
IMPORT TARIFF	1.35	1.38	1.42	1.34	1.38	1.47	1.57
EXCISE TAX	1.14	1.16	1.18	1.13	1.16	1.25	1.30
VALUE ADDED TAX	1.15	1.17	1.21	1.15	1.17	1.22	1.28
Long-Run (steady-state)							
INCOME TAX	1.53	1.59	1.70	1.55	1.59	1.69	1.91
PAYROLL TAX	1.53	1.59	1.70	1.55	1.59	1.69	1.91
PROFITS TAX	5.03	5.17	5.44	4.89	5.17	5.87	6.83
IMPORT TARIFF	2.41	2.46	2.54	2.38	2.46	2.66	2.88
EXCISE TAX	1.15	1.18	1.20	1.15	1.18	1.25	1.31
VALUE ADDED TAX	1.76	1.80	1.87	1.77	1.80	1.87	1.99

Source: Armenian general equilibrium model calculations.

Key:

- σ A measure of the acceptance of *acceptance* of informal goods in place of formal goods. This elasticity reflects willingness of consumer and producers to substitute formal and informal goods and services.
- θ Base year economy-wide share of informal activity, a measure of the *extent* of informality within the economy.

indicated by comparing the short- and long-run results in Table 10.

4.1 IMF Tax Reform Packages

A tax reform typically involves the combined adjustment of a number of tax rates and several tax bases. Indeed, a crucial role which can be played by a general equilibrium model is to evaluate the combined effect of simultaneous adjustment of several tax instruments. This more complex approach to tax reform is required when political feasibility becomes an important consideration in the design of tax policy.

We have constructed model-based representations of several possible reform packages as is indicated in Table 11. These scenarios are (loosely) based upon the recommendations made in the 2004 Aide Mémoire, as prepared by the IMF Fiscal Affairs Department. Including the agriculture sector into the tax base is considered in AGR5 and AGR. TM5 and UNIF5 present two tariff reforms. UNIF5 removes within-sector exemptions, setting the tariff rate to 5% for all sectors in which tariffs

are currently applied while retaining trade preferences with other CIS countries. TM5 is a more profound reform which apply uniform levy equal to 5% on imports from all trading partners. A target value of 5% was used for the ad-valorem rate because about 50% of Armenian imports come from free trade partners such as Russia. 5% represents half of the standard 10% rate.

Table 11: Revenue and Welfare Impacts of Selected Tax Reforms

	TOTAL REVENUE		CHANGE IN REVENUE					
	BENCHMARK	SCENARIO	DIRECT	INDIRECT	NET	% GDP	EV (US$)	ACF
Short-run								
AGR5	172.6	178.9	6.27	-0.05	6.22	0.2	-6.4	1.03
AGR	219.7	236.1	16.39	0.25	16.64	0.6	-17.1	1.03
UNIF5	16.7	24.2	7.57	-0.22	7.35	0.3	-7.0	0.95
TM5	16.7	49.0	32.30	-0.32	31.98	1.2	-29.8	0.93
TXS10	62.1	67.9	5.76	-0.37	5.39	0.2	-6.1	1.13
TXS	62.1	75.8	13.73	-0.39	13.33	0.5	-13.7	1.03
Long-Run (steady-state)								
AGR5	172.6	178.9	6.27	-0.05	6.22	0.2	-6.7	1.07
AGR	219.7	238.4	18.77	1.48	20.25	0.7	-15.2	0.75
UNIF5	16.7	24.2	7.58	-0.26	7.33	0.3	-15.1	2.07
TM5	16.7	49.2	32.50	0.59	33.10	1.2	-46.7	1.41
TXS10	62.1	68.5	6.39	2.21	8.60	0.3	-6.2	0.72
TXS	62.1	76.5	14.43	2.19	16.62	0.6	-14.1	0.85

Source: Armenian general equilibrium model calculations.

Key:

AGR5	Apply a 5% value-added tax on all agricultural sectors.
AGR	Apply a 5% tax on value added, profits and wages in the formal agricultural sector.
UNIF5	Move to a uniform tariff of 5%, retaining exemptions for imports from free-trade partners.
TM5	Apply a uniform 5% tariff on all imports.
TXS10	Increase excise tax rates by 10% from current levels.
TXS	Increases excise taxes by 10% on the current base and tax domestic tobacco.

As has been noted above, capital and tariff based taxes are most efficient in short time frames, but in the long-run, high tariffs are detrimental to economic growth and they encourage smuggling and higher underground activity – the ACF for import tariffs consequently increases.

Among the tax policy reforms presented here, we conclude that there are several directions in which the tax system might be improved. The elimination of preferences for agriculture in the tax system strengthens revenues over the long-term and does not discourage economic growth. As indicated in Table 11, revenues raised through tariffs are efficient in the short-run, with ACF values of: 0.95 (UNIF5) and 0.93 (TM5). The ACF for moving to a uniform tariff is less than one because the tariff reform package increases efficiency as well as revenues. Import tariffs are less

attractive in the long run, where the ACF is (2.07 and 1.42, respectively). Conversely, the AGR scenario, where agricultural activity is included into all streams of the tax system (VAT, profits and income), has a relatively low short-run ACF of 1.03, and a long-run ACF of 0.75.

The long-run efficiency cost of taxes on agricultural products is low because existing profits and income taxes tend to discriminate against formal activities in manufacturing and industry. These taxes lead to underinvestment in industry, an effect which is partially offset by a tax on agricultural income. In the long-run, by including agriculture into the tax stream like other sectors, revenuess increase together with overall efficiency of the tax system. It is pointed out in the IMF report that taxes on agricultural activity are difficult to administer, since most farmers are small-holders. These farmers would be exempt from income and profits taxes in any case, if revenues and income are low. Large agricultural firms, however, currently enjoy preferential treatment as a side-effect of well-intentioned tax breaks for small farmers.

5 Sensitivity Analysis

In a typical CGE sensitivity analysis, results are compared across a range of elasticity values. In the present application, however, uncertainty is associated as well with construction of the base year input-output table. In order to develop a better understanding of the degree of uncertainty introduced through the data construction, we have repeated the calculations reported above using source data from the Hungarian input-output coefficients in place of the Polish coefficients. We find that our model results are remarkably robust in this dimension. The structure of the input-output matrix turns out to be a *third-order* determinant of model results, as can be seen in the ACF-SR and ACF-LR columns in Table **??**

Least-squares methods are used to construct the benchmark database for the model. When input-output coefficients are drawn from different sources, this leads to slight differences in the benchmark value shares, as suggested by comparing the R and Δt columns in Table 12. Our calibration procedure holds tax revenue and sector GDP more or less consistent, but it returns somewhat different benchmark tax rates. The differences in the benchmark values, however, are very small, and the estimates of the cost of public funds, as is indicated by the values reported in the ACF-SR and ACF-LR columns of this table.

Table 12: Sensitivity Analysis for the Cost of Raising $\frac{1}{2}$% of GDP

	Hungarian Input-Output Coefficients					
	R	ΔR	Δt	ACF-SR	ACF-LR	$\Delta\kappa$
WAGE	19.1	78	118	1.3	1.6	0
PYRL	41.7	36	54	1.3	1.6	0
PROFITS	27.9	54	71	1.3	5.2	-4
TARIFF	16.7	90	129	1.4	2.5	-1
EXCISE	62.1	24	29	1.2	1.2	0
VAT	172.6	9	11	1.2	1.8	-1

	Polish Input-Output Coefficients					
	R	ΔR	Δt	ACF-SR	ACF-LR	$\Delta\kappa$
WAGE	19.1	78	131	1.3	1.6	0
PYRL	41.7	36	60	1.3	1.6	0
PROFITS	28.1	53	77	1.3	5.5	-5
TARIFF	16.7	90	150	1.5	2.8	-2
EXCISE	62.1	24	31	1.2	1.5	0
VAT	172.6	9	11	1.2	2.1	-1

Source: Authors' calculations.

Key:

R	2002 base revenue (million dollars).
ΔR	Revenue required as percentage of the original tax base.
Δt	Required percentage increase in tax rate.
ACF-SR	Average cost of funds in the short-run ($= -\Delta EV/\Delta G$)
ACF-LR	Average cost of funds after allowing sufficient time for capital stocks (κ) to adjust.
$\Delta\kappa$	Percentage change in Armenia's aggregate capital stock as a result of additional taxes.

6 Conclusions

This paper has demonstrated the feasibility of quantitative analysis of tax policy issues in Armenia, despite the unavailability of current input-output statistics.

In our constructed model the cost of public funds in Armenia ranges from 1.3 to over 5, depending on the tax base and the model horizon. In the short-run, the various tax bases are between 1.3 and 2, depending on the tax base.

Our analysis highlights the efficiency cost of informal activity. The marginal cost of public funds from any of the direct and indirect tax instruments are increased when a substantial fraction of the tax base is able to avoid payments, or when individuals are more willing to substitute informal goods and services for formal goods and services. These results provide strong support for tax policies which reduce tax evasion and informal activities organized primarily to evade tax payments.

Our model-based analysis emphasizes the important impact of tax policy on capital accumulation and economic growth. The existing profits, income and value-added taxes all tend to discriminate against investment in formal sectors, and the long-run perspective underscores the need for avoiding further discouragement of investment in these areas.

We have shown that the blind application of "first-best" rules for taxation (low rates, broad base), rules which apply in many competitive economies, may be misleading in this second best environment.

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A: Sectoral classifications

The Armenian CGE model has 24 sectors. This aggregation been chosen because it offers a reasonable characterization of the Armenian economy given data available from the Armenian ministry of Finance and National Statistical Office, and an ad-hoc set of reports provided by various international organizations.

Some aspects of the current national accounts are notable. The first is that ten years after separating from the Soviet Union and undertaking market reforms, the National Statistics Service remains loyal to the original socialist accounting system.

In this system, several superfluous accounts that comprise less than 0.5% of GDP are distinguished while several more important categories of economic activity such as manufacturing and food processing are ignored. These shortcomings are rectified to a certain extent by leveraging evidence from IMF country reports, auxiliary data, and outside accounts, such as the GTAP database.

This appendix is designed to be comprehensive so that the interested reader can re-create, append, or improve our Armenian dataset. Although the national statistics office intends to switch accounting methods to the International Standard Industrial Classification (ISIC).

Sectoral Mapping Some of the sectors in our accounts have been dis-aggregated from the Armenian national statistics. Other sectors reflect aggregations of inconsequential sectors from the accounts. A detailed description of each sector is included here. The tables used to compute total output for these sectors have been provided at the end of this report.

- GRN *Grains and Legumes.* This sector comes from the Agriculture_2002 dataset (see Figure 3), combining wheat, potatoes and leguminous plants.
- VFR *Vegetables and fruits, including grapes.* This sector includes vegetables, fruit and grapes.
- VOL *Vegetable oils.* This sector is taken directly from 2002 agriculture accounts.
- SGR *Sugar.* This sector is taken directly from 2002 agriculture accounts.
- MIL *Milk and milk products.* This sector is comprised of eggs and milk (without butter).
- OMT *Other Meats.* This sector includes the beef, pork, mutton and goat, and poultry categories from the 2002 agriculture dataset.
- MIN *Mining and Quarrying.* This sector comes from the national accounts (Macro Data.xls), sector "Geology". It is also based on the IMF Statistical Annex, page 7, table 4: Structure of Industrial Production (1996-2001). The portion for "Mining and Quarrying" is taken from the "industry" sector of the national accounts.

- FOD, TBC, CRP, OMF Each of these sectors is disaggregated directly from the industry macro-sector via Table 4 from the IMF Statistical Annex. The shares listed for year 2001 are used.

- LMF *Light manufacturing and textiles.* This sector includes textiles, dressing, and dying of fur.

- MNM *Minerals and mining goods.* This sector mainly represents the jewelry-cutting business in Armenia. The single largest import and export good in Armenia is jewels. Un-cut jewels enter the country and finished jewelry is exported. Shares are taken from Table 4 of the statistical annex. See Figure 4 in this appendix.

- MTL *Basic metals and fabricated metals.* This sector is taken directly from the IMF statistical annex. It represents 8% of industrial output.

- MCH *Manufacturing.* This sector combines machinery, equipment and motor vehicles with optical, medical and other precision devices. The combined share is of these activities in GDP is 3.8%.

- TRD *Wholesale and retail trade and commerce.* This sector combines macro lines for retail trade and catering with general commerce.

- BNK *Banking and insurance.* This combines two lines from the 2002 national accounts.

- ENR *Energy* This sector accounts for natural gas and oil. Energy imports are used to calculate total domestic supply.

- UTL *Gas, Water, and Electricity.* This sector appears twice; first in the industrial section from the IMF report, then again as a separate account in the offical NSS accounts. We combine these two accounts for the total. The totals are: the "utility sector" from the macro report and "electricity, gas, and water" from the IMF Table 4.

- GOV *Government, defense, and public procurment.* This sector represents government activities within the economy. It is based on the macro data spreadsheet, and also compared with general statistics regarding the government sector. This sector also include "social spending," including four lines from the national accounts: health & sport, education, culture, and science.

- DWE *Dwellings and housing.* This sector is based on the housing entry in the national accounts.

- CON *Construction.* This sector is taken directly from the Official NSS national accounts (see Figure 5 for this table).

- OSR *Other services.* This sector captures the sectors real-estate, culture, and information technology.

- CGD *Savings good.* This good represents net savings and capital investment for the country. The sector consumes mostly durable goods and construction.

B: Accounting Identities

The economic model for Armenia represents an Arrow-Debreu equilibrium. This means that firms are assumed to maximize profits and face competition, households maximize utility, and markets for goods are balanced (supply equals demand). These basic conditions require a handful of accounting identities to hold. These identities are discussed in this section.

First, we take the set I to represent sectors in the model {GRN, MIN, FOD, etc...}. Then we have the following conditions:

The total sales value must equal the total cost of production:

$$Y_i = \sum_j ID_{ji} + L_i + K_i + T_i = C_i \tag{2}$$

Total output or sales for good i (Y_i), at producer prices, must be large enough to cover the cost of production (C_i). This includes the purchase of intermediate inputs (ID_{ji}), value-added (L_i, K_i) and taxes (T_i).
Supply must equal demand for all markets:

$$A_i \geq \sum_j ID_{ij} + G_i + FD_i + INV_i$$

Where

$$A_i = D_i + M_i$$

Total supply is represented by the "Armington Composite Good" (A_i), which combines domestic production (D_i) with imported goods (M_i). Domestic endowments of Value Added (Ω_{fi}) can also be included in this condition, where Ω_{fi} represents the aggregated endowments of labor (L_i) and capital (K_i).
Domestic supply is either consumed or exported:

$$Y_i = D_i + X_i$$

Total production for a given good (Y_i) is either sold to the domestic market, or it is exported. The *export share* represents the value of exports divided by total output $\frac{X_i}{Y_i}$. These basic conditions are sufficient to identify or compute most of the national accounts for Armenia.

The origin of each variable appearing in the equilibrium benchmark identities is now listed:

Y_i Total supply. This parameter is given by the NSS National accounts data, the sub-tables from the IMF Statistical Annex (2002), and the Agriculture subtable.

X_i, M_i Imports and Exports of goods and services. Provided for 2002 by the customs authorities and the NSS. Each traded good was mapped onto the model sectors.

D_i Domestic supply. Computed parameter based on the values for Y_i and X_i.

A_i Armington aggregate supply. A_i represents the total supply for a good in Armenia. It is a computed parameter, which combines D_i and M_i, net of import and value-added levies applied at the border and domestically.

ID_{ji} Intermediate demand. Aggregate values for intermediate demand are provided in the National Accounts data (Figure 5). But individual input coefficients are taken from a surrogate input-output table for Hungary. This input-output table is reproduced for the reader in section C: .

L_i, K_i Labor and capital demand for production in sector i. Total value-added is provided in the National Accounts, but the share of labor, capital, land, and indirect taxes is not provided by the NSS. These values are based upon the surrogate input-output tables from the GTAP database. The capital-intensity can be an important determinant of labor/capital returns, and should be reviewed more carefully by experts in Armenia.

Ω_{fi} Factor endowments. Factor endowments for labor, capital and land are computed from total demand by firms and government. Total sales of labor and capital are allocated to households. A data discrepancy exists between the official wage statistics, provided by the NSS and the official Value-Added statistics. Although total value-added is reported to be more than \$2,100 million, officially-reported wages are only (approximately) \$600 million, which implies that labor's share in value-added is less than 30% of total value added.

G_i Government demand for good i. These values are based upon the GTAP surrogate dataset, but can be also reconciled by reports by the Armenian Ministry of Finance.

INV_i Investment demand for good i. Taken from the surrogate dataset from GTAP.

FD_i Final demand for good i. Computed as a residual based upon total supply and total demand. Total final demand should be compared with the surrogate data, as well as with Armenian household surveys. This task is forthcoming in a future study.

C: Input-Output Data

When the total production, value-added, and intermediate demand values are calculted from the National Accounts data, we then decompose the intermediate demand structure using our surrogate input-output table. We follow a similar procedure to compute the capital/labor shares in value-added. The current implementation distinguishes four factors: *skilled labor, unskilled labor, capital*, and *land*. Each factor's share in production is presented in the main paper. We include the dollar payments to those factors below, in the input-output table. We also include payments made by producers to various tax authorities. Although the employer does not distinguish tax payments from labor costs (they are still factor payments), we know that the labor costs will change when tax-rates are altered, so they are distinguished here.

Table 13: Production technolgy structure for Armenia. This table displays the zero profit accounting for each production sector. The table includes intermediate inputs, factor inputs, and tax payments by producers.

	GRN	VFR	VOL	OCR	MIL	OMT	MIN	FOD	TBC	LMF	CRP	MNM	MTL	MCH	OMF	UTL	CON	TRN	TRD	BNK	GOV	OSR	DWE
GRN	24.35	0.01	0.00	0.16	5.50	6.93	-	11.82	1.21	0.03	0.01	0.56	0.02	0.01	0.02	-	0.43	0.03	1.02	-	0.39	0.01	-
VFR	-	23.61	-	0.10	3.98	1.53	0.20	15.94	0.88	0.06	0.06	1.07	0.13	0.05	0.15	-	0.91	0.13	2.89	0.05	0.75	0.05	-
VOL	0.60	1.04	0.31	0.49	1.48	1.75	-	8.82	0.03	0.10	0.01	0.09	0.01	-	0.03	-	0.05	0.00	0.27	-	0.16	0.00	-
OCR	0.30	0.89	0.01	25.35	3.49	2.20	0.34	6.78	2.66	1.73	0.03	0.41	0.05	0.04	0.28	0.01	1.18	0.15	0.94	-	0.25	0.01	-
MIL	0.48	0.42	0.00	0.30	43.59	1.05	0.31	0.56	0.24	0.08	0.03	1.18	0.12	0.04	0.04	0.02	1.16	0.13	2.91	0.05	2.74	0.05	-
OMT	0.19	-	0.11	0.18	9.14	8.85	-	65.46	0.12	0.07	-	-	-	-	-	-	0.41	-	0.84	-	0.34	0.01	-
ENR	0.02	0.27	0.00	0.05	0.42	0.05	1.03	0.94	0.15	0.06	0.52	16.58	1.32	0.01	7.87	7.95	0.17	0.03	-	-	1.77	0.06	-
MIN	-	0.06	-	-	-	-	0.78	0.05	0.01	0.02	0.39	5.43	0.45	0.01	0.03	0.44	0.84	0.08	0.03	-	0.19	0.01	-
FOD	2.57	7.44	0.02	2.71	11.00	10.64	0.31	36.34	1.37	0.45	0.08	0.71	0.21	0.07	0.14	0.01	0.45	0.21	3.03	-	5.35	0.06	-
TBC	-	-	0.00	0.13	-	-	-	0.29	1.90	0.01	0.02	-	-	-	0.02	-	-	0.07	0.26	-	0.59	0.07	-
LMF	0.53	0.82	0.00	0.73	0.79	0.08	0.59	6.33	0.62	11.96	0.45	9.22	0.40	1.07	4.17	0.07	4.68	1.30	3.57	0.33	6.37	0.22	-
CRP	11.03	13.04	0.02	5.23	6.37	2.30	5.12	12.07	1.46	3.57	5.96	34.55	5.50	3.62	1.63	3.99	10.05	8.92	4.29	0.11	13.17	0.23	-
MNM	0.85	0.99	0.00	0.50	0.53	0.24	0.83	0.91	0.58	0.24	0.18	27.77	1.67	1.00	0.12	0.13	39.45	0.39	0.97	0.01	1.19	0.25	-
MTL	2.29	2.55	0.00	1.28	1.63	0.63	5.69	4.05	0.72	0.67	0.50	24.64	30.04	9.30	0.46	0.48	24.33	2.04	2.99	0.20	2.21	0.24	-
MCH	4.30	3.90	0.01	2.53	3.36	1.21	9.25	5.99	0.82	1.24	0.65	16.83	3.71	43.61	0.51	1.73	16.59	9.78	7.19	2.04	11.59	0.35	-
OMF	2.49	3.52	0.01	1.50	2.27	0.50	1.69	6.08	1.36	12.10	1.63	19.89	0.69	1.64	5.16	5.01	7.15	7.03	9.31	0.54	12.76	0.43	-
UTL	1.29	2.24	0.00	1.63	2.20	0.70	12.36	4.79	0.45	0.99	0.83	22.66	3.44	0.64	0.36	13.07	1.27	2.83	1.74	0.25	8.11	0.33	-
CON	-	0.17	0.00	0.06	0.16	-	0.38	0.27	0.07	0.00	0.05	1.10	0.16	0.13	0.01	0.23	3.03	3.09	2.05	0.44	0.58	0.33	-
TRN	2.25	3.00	0.01	2.41	1.83	0.57	3.75	6.51	0.78	2.28	0.67	18.31	3.55	2.23	0.86	1.34	38.42	16.97	40.88	2.08	15.09	0.68	-
TRD	8.71	12.51	0.02	5.85	6.96	3.11	3.84	13.20	1.16	2.90	0.71	19.34	4.88	3.48	1.29	0.46	27.25	14.94	18.60	1.74	18.20	0.91	-
BNK	1.75	2.10	0.00	0.96	1.09	0.31	1.28	2.61	0.55	0.51	0.30	4.98	0.71	0.72	0.22	0.61	5.10	3.50	8.48	0.90	2.53	0.15	24.70
GOV	1.11	1.30	0.00	0.91	1.33	0.45	2.73	2.32	0.34	0.66	0.25	13.34	1.22	1.02	0.32	0.29	8.59	3.95	10.03	1.06	12.26	0.58	-
OSR	1.49	1.75	0.00	1.57	1.78	0.19	4.62	8.90	1.72	2.69	0.91	31.80	2.38	4.36	1.08	1.36	26.64	27.42	43.39	3.42	33.79	2.55	-
DWE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	0.02	-	0.02	0.00	-
Skilled Lab	0.76	1.01	0.02	1.51	5.69	0.46	2.95	14.20	0.71	1.96	7.46	2.72	5.16	3.99	3.44	14.42	16.96	13.45	18.59	14.00	83.20	23.48	-
Unskilled Lab	54.45	66.65	0.35	43.67	81.54	35.21	22.52	77.65	5.06	13.58	29.05	17.30	31.44	15.11	22.77	34.78	110.19	42.34	112.46	15.80	52.30	26.48	-
Land	36.45	44.73	0.16	21.93	22.76	22.22	5.31	5.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital	12.49	15.24	0.33	18.33	59.55	7.17	5.60	56.50	6.42	6.68	53.59	19.96	22.07	26.84	20.64	49.01	167.26	80.07	128.05	38.90	60.50	163.60	66.90
Capital Tax	-	-	-	-	0.17	2.05	2.94	1.47	1.14	0.50	0.35	0.69	0.17	0.35	2.13	7.79	2.73	3.34	1.65	0.65	-	-	-
VAT Rebate	-3.03	-	-0.07	-1.03	-0.81	-1.63	-6.96	-25.49	-2.84	-5.68	-0.83	-	-2.92	-7.43	-2.95	-1.45	-1.65	-1.57	-7.43	-	-	-	-
Labor Tax	-	-	-	-	0.18	0.18	0.18	1.58	0.18	0.18	0.18	0.18	0.53	0.18	1.23	1.05	1.40	2.11	2.63	1.40	5.79	-	-
Payroll Tax	-	-	-	-	0.38	0.38	0.38	3.44	0.38	0.38	0.38	0.38	1.15	0.38	2.67	2.29	3.06	4.59	5.73	3.06	12.61	-	-
Output	167.7	209.3	1.3	139.0	278.4	109.3	88.0	355.5	30.2	60.0	104.4	311.7	118.3	112.5	74.7	145.1	518.2	247.3	427.4	87.0	364.8	221.2	91.6

D: External Data Sources

In this section, we include tables from the data sources mentioned above. Each table represents an XLS worksheet. This data is available upon request, but it is also printed in this section for convenience.

Different accounts data is stored as a set of spreadsheets and archived on the Armenia project website. These files have been posted to `http://mileslight.com/armenia/`. A password may be necessary to access this site. Please contact the authors if necessary.

File	Description
`armdata.xls`	Macroeconomic production statistics for import into GAMS. This spreadsheet was taken from `Macro Data.xls`. The spreadsheet reports *value-added* only, not the total production value. Nevertheless, the shares from this sheet for year 2002 are used to calculate the share of total production in Armenia.
`arm_ag_2002.xls`	Contains major agricultural sectors, including production, imports, exports, and final demand. This is a very useful spreadsheet. The agricultural information from this sheet is used in the model.
`Stat. Annex 2001`	IMF macroeconomic statistics for Armenia for 2001. Several tables are used from this report, including industrial production (page 7) and the statutory tax code (page 52-57).

Figure 3: Armenian Agricultural Accounts for 2002. These accounts were used to compute production values for agricultural sectors in the current Armenia dataset.

Table: Armenia, food national balance in 2002

mln. US $

	Average retail prices AMD/kg	Stocks beginning of year	Production	Import	Gross supply	Food consumption	Animal feed	Losses	Seed	Export	Other use	Stocks end of year	Use	Satisfaction rate, %	Consumption per capita		
															kg/year	gram / day	kilo-calorie / day
Wheat	95.4	9.0	47.4	57.9	114.2	75.5	13.4	1.7	6.0	0.3	0.0	17.3	114.2	45.2	151.2	414.2	1325.6
Potato	154.3	20.5	100.7	0.5	121.7	32.5	19.2	7.3	32.8	0.0	0.0	29.9	121.7	99.5	40.2	110.1	82.5
Vegetables	80.0	3.1	77.5	1.0	81.6	66.2	1.6	3.5	0.4	3.1	0.0	6.7	81.6	102.8	158.1	433.2	130.0
Fruit (without grapes)	250.0	2.6	36.0	4.1	42.7	34.8	0.0	3.4	0.0	2.0	0.0	2.4	42.7	94.6	26.6	72.9	109.4
Leguminous plants	475.0	0.7	2.9	3.3	6.9	5.7	0.0	0.3	0.2	0.0	0.0	0.7	6.9	46.7	2.3	6.3	18.2
Vegetable oil	574.0	1.1	1.2	12.4	14.7	13.4	0.0	0.2	0.0	0.0	0.0	1.1	14.7	8.8	4.5	12.2	80.7
Sugar	257.9	1.4	0.0	30.8	32.2	30.4	0.0	0.5	0.0	0.0	0.0	1.3	32.2	0.0	22.5	61.6	237.8
Eggs	718.5	0.4	33.0	0.1	33.5	29.2	0.0	1.8	1.1	1.0	0.0	0.4	33.5	102.7	7.8	21.3	11.3
Milk (without butter)	250.1	20.0	213.5	4.6	238.2	189.5	21.4	9.5	0.0	0.3	0.0	17.4	238.2	98.0	144.7	396.4	158.6
Beef	1111.7	1.6	57.4	17.1	76.0	73.3	0.0	1.0	0.0	0.2	0.0	1.6	76.0	77.3	12.6	34.5	62.1
Pork	1197.1	0.4	21.5	7.9	29.9	28.8	0.0	0.4	0.0	0.0	0.0	0.6	29.9	73.1	4.6	12.6	26.4
Mutton and goat	999.5	0.2	10.3	0.0	10.5	10.1	0.0	0.2	0.0	0.0	0.0	0.2	10.5	100.0	1.9	5.3	8.5
Poultry meat	1146.7	0.8	8.8	25.6	35.2	34.2	0.0	0.2	0.0	0.0	0.0	0.8	35.2	25.6	5.7	15.6	16.7
Grape	387.0	1.5	70.2	2.4	74.1	68.5	0.0	3.4	0.0	0.4	0.0	1.8	74.1	97.2	33.8	92.6	4.2
TOTAL		**63.1**	**680.4**	**167.7**	**911.3**	**692.2**	**55.6**	**33.3**	**40.5**	**7.5**	**0.0**	**82.2**	**911.3**				**2272.0**
Average Ex. Rate 1US$=573,35 AMD																	
Source: NSS, staff estimates																	

Figure 4: Industrial production shares, according to the National Statistical Service. Taken from IMF Country Report number 02/225, Statistical Annex (October 2002).

Total industry	100.0	100.0	100.0	100.0	100.0	100.0
Mining and quarrying	3.6	3.5	3.9	3.9	5.3	6.6
Manufacturing	74.4	69.6	62.6	64.1	64.5	64.8
Food processing and beverages	44.1	45.6	40.7	39.1	36.6	35.6
Tobacco products	0.1	0.9	2.2	3.9	3.8	2.8
Textiles, dressing and dyeing of fur	1.7	1.5	1.7	1.3	1.3	1.4
Chemicals, chem. products, rubber,plastics	4.2	3.3	2.8	2.9	3.4	3.0
Other non-metallic mineral products	3.1	3.9	3.8	3.3	2.4	2.7
Basic metals and fabricated metal	2.3	1.5	2.6	3.6	6.6	8.0
Machinery, equipment and motor vehicles	8.0	4.7	3.1	1.9	2.5	3.1
Medical, precision,optical instruments	1.0	1.1	0.8	0.3	0.4	0.7
Jewelery and related articles	9.3	6.0	4.0	6.3	5.7	5.4
Other	0.6	1.3	0.9	1.4	1.8	2.1
Electricity, gas and water supply	21.9	26.9	33.5	32.0	30.2	28.6

Source: Armenian authorities, National Statistical Service.

Figure 5: Official Armenian national production statistics for 2002.

	2002		
Current prices, mln AMD	VA	IDO	YO
	Millions of AMD		
Industry	256,925	354,955	611,879
Agriculture	318,773	203,861	522,634
Forestry	713	229	942
Construction	172,238	124,850	297,088
Transport and communication	83,640	59,031	142,670
Retail trade and public catering	144,051	89,838	233,889
Public procurements	5,703	2,873	8,576
Sear-parts	1,016	510	1,526
Information-technological provision	959	330	1,288
Real estate transactions	3,987	927	4,914
General commerce	3,538	1,758	5,295
Geology	279	137	417
Other branches	2,200	1,099	3,300
Housing	38,331	14,140	52,471
Utility sector	63,270	21,334	84,605
Health, sport	32,418	35,860	68,277
Education	43,296	9,245	52,541
Culture	6,532	3,098	9,630
Science	4,856	2,132	6,988
Lending	19,470	7,278	26,748
Insurance	1,223	261	1,485
Governance and Defense	35,833	35,958	71,791
NGOs	6,283	4,362	10,645
Financial intermediaries	-14,937	14,937	0
Total by branches, in main prices	1,230,597	989,003	2,219,600
Net taxes on production and import minus subsidies	131,875		
Taxes	140,145		
Subsidies	8,271		
Gross Domestic product at Market price	1,362,472		
Source: NSS			