Hungary, Austria, and the European Community: A CGE Model of Economic Reform and Integration

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Abstract

The countries of Eastern Europe are currently facing both major systemic changes and major shifts in their trade patterns as they seek increased integration with Western economies. The impact of these structural changes on Hungary is analyzed using a four-country, seven-sector, computable general equilibrium (CGE) model of Hungary, Austria, the European Community (EC), and the rest of the world. By simulating a variety of scenarios, the model is used to examine the effects of Hungary's domestic restructuring, change in trade orientation, and increased integration with Austria and the EC. Adjusting to the elimination of trade with the Ruble-area and to the restructuring of the domestic economy lead to major changes in the sectoral structure of production and to a deterioration in the international terms of trade facing Hungary. Full adjustment leads to major efficiency gains and to large increases in exports and imports. Assuming sectoral capital stocks do not change leads to incomplete adjustment, smaller increases in trade, less structural change, and much smaller efficiency gains. Increased integration with Austria, and of both countries with the EC, allows Hungary to increase exports. The impact on Hungary of increased integration with Austria and the EC is less than that from domestic restructuring and the loss of Ruble-area trade, but should significantly facilitate Hungary's adjustment process. The impact on the EC of integration with Austria and Hungary is very small.

Acknowledgments

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1. Introduction

Recent changes in the countries of Eastern and Central Europe, which comprised the former "Soviet bloc," represent a watershed in their economic and political relations. One possible outcome is that these countries will achieve unprecedented integration with the European Economic Community (EC). Alternatively, their efforts at economic and political reform may collapse, leading to a period of economic, social, and perhaps military conflict. While the stakes are high, there are no historical or theoretical models which can be used to evaluate the economic challenges facing these countries. They are simultaneously reforming their economic systems and reorienting the structure of their international trade away from a politically-determined, eastward-oriented pattern toward a westward orientation. In addition, the current challenge of expanded East-West integration will take place between countries with much wider gaps in their levels of economic development than in the earlier expansion of the European Community in the 1970s and 80s.

Different combinations of internal restructuring and external trade orientation have different implications for trade, output, and income levels, both within Eastern Europe and for Europe as whole. We need to understand how these changes are linked in order to identify patterns of restructuring which can minimize social dislocations. In this paper we present a multi-country computable general equilibrium (CGE) modeling approach to these issues. Multi-country CGE modeling provides the capacity to look at the impact of both internal reform and the reorganization of regional trade on different countries. The methodology is best suited for analyzing issues of medium- to long-term structural change,
rather than short-term, macroeconomic adjustment. In particular, the model we develop assumes full employment, so that there are no adjustment costs or frictional unemployment.

Using this methodology, we analyze both components of the transformation of centrally planned to market economies and progressive integration between East and West. Our particular example is that of Hungary. We present a four-country CGE model of Hungary, Austria, the EC, and the rest of the world. This model extends work on regional modeling in the U.S.-Mexico case, allowing comparative analysis of regional integration under different economic and institutional settings.

In the next section, we review previous approaches to the issues of liberalization, integration, and transition in Eastern Europe. In section three we discuss Hungary in comparison with other Eastern European countries and Austria. Sections four and five describe the CGE Model and the results from a variety of projected reform scenarios, followed by a conclusion in section six.

We find that the structural shocks of trade reorientation and domestic restructuring are very large for Hungary. Major changes in the structure of output are required and there is a large deterioration in Hungary's international terms of trade. Increased integration allows Hungary to increase exports further, but the changes in output and trade structure are smaller than those resulting from domestic restructuring. Under scenarios assuming less complete adjustment (assuming sectoral capital stocks are fixed), there is a smaller drop in the terms of trade, but also smaller increases in output and exports, and less structural change. In sum, even in the best case, with full and costless adjustment, large structural changes are required, exacerbating the economic, political, and social strains that are an inevitable part of the transformation process.
2. Reform and Integration: A Review of Approaches

Since Autumn 1989, there have been a series of studies attempting to determine the future of Eastern Europe and of an expanded Europe in general. One important vein of research has concentrated on the changes taking place within Eastern Europe and the former Soviet Union with the collapse of socialist central planning. While there has been a great deal written on the theory of the transition from capitalism to socialism, there is little theoretical work on the reverse transition. Recently there have been some attempts to fill this void, but mostly descriptive rather than analytical. ¹ Many have chosen to concentrate on specific issues such as: macroeconomic adjustment [Wolf (1990) and Commander (1991)]; microeconomic issues [Hare (1990)]; financial markets [McKinnon (1991)]; enterprise reform [Lee and Nellis (1990)]; privatization [Borensztein and Kumar (1990) and Gábor (1991)]; institutional issues [Frydman and Rapaczynski (1991) and Murrell and Olson (1991)]; trade liberalization [Havrylyshyn and Tarr (1991)]; and trade relations within the defunct East-bloc trade group, the CMEA (Council for Mutual Economic Assistance) [Kenen (1991)]. Others have concentrated on specific countries: Poland [Lipton and Sachs (1990a,b) and World Bank (1990a,b)]; Hungary [Kornai (1990)]; and Czechoslovakia [Klaus (1990); World Bank (1991)].² A running debate throughout this literature has centered on the issue of timing and sequencing of reforms. Some argue for rapid and simultaneous reforms [Geneberg (1991)] while others suggest that reforms must be harmonized with a timetable of requisite institutional change [Junz (1991)].

¹For general discussions, see Kornai (1992); Fischer and Gelb (1990); Blanchard et al. (1991); Calvo and Frenkel (1991a); and Marer (1990).

In parallel with economic analysis is a growing literature concerned with the political transition within Eastern Europe. While some have attempted to develop a theoretical understanding of both economic and political transition [Przeworski (1991), Rausser and Simon (1991), and Shopflin (1991)], many are concentrating on theoretical issues of transitions from authoritarian regimes to democracy raised by the Eastern European experience [Schmitter and Karl (1991); Offe (1991) and Richter (1991)]. Many are trying to develop new lessons from the rapidly changing political realities of each country. Hungary, for example, has been analyzed by Kis (1991) and Laki (1991). Others look for lessons in Eastern Europe’s tumultuous history [Rothschild (1989)], pointing out that Eastern Europe had democracies in the inter-war period, all of which collapsed. There is also a debate as to whether the Eastern European experience can be usefully compared with other cases of economic and political liberalization such as Latin America [Przeworski (1991)], or whether the nature of the transition from socialism to capitalism is so fundamentally different that it requires caution in making such comparisons [Offe (1991)]. The debate has not stopped many from offering such comparative advice [Gurria (1991) and Corbo et al. (1991)].

A second vein of research has concentrated primarily on the changes in Eastern Europe’s external economic and political relations. Some studies are primarily concerned with the impacts on specific parts of the world, such as the Congressional Budget Office (1990) on the U.S. and Szentes (1991) on the “South.” In a study of Hungary, Oblath and Tarr (1991) analyze the impact on Hungary’s international terms of trade of eliminating trade with the former Soviet Union. They estimate that Hungary will suffer an income terms-of-trade loss of $1.5 to 2.15 billion dollars, which represents 5-7 percent of Hungarian GDP. Crawford and Schulze (1990) are more interested on the potential impacts on relations between East and West within Europe. Collins and Rodrik (1991) and CEPR (1991) both seek
to address the issue of what Eastern European global trade and financial relations are likely to be. For lack of good comparators, Collins and Rodrick draw on historical analysis of the pre-World-War-II period, which is likely to be of limited value in assessing the current situation and outlook for the region. Both studies share with Blackhurst (1991) a generally optimistic view of the prospects for growth in trade, which should benefit both Eastern Europe and the World economy. They caution that considerable global resources will be needed and argue for an extended period of transition. Allison and Yavlinsky (1991) note that these large amounts of resources are necessary quickly in order to stabilize domestic and external relations during the transition.

There have been few attempts at a comprehensive approach to analyzing economic liberalization, integration, and transition. The CGE modeling approach is a useful way to examine these interrelated issues. It allows examination of the necessary structural changes and their effects on output, trade, and welfare in the medium to long run. The CGE model used here is described in section four, after a review of the Hungarian economy in the Eastern European framework.

3. Hungary in a European Context

The five Eastern, or Central, European countries (Hungary, Poland, Czechoslovakia, Bulgaria, and Romania) have comparable economic systems in many ways. A similar centrally planned "Stalinist" model was imposed after the Second World War. All had the same emphasis on industry, especially heavy industry, and relatively underdeveloped

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3 Earlier CGE work on structural adjustment in socialist countries includes: Robinson and Tyson (1985); Dewatripont, Robinson, and Tyson (1986); Kis, Robinson, and Tyson (1990); Zalai (1983, 1984); Zalai and Revesz (1991); and Tesche (1992).
services. Investment was stressed over personal consumption. All have relatively more resources in agriculture than most Western European countries.

Another area where these economies were similar is trade orientation. All were members of the Council for Mutual Economic Assistance (CMEA), the East-bloc trade group. Through 1989, Table 1 indicates that the Eastern European countries all conducted more than half of their total trade within this group (with the exception of Romania, for whom we have no data past 1985). CMEA trade was mostly in the form of bilateral barter, since the clearing currency, the transferable ruble, was not convertible. Trade patterns tended to be East European exports of manufactured goods and agricultural products in exchange for Soviet resources, especially oil and gas. Since the CMEA disbanded in 1991, and Soviet shipments of oil and gas have collapsed, the reorientation of East European trade is critical. It is obvious from the large non-convertible currency trade shares that this shift will necessitate major adjustments, especially since the manufactured goods previously exported to other socialist countries may not be of sufficient quality to sell in the West.

In spite of the similarities, there were persistent differences among these countries from the first. Hungary has the longest history of “comprehensive” reform, beginning with the New Economic Mechanism (NEM) in 1968. The main change with the introduction of the NEM was the elimination of compulsory plan instructions and central allocation of materials and products. These were replaced with indirect financial controls. Prices were partially freed from central control, particularly at the producer level. Enterprise autonomy increased, especially in the areas of self-financed enterprise investment and foreign trade rights, but management still depended on the ministries for promotions, tax exemptions, and

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4There is an extensive literature on the New Economic Mechanism. See, for example: Friss (1969), Balassa (1983), World Bank (1984), and Kornai (1986).
### Table 1 — Comparative Aggregate Data, Eastern Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Population 1989 (millions)</th>
<th>GDP per Capita, 1989 (US$)</th>
<th>Share of total exports to USSR and East Europe (percent)</th>
<th>Share of total exports to non-convertible currency (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>9.0</td>
<td>1,730</td>
<td>72%</td>
<td>—</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>15.6</td>
<td>3,235</td>
<td>55%</td>
<td>62%</td>
</tr>
<tr>
<td>Hungary</td>
<td>10.6</td>
<td>2,742</td>
<td>67%</td>
<td>39%</td>
</tr>
<tr>
<td>Poland</td>
<td>37.9</td>
<td>1,802</td>
<td>70%</td>
<td>36%</td>
</tr>
<tr>
<td>Romania</td>
<td>23.2</td>
<td>—</td>
<td>39%</td>
<td>—</td>
</tr>
</tbody>
</table>

**Notes:**
All data are for 1989 except for Bulgaria (1988) and Romania (1985). In the 1980s, part of CMEA trade was conducted in convertible currencies, so the two figures differ. A dash (—) indicates no information available.

**Sources:**

### Table 2 — Eastern European External Debt, 1989

<table>
<thead>
<tr>
<th>Country</th>
<th>Commercial $ billions</th>
<th>Official $ billions</th>
<th>BIS/IMF $ billions</th>
<th>Total $ billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>8.8</td>
<td>1.2</td>
<td>0.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>5.9</td>
<td>1.9</td>
<td>0.0</td>
<td>7.8</td>
</tr>
<tr>
<td>Hungary</td>
<td>15.7</td>
<td>3.2</td>
<td>1.8</td>
<td>20.7</td>
</tr>
<tr>
<td>Poland</td>
<td>13.4</td>
<td>26.3</td>
<td>0.0</td>
<td>39.7</td>
</tr>
<tr>
<td>Romania</td>
<td>0.2</td>
<td>0.2</td>
<td>0.0</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Notes:**
BIS is the Bank for International Settlements.

**Sources:**
subsidies. Bargaining over plan targets was replaced with bargaining over special tax and subsidy treatment. Although considered somewhat successful at first, the similarity of policies in subsequent reform periods, 1979-81 and 1984-5, indicates that the original reform was never fully implemented [Balassa and Tyson (1984)].

In the late 1980s more extensive reform with structural change was attempted. In 1987 more retail prices were freed and a two-tier banking system was introduced. In 1988 the turnover tax system (based on the difference between retail and wholesale prices) was replaced with a value added tax. In 1989 the stock market was reopened, private enterprises were allowed to hire up to 500 employees, and 100% foreign ownership was allowed. However, at the end of 1989, the majority of production was still in state hands, the production structure was still tied to the CMEA, and there were continued problems with slowing growth and current account deficits.

Poland experienced several reform periods, but only attempted an NEM type comprehensive decentralization in 1987. The reforms of the early 1970s mainly changed incentives. Poland’s attempted reforms were influenced by political upheaval and repression. Czechoslovakia (after 1968) and Bulgaria were more orthodox and only followed the few Soviet partial reform attempts. These also mainly affected the incentive systems. Romania had more autonomy from the Soviet Union politically, but did not attempt decentralizing economic reform.

Today all the countries are agreed that they want a market economy, but differ in their approaches to reform, the speed of adjustment, and the methods and extent of

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5 However, while agriculture was collectivized in the other countries, it remained predominantly private in Poland.

6 For a comparison of economic reforms in Eastern Europe from the 1960s see Adam (1989).
privatization. They differ in income and debt levels (Tables 1 and 2), and the extent of reform. Hungary is ahead in the sense of having had a longer reform period for increased management autonomy and, especially, for the private and cooperative sectors to develop. Although more decentralized management of state owned enterprises did not necessarily mean that Hungarian managers were concerned with profit maximization, they do have more experience dealing directly with customers, including foreign buyers. Privatization is proceeding more slowly than in Poland or Czechoslovakia since no giveaway of state assets is planned. Hungary has the highest per capita external debt in Eastern Europe (Table 2).

Poland had the most radical first step, with its "big bang" stabilization program in January 1991. However, structural changes have been much slower. Poland also has a large amount of external debt, although more is owed to governments than to commercial banks. Czechoslovakia had very little reform before 1990 and, although committed to a market economy, has made only slow progress with privatization until very recently. Czechoslovakia has very little external debt. Bulgaria and Romania both are starting economic changes, but progress is slow. Romania has little debt as a result of Ceausescu's policies of the 1980s. External debt went from over $9 billion in 1980 to virtually nothing in 1989.

Hungary's goal, as well as that of most of the other former Socialist countries, is reintegration into Western Europe and EC membership. Associate EC status and trade liberalization was agreed to in December 1991 for Hungary, Poland, and Czechoslovakia. Hungary's trade with the EC was around 50% of non-ruble trade in 1989 and has been increasing. Greater integration with the EC is vital. West Germany (now Germany) was Hungary's largest Western trading partner, followed by Austria. Austria is a market economy with a large state sector (25% of industry) and is closer to the EC economically and in living standards. Austria joined the European Free Trade Area (EFTA) in 1960. EFTA
concluded a free trade agreement with the EC in 1972. Austria applied to join the EC in 1989, but it is not likely that it will be allowed to join before 1996. It may be beneficial for Hungary to be linked with Austria as a first step toward greater EC integration. This interim step may prove unnecessary with Hungary’s new Associate status, although it appears that EC trade barriers against Eastern Europe will only be phased out over 10 years, so the immediate impact may not be large.\(^7\)

The experience of Hungary in trade redirection, domestic restructuring, and increased integration with Austria and the EC can serve as an indication of the adjustments necessary in other East European countries as well. As a result of earlier reform efforts, prices in Hungary were somewhat flexible, enterprises were at least more aware of customers, and managers did not look only to the ministries for guidance. The financial infrastructure was developed sooner in Hungary and the private and cooperative sectors have had over 20 years to develop.

4. The Hapsburg CGE Model

The Hapsburg CGE model is a seven-sector, four-country, computable general equilibrium model composed of three single-country CGE models (Hungary, Austria, and the EC) linked by trade flows, plus a set of export-demand and import-supply equations to represent the rest of the world. The model is an extension of earlier CGE modeling undertaken at the USDA, which began with the single-country, USDA/ERS CGE model [Robinson, Kilkenny, and Hanson (1990)]. The Austria model was first constructed at the

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\(^7\)See story in the Hungarian Stock Market Courier, December 19, 1991. Lowering agricultural trade barriers represents a more serious problem for the EC, and the formation of the European Economic Area (EEA), which excludes agriculture, represents an attempt to avoid dealing with agricultural trade issues.
Austrian Institute for Economic Research (WIFO) based on a 1976 input-output table (the latest available) (Breuss and Tesche (1991a)). The Hungary model is based on the 1977 model by Tesche (1992) updated to 1986 by Breuss and Tesche (1991b). The EC model is from the RUNS model by the OECD. The software for the multi-country application was initially developed by Hinojosa and Robinson (1991) in a model of the US and Mexico.

4.1 Data

Table 3 presents aggregate data on the three economies and their trade, which are used to generate the benchmark or base solution of the CGE model. Both Hungary and Austria are, of course, much smaller than the EC in terms of population and GDP. Hungary is also much less developed, with a GDP per capita of around one fifth of that of Austria or the EC. Hungary has a much smaller total exports to GDP ratio, but the figures shown in Table 3 refer only to dollar (non-ruble) trade, which represents about half of total Hungarian trade. In 1989, nearly half of Hungary's non-ruble trade was conducted with the EC. A much smaller amount of trade was conducted with Austria, although Austria was Hungary's second largest Western trading partner. Austria's trade is 65% with the EC and only 1% with Hungary. Both the Austrian and Hungarian markets are very small for the EC.

Table 4 shows the sectoral structure of GDP, employment, and trade for the three countries. The model has seven sectors: agriculture and food, building materials and construction, intermediates (mining, electricity, metals and chemicals), machinery, light manufacturing (industrial consumer goods), productive services, and non-productive services. Productive services include transport, communications, and trade. The non-productive service

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8The current model was updated with data from the Osterreichisches Volkseinkommen, 1989 by Fritz Breuss.
Table 3 — Comparative Aggregate Data: Hungary, Austria, and the European Community (EC)

<table>
<thead>
<tr>
<th></th>
<th>Hungary</th>
<th>Austria</th>
<th>EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP ($US billions, 1989)</td>
<td>29.1</td>
<td>126.5</td>
<td>4,689.9</td>
</tr>
<tr>
<td>Per Capita GDP ($US, 1989)</td>
<td>2,742</td>
<td>16,642</td>
<td>14,413</td>
</tr>
<tr>
<td>Export share in GDP (percent)</td>
<td>17.8</td>
<td>40.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Export shares by country (percent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to Hungary</td>
<td>—</td>
<td>1.3</td>
<td>0.2</td>
</tr>
<tr>
<td>to Austria</td>
<td>12.3</td>
<td>—</td>
<td>2.4</td>
</tr>
<tr>
<td>to the EC</td>
<td>46.3</td>
<td>65.1</td>
<td>—</td>
</tr>
<tr>
<td>to the rest of the world</td>
<td>41.4</td>
<td>33.6</td>
<td>97.4</td>
</tr>
<tr>
<td>Total population (millions)</td>
<td>10.6</td>
<td>7.6</td>
<td>325.4</td>
</tr>
</tbody>
</table>

Notes:
Hungarian trade data refer to non-Ruble trade only. A dash (—) indicates not applicable.

Sources:
GDP and population data are for 1989 and come from World Bank, World Development Report 1991. All other data come from Hungarian and Austrian Statistical Yearbooks and RUNS model data for the EC. All Austrian data is for 1989, Hungarian total trade figures are for 1986. EC data is for 1988. All bilateral trade shares are from 1989.
<table>
<thead>
<tr>
<th>Commodity</th>
<th>GDP:</th>
<th>Employment:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hungary</td>
<td>Austria</td>
</tr>
<tr>
<td>Agriculture and Food</td>
<td>23.9%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Building and Construction</td>
<td>10.1%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Intermediates</td>
<td>19.6%</td>
<td>21.9%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>13.9%</td>
<td>7.2%</td>
</tr>
<tr>
<td>Light Manufactures</td>
<td>8.4%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Productive Services</td>
<td>12.7%</td>
<td>33.4%</td>
</tr>
<tr>
<td>Non Productive Services</td>
<td>11.4%</td>
<td>13.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Imports:</th>
<th>Exports:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hungary</td>
<td>Austria</td>
</tr>
<tr>
<td>Agriculture and Food</td>
<td>12.5%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Building and Construction</td>
<td>2.8%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Intermediates</td>
<td>34.1%</td>
<td>49.9%</td>
</tr>
<tr>
<td>Manufactures</td>
<td>30.0%</td>
<td>23.9%</td>
</tr>
<tr>
<td>Light Manufactures</td>
<td>14.2%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Productive Services</td>
<td>6.5%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Non Productive Services</td>
<td>0.0%</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

Sources: Hungarian, Austrian and EC social accounting matrices 1986 for Hungary, 1989 for Austria, 1988 for EC.
sector includes health, social and cultural services, and public administration. Hungary's relative backwardness can be seen in the output and employment structure: a much higher proportion in agriculture and less in services. The base year for Hungary is 1986. Austria has a 1989 base year and the EC 1988. Bilateral trade flows are from 1989.

4.2 Model Structure

The core model follows the standard theoretical specification of trade-focused CGE models. Each sector produces a composite commodity that can be transformed according to a constant elasticity of transformation (CET) function into a commodity sold on the domestic market or into an export. Output is produced according to a CES production function in primary factors, and fixed input-output coefficients for intermediate inputs. The model simulates a market economy, with prices and quantities assumed to adjust to clear markets. All transactions in the circular flow of income are captured. Each country model traces the flow of income (starting with factor payments) from producers to households, government, and investors, and finally back to demand for goods in product markets.

Consumption, intermediate demand, government, and investment are the four components of domestic demand. Consumer demand is based on Cobb-Douglas utility functions, generating fixed expenditure shares. Households pay income taxes to the government and save a fixed proportion of their income. Intermediate demand is given by fixed input-output coefficients. Real government demand and real investment are fixed exogenously.

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9See the appendix for a complete equation listing. Robinson (1989) surveys single-country CGE models. The Hapsburg model is implemented using the GAMS software, which is described in Brooke, Kendrick, and Meeraus (1988).
In factor markets, full employment for all labor categories is assumed. Aggregate supplies are set exogenously. Sectoral distortions in factor markets exist in the differences between sectoral wages and the economy average (see Table 6 for an index of distortions in Hungary). The model can incorporate different assumptions about factor mobility. In the first set of experiments, we assume that all factors are mobile, including capital. These results should be seen as reflecting adjustment in the long-run, with capital able to move between sectors. The same set of experiments are performed assuming that capital is not mobile.

There are three key macro balances in each country model: the government deficit, aggregate investment and savings, and the balance of trade. Hungary has the additional ruble trade balance, although the surplus or deficit is simply financed by the government. Government savings is the difference between revenue and spending, with real spending fixed exogenously but revenue depending on a variety of tax instruments. The government deficit is therefore determined endogenously. Real investment is set exogenously, and aggregate private savings is determined residually to achieve the nominal savings-investment balance. The balance of trade for each country (and hence foreign savings) is set exogenously, valued in world prices.

Each country model solves for relative domestic prices and factor returns which clear the factor and product markets, and for an equilibrium real exchange rate given the exogenous aggregate balance of trade in each country. The GDP deflator defines the numeraire in each country model, and the currency of the rest of the world (dollars) defines the international numeraire. The model determines three equilibrium real exchange rates

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10Enterprise savings rates are assumed to adjust to achieve the necessary level of aggregate savings in each country.
(for Hungary, Austria, and the EC), which are measured with respect to the rest of the world and the cross rates are implicitly determined by arbitrage conditions. Internationally, the model effectively specifies sectoral export supply and import demand functions for each country, and solves for a set of world prices that achieve equilibrium in world commodity markets.

4.4 Import Demand Equations

The standard approach in trade-focused CGE models is to assume that at the sectoral level in each country, demanders differentiate goods by country of origin and exporters differentiate goods by county of destination. Domestic and imported goods are modelled as imperfect substitutes, using a constant elasticity of substitution (CES) import-aggregation function. In the case of a multi-country model, the function aggregates imports from all countries of origin. In the simplest case, the CES function is extended to include goods from many countries, with the substitution elasticity assumed to be the same for all pairwise comparisons of goods by country of origin. The first-order conditions define import demand as a function of relative prices and the elasticity parameter.

The use of CES functions in multi-country Armington trade models has led to empirical problems due to the restrictive nature of the CES functions. Instead of the CES import aggregation function, we use import demand equations based on the Almost Ideal

\[ \text{Almost Ideal} \]

The properties of single-country CGE models incorporating CES import aggregation functions have been extensively studied. See, for example, de Melo and Robinson (1989) and Devaraj, Lewis, and Robinson (1990).

Other generalizations of the CES function could allow different, but fixed, elasticities of substitution between goods from different countries. See, for example, the CRESH function described in Dixon et al. (1982). It is also common to use nested CES functions, with a two-good CES function specifying substitution between domestically produced goods and a composite of imports, which is itself a CES function of goods from various countries of origin.
Demand System (or AIDS). The AIDS function is a flexible functional form in that it can generate arbitrary values of substitution elasticities at a given set of prices, and also allows expenditure elasticities different from one.

In the AIDS approach, the expenditure shares are given by:

\[ S_{i,k,c1} = \alpha_{i,k,c1} + \sum_{c2} \gamma_{i,k,c1,c2} \log(PM_{i,k,c2}) + \beta_{i,k,c1} \log \left( \frac{\bar{C}_{i,k}}{P_{i,k}} \right) \]

where subscript \( i \) refers to sectors; subscript \( k \) refers to Austria, Hungary, and the EC; and subscript \( c1 \) (or \( c2 \)) refers to Austria, Hungary, the EC, and the rest of the world. \( S_{i,k,c1} \) is the expenditure share on imports of good \( i \) into country \( k \) from country \( c1 \). \( \bar{C}_{i,k} \) is nominal expenditure on composite good \( i \) in country \( k \), \( PM_{i,k,c2} \) is the domestic price of imports, and \( P_{i,k} \) is the aggregate price of the composite good. The Greek letters are parameters. We adopt the notation convention that when \( k = c1 \), \( M_{i,k,k} = D_{i,k} \), which is the domestically produced good sold on the domestic market, and \( PM_{i,k,k} = PD_{i,k} \), which is the price of \( D_{i,k} \).

Deaton and Muellbauer (1980) define the aggregate price index, \( P_{i,k} \), by a translog price index. In econometric work, the translog price index is often approximated by a geometric price index — a procedure we have followed in the results presented below. 14

Various restrictions on the parameters are required to have the system satisfy standard properties of expenditure functions such as symmetry, homogeneity, adding up, and local concavity. We calibrated the parameters for the Hapsburg model by starting from a set

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13 The AIDS specification in this model draws heavily on work by Robinson, Soule, and Weyerbrock (1992). The discussion below is based on their paper. The specification was first used by Hanson, Robinson, and Tokarick (1989).

14 The geometric price index is usually called a Stone index. Robinson, Soule, and Weyerbrock (1992) analyze the empirical properties of different import aggregation functions in a three-country model of the U.S., European Community, and rest of world, which is a close cousin of the Hapsburg model. Green and Alston (1990) discuss the computation of various elasticities in the AIDS system when using the Stone or translog price indices.
of expenditure elasticities and substitution elasticities for each sector in each country. We assumed that substitution elasticities are the same for goods from any pair of countries, so our AIDS functions are effectively simple extensions of the multi-country CES functions to include expenditure elasticities different from one.

Border policies (tariffs, quotas, and export subsidies) affect producers through their effect on the output price, $P_{X_{i,k}}$, which is effectively a weighted average of the prices of output sold in the domestic market, $P_{D_{i,k}}$, and in each export market, $P_{E_{i,k,cl}}$. Similarly, they affect consumers through the price of the composite good, $P_{i,k}$, which is effectively a weighted average of the domestic currency price of the imported good, $P_{M_{i,k}}$, and the domestic good price, $P_{D_{i,k}}$. Given the CET and AIDS functions, the link between trade policy and domestic prices is weaker than in a model where all goods are perfect substitutes.

In trade theory models, it is common to denominate all prices in world currency, thus eliminating the country exchange-rate variables. The resulting model still determines equilibrium real exchange rates — which are defined as ratios of domestic prices of “semi-tradeables” ($P_{D_{i,k}}$) to those for tradeables ($P_{M_{i,k,cl}}$ and $P_{E_{i,k,cl}}$) — given the exogenously specified balance of trade for each country. In applied models, it is convenient to measure national aggregates in local currency, so we carry the exchange-rate variables in the model equations. The equilibrating mechanism at work is unchanged. It is a real trade model which specifies a functional relationship between the real exchange rate and the balance of trade. The model has no assets, no asset markets, and no financial variables. It solves for relative prices given a set of flow-equilibrium conditions.

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16 $P_X$ is a CET aggregation of $P_D$ and $P_E$, while $P$ is a translog or Stone aggregation of $P_D$ and $P_M$. 
5. Results

In its liberalization effort, Hungary starts with an economy far from the competitive ideal. Table 5 presents data on the initial levels of sectoral import protection in Hungary, Austria, and the EC. Hungary has by far the largest tariffs, and the highest sectoral variation in protection. Table 6 gives sectoral data for Hungary on the importance of ruble trade, domestic taxes and subsidies, and indicators of factor market distortions. Ruble trade is very important, especially in manufacturing and intermediates. Domestic incentive distortions are also significant. Sectoral tax/subsidy rates range from a tax of 9.7% to a subsidy of 5.1%. Factor market distortions are also significant, with returns across sectors deviating widely from economywide averages.

We analyze the effects of a variety of Hungarian liberalization scenarios, which are summarized in Table 7. The policy scenarios are cumulative, adding additional policy changes to earlier scenarios. The first scenario involves the elimination of all ruble trade in Hungary. In the second scenario, two domestic distortions in Hungary are removed. First the differentiated sectoral taxes and subsidies in Hungary are eliminated, and are replaced by a uniform value-added tax which raises the same net revenue as the original tax-subsidy structure. Second, the distortions in factor markets are eliminated. These first two scenarios represent the transformation of the Hungarian economy to a market system, with production and trade determined by market mechanisms, but with no change in trade policy with respect to Austria, the EC, and the rest of the world.

\[16\] The distortions are modelled as fixed sectoral distortion parameters fixing the ratio of sectoral marginal revenue products for each factor to the economywide average return to that factor. The parameters are given in Table 6.
### Table 5 — Sector Tariff Rates: Hungary, Austria, and EC

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Hungary</th>
<th>Austria</th>
<th>EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Food</td>
<td>14.7%</td>
<td>3.0%</td>
<td>32.0%</td>
</tr>
<tr>
<td>Building and Construction</td>
<td>1.1%</td>
<td>0.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Intermediates</td>
<td>4.9%</td>
<td>1.1%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>18.0%</td>
<td>2.5%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Light Manufactures</td>
<td>12.0%</td>
<td>2.6%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Productive Services</td>
<td>2.0%</td>
<td>0.5%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Non Productive Services</td>
<td>0.0%</td>
<td>0.4%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

**Notes:**
Hungarian data refer to non-ruble trade only. Tariff rate for agriculture in the EC includes the tariff-equivalent of the import quotas under the Common Agricultural Policy (CAP).

### Table 6 — Hungary: Ruble Trade and Market Distortions

<table>
<thead>
<tr>
<th>Sector</th>
<th>Ruble trade share of output</th>
<th>Sectoral factor market distortion index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exports</td>
<td>Imports</td>
</tr>
<tr>
<td>Agriculture</td>
<td>5.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Construction</td>
<td>0.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Intermediates</td>
<td>3.3</td>
<td>20.4</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>37.0</td>
<td>24.9</td>
</tr>
<tr>
<td>Light mfg</td>
<td>10.9</td>
<td>7.4</td>
</tr>
<tr>
<td>Productive svc</td>
<td>1.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Other svc</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Notes:**
The ruble trade shares are the ratio (%) of sectoral exports and imports denominated in rubles to sectoral production. The index of factor market distortion equals the ratio (%) of sectoral wage and capital rental to the economywide average wage and rental.
<table>
<thead>
<tr>
<th>No.</th>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ruble trade elimination</td>
<td>Eliminate all Ruble trade in Hungary.</td>
</tr>
<tr>
<td>2.</td>
<td>Hungarian domestic liberalization</td>
<td>Scenario 1 plus eliminate differentiated sectoral taxes and subsidies, replace them with a uniform value added tax, and eliminate factor market distortions.</td>
</tr>
<tr>
<td>3.</td>
<td>Austria-Hungary integration</td>
<td>Scenario 2 plus eliminate all sectoral tariffs and import rationing between Hungary and Austria.</td>
</tr>
<tr>
<td>4.</td>
<td>Partial EC integration</td>
<td>Scenario 3 plus eliminate all non-agricultural tariffs between Austria, Hungary, and the EC.</td>
</tr>
<tr>
<td>5.</td>
<td>Full EC integration</td>
<td>Scenario 4 plus eliminate agricultural tariffs and quotas between Austria, Hungary, and the EC; and adopt EC tariffs with respect to rest of world.</td>
</tr>
</tbody>
</table>
The next three scenarios involve various degrees of trade liberalization. In scenario 3, Hungary and Austria eliminate all barriers on their bilateral trade. Scenario 4 adds integration with the EC in the non-agricultural sectors, creating a free trade area in non-agricultural sectors incorporating Hungary, Austria, and the EC. Policies of the three countries with respect to the rest of the world are left unchanged. Scenario 5 extends the free trade area to include agricultural goods and assumes that Hungary and Austria join the European Community, adopting EC tariffs, including the tariff equivalents of the common agricultural program (CAP) policies, with respect to trade with the rest of the world.\footnote{We ran a scenario in which we did not change Hungarian and Austrian tariffs against the rest of the world. The differences were minor. We do not explicitly model EC agricultural subsidies under the common agricultural policy, which would be a major difference between the formation of a free trade area versus complete integration into the common market.}

In all scenarios, the macro environment is left unchanged. Real government expenditure, real investment, and the aggregate balance of trade in each country (in world prices) are fixed. Real exchange rates adjust, and there are also some changes in bilateral trade balances. Aggregate employment and the aggregate capital stock in each country are also assumed fixed.

We ran all five scenarios under two model variants. In the first, a long-run variant, we assumed all factors are sectorally mobile, so capital and labor are reallocated to maintain equal wages and rental rates across sectors. In the second, shorter-term, variant, capital is assumed sectorally fixed, so sectoral capital rental rates are determined endogenously and will differ across sectors in equilibrium. Note that in both model variants, factors are fully employed, so there are no adjustment costs or frictional unemployment as the economies move to their new equilibria. The scenarios should be viewed as exploring structural affects
of the different policy scenarios in the medium to long run. The results are presented in Tables 8 to 14.

5.1 Domestic restructuring

The first two scenarios focus on issues of internal adjustment as Hungary deals with the collapse of CMEA ruble-denominated trade and reforms its domestic economy. The first scenario, the loss of ruble-area trade, necessitate major adjustments. Nearly 20% of Hungarian output was traded on CMEA markets. From Table 6 it can be seen that 37% of the domestic production of manufacturing (such as machinery) and 11% of light manufacturing (consumer goods) were exported to CMEA markets. Ruble area intermediate imports accounted for 20% and machinery 25% of total supply. The second scenario also leads to major adjustments.

It is clear that the required adjustments from reorienting trade and reforming domestic incentives are large. Hungary greatly increases its hard-currency trade, which requires a depreciation of the exchange rate and leads to a deterioration in Hungary's international terms of trade (Tables 8, 10, and 11). In the mobile capital model, ruble trade elimination leads to a fall in GDP, while domestic liberalization (scenario 2) leads to a significant increase, by 10.4%. In the fixed capital model, the impediments to structural adjustment in capital allocation eliminate a major source of efficiency gains, so real GDP changes little in scenario 2 (Table 8). Domestic liberalization leads to a large jump in trade in the mobile capital model (Table 8), more than doubling exports compared to scenario 1, but there is little change in exports with the fixed capital model (Table 8).

In both model variants, domestic restructuring leads to a fall in real wages, even though there is full employment of labor. When GDP rises, the fall in wages is much
Table 8 — Aggregate Results, Hungary  
(percent change from base run)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ruble trade elimination</td>
<td>domestic liberalization</td>
<td>AU-HU integration</td>
<td>partial EC integration</td>
<td>full EC integration</td>
</tr>
<tr>
<td>Real GDP</td>
<td>-1.0</td>
<td>10.4</td>
<td>10.4</td>
<td>10.6</td>
<td>10.5</td>
</tr>
<tr>
<td>Real exports</td>
<td>23.2</td>
<td>47.1</td>
<td>49.5</td>
<td>54.1</td>
<td>56.6</td>
</tr>
<tr>
<td>Real imports</td>
<td>6.8</td>
<td>22.4</td>
<td>23.6</td>
<td>25.9</td>
<td>27.9</td>
</tr>
<tr>
<td>Real exchange rate</td>
<td>12.8</td>
<td>7.1</td>
<td>7.7</td>
<td>8.1</td>
<td>6.6</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>-12.8</td>
<td>-20.2</td>
<td>-21.4</td>
<td>-21.8</td>
<td>-21.7</td>
</tr>
<tr>
<td>Factor prices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>-4.5</td>
<td>-2.3</td>
<td>-2.1</td>
<td>-1.2</td>
<td>-0.9</td>
</tr>
<tr>
<td>Rental</td>
<td>-1.8</td>
<td>-2.7</td>
<td>-2.4</td>
<td>-1.4</td>
<td>-1.0</td>
</tr>
</tbody>
</table>

Fixed capital model

<table>
<thead>
<tr>
<th>Scenario</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP</td>
<td>-1.6</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Real exports</td>
<td>22.7</td>
<td>23.9</td>
<td>25.9</td>
<td>29.7</td>
<td>31.8</td>
</tr>
<tr>
<td>Real imports</td>
<td>7.6</td>
<td>9.7</td>
<td>10.6</td>
<td>12.5</td>
<td>14.6</td>
</tr>
<tr>
<td>Real exchange rate</td>
<td>12.7</td>
<td>12.6</td>
<td>13.4</td>
<td>14.2</td>
<td>11.8</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>-11.5</td>
<td>-13.2</td>
<td>-14.4</td>
<td>-14.9</td>
<td>-14.6</td>
</tr>
<tr>
<td>Factor prices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>-6.5</td>
<td>-7.9</td>
<td>-7.7</td>
<td>-6.7</td>
<td>-6.4</td>
</tr>
<tr>
<td>Rental</td>
<td>-1.4</td>
<td>-1.3</td>
<td>-1.0</td>
<td>0.3</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Notes:

"Terms of trade" refers to the ratio of world export prices to world import prices. "Real exchange rate" refers to the real price-level-deflated exchange rate, using the GDP deflator. The units are domestic currency per unit of world dollars, so a positive change represents a real depreciation. "Factor prices" are also in real terms.
Table 9 — Aggregate Results, Austria  
(percent change from base run)

<table>
<thead>
<tr>
<th>Mobile capital model</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ruble trade elimination</td>
<td>domestic liberalization</td>
<td>AU-HU integration</td>
<td>partial EC integration</td>
<td>full EC integration</td>
</tr>
<tr>
<td>Real GDP</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Real exports</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Real imports</td>
<td>0.3</td>
<td>0.6</td>
<td>0.7</td>
<td>3.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Real exchange rate</td>
<td>-0.1</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-2.1</td>
<td>-3.1</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>4.2</td>
<td>9.5</td>
<td>9.6</td>
<td>11.4</td>
<td>11.2</td>
</tr>
<tr>
<td>Factor prices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>1.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Rental</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>1.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fixed capital model</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ruble trade elimination</td>
<td>domestic liberalization</td>
<td>AU-HU integration</td>
<td>partial EC integration</td>
<td>full EC integration</td>
</tr>
<tr>
<td>Real GDP</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>Real exports</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>1.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Real imports</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>3.1</td>
<td>2.3</td>
</tr>
<tr>
<td>Real exchange rate</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.3</td>
<td>-1.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>2.3</td>
<td>4.2</td>
<td>4.3</td>
<td>6.0</td>
<td>5.7</td>
</tr>
<tr>
<td>Factor prices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
<td>1.3</td>
<td>0.9</td>
</tr>
<tr>
<td>Rental</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>1.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Notes:  
"Terms of trade" refers to the ratio of world export prices to world import prices. "Real exchange rate" refers to the real price-level-deflated exchange rate, using the GDP deflator. The units are domestic currency per unit of world dollars, so a positive change represents a real depreciation. "Factor prices" are also in real terms.
### Table 10 — Bilateral Trade and Prices, Mobile Capital Model
(percent change from base run)

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
<th>Scenario 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>ruble trade elimination</td>
<td>domestic liberalization</td>
<td>AU-HU partial integration</td>
<td>Full EC integration</td>
<td></td>
</tr>
<tr>
<td>HU.AU</td>
<td>17.4</td>
<td>31.2</td>
<td>34.7</td>
<td>37.6</td>
</tr>
<tr>
<td>HU.EC</td>
<td>16.8</td>
<td>22.9</td>
<td>23.8</td>
<td>28.7</td>
</tr>
<tr>
<td>HU.RT</td>
<td>32.1</td>
<td>79.0</td>
<td>82.8</td>
<td>87.7</td>
</tr>
<tr>
<td>AU.HU</td>
<td>22.5</td>
<td>46.3</td>
<td>58.6</td>
<td>55.0</td>
</tr>
<tr>
<td>AU.EC</td>
<td>-0.1</td>
<td>-0.3</td>
<td>-0.4</td>
<td>3.9</td>
</tr>
<tr>
<td>AU.RT</td>
<td>-0.5</td>
<td>-1.1</td>
<td>-1.3</td>
<td>-5.9</td>
</tr>
<tr>
<td>EC.HU</td>
<td>7.8</td>
<td>13.7</td>
<td>12.9</td>
<td>19.2</td>
</tr>
<tr>
<td>EC.AU</td>
<td>0.1</td>
<td>0.3</td>
<td>0.3</td>
<td>3.3</td>
</tr>
<tr>
<td>EC.RT</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Bilateral terms of trade**

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
<th>Scenario 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>HU.AU</td>
<td>-16.4</td>
<td>-31.0</td>
<td>-31.9</td>
<td>-32.7</td>
</tr>
<tr>
<td>HU.EC</td>
<td>-14.9</td>
<td>-27.2</td>
<td>-28.4</td>
<td>-28.4</td>
</tr>
<tr>
<td>HU.RT</td>
<td>-9.3</td>
<td>-9.3</td>
<td>-10.4</td>
<td>-11.1</td>
</tr>
<tr>
<td>AU.HU</td>
<td>12.7</td>
<td>24.0</td>
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**Notes:**
AU is Austria, HU is Hungary, EC is the Economic Community, and RT is the rest of the world.
<table>
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<th>Scenarios:</th>
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</table>

Notes: AU is Austria, HU is Hungary, EC is the Economic Community, and RT is the rest of the world.
Table 12 — Sectoral Real Value Added in Hungary
(Percent change from base run)

<table>
<thead>
<tr>
<th>Scenarios:</th>
<th>1</th>
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<th>3</th>
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<td>integration</td>
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<td>6.5</td>
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<td>-6.6</td>
<td>-7.1</td>
<td>-7.4</td>
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|                    |                    |                    |                    |                    |                    |
| Agric              | -0.3               | -8.2               | -8.2               | -8.3               | -6.8               |
| Construct          | 0.8                | 3.8                | 3.9                | 4.1                | 3.6                |
| Intermed           | 16.5               | 24.5               | 24.4               | 25.0               | 24.2               |
| Mfg                | -21.8              | -13.8              | -13.6              | -13.5              | -14.5              |
| Light mfg          | -6.0               | -3.2               | -3.2               | -2.9               | -3.5               |
| Prod svc           | -0.5               | 0.5                | 0.5                | 0.5                | 0.4                |
| Other svc          | -4.4               | -2.8               | -3.1               | -3.5               | -3.7               |
Table 13 — Sectoral Exports, Mobile Capital Model
(precent change from base run)

<table>
<thead>
<tr>
<th></th>
<th>1 ruble trade liberalization</th>
<th>2 domestic liberalization</th>
<th>3 AU-HU integration</th>
<th>4 partial EC integration</th>
<th>5 full EC integration</th>
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Table 14 – Sectoral Exports, Fixed Capital Model
(Percent change from base run)

<table>
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ameliorated (Table 8), but the rise in GDP is not sufficient to offset the major deterioration in the international terms of trade facing Hungary as it seeks to expand its exports. The model may overstate the terms-of-trade shock due to the assumption of international product differentiation. However, the required trade expansion is very large for Hungary and, even though it is a small country, it is difficult to see how it can expand trade by these magnitudes without significant terms-of-trade effects.\(^{18}\)

At the sectoral level, the effects of reorienting trade are dramatic (Tables 13 and 14). With the loss of ruble area markets, Hungary increases exports (especially agriculture and intermediate exports) to all markets (Table 9). Austria and the EC both increase exports to Hungary, mainly of intermediates and machinery, and greatly decrease agricultural exports to Hungary (although the base levels are small). There is little change in their bilateral exports or exports to the rest of the world.

Domestic restructuring leads to major changes in the structure of output, mirroring the changes in trade. Ruble trade elimination leads to a dramatic expansion of the sector producing intermediates, and a decline in manufacturing (Table 12). Adding domestic liberalization further increases the production of intermediates, and also slows (with fixed capital) or reverses (with mobil capital) the decline in manufacturing. In both scenarios, there is a decline in agriculture.

Overall the elimination of ruble trade and domestic liberalization cause major shifts in resource use and large terms-of-trade shocks. With mobile capital, the extent of structural change is larger, and there are significant increases in efficiency of resource use leading to significantly increased GDP. The adjustment, however, is major and the model undoubtedly

\(^{18}\)Our terms-of-trade results are roughly consistent with those estimated by Oblath and Tarr (1991), who used a partial equilibrium approach, analyzing sectoral data.
understates the adjustment costs that would likely be incurred. There is a tradeoff between slowing the rate of structural change to minimize the disruption and achieving the efficiency gains that accompany the reallocation of resources.

5.2 Trade Liberalization

The three trade liberalization scenarios examine the effects of a free trade association between Hungary and Austria, a partial FTA between them and the EC, and, finally, both joining the EC. Hungary has the highest starting tariff levels, Austria the lowest, with the EC in between. The EC has the highest agriculture import barriers due to the CAP (see Table 5).  

Adding trade liberalization to domestic restructuring in Hungary leads to further increases in trade. However, there is little further depreciation of the real exchange rate or deterioration in the international terms of trade. Real wages increase significantly from the levels achieved under domestic liberalization, but never reach their starting levels. Increased trade leads to only slight changes in GDP. The mobile capital model displays somewhat larger responses to trade liberalization than does the fixed capital model, but the differences are much less than those arising from the domestic liberalization scenarios.

In the free trade agreement with Austria (scenario 3), bilateral trade increases, especially two-way trade in agriculture (Tables 13 and 14). Austria also has a large increase in machinery exports to Hungary. No trade is diverted from other sources in this scenario. In an industrial FTA including Austria, Hungary, and the EC (Scenario 4), Hungary is able

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19 The model does not explicitly capture the price and export subsidies involved in the common agricultural policy in the E.C. model, but only models the import protection side.
to increase exports to all partners. Austria increases exports to the EC, diverting some trade from both Hungary and the rest of the world, compared to scenario 3 (Tables 10 and 11).

If Austria and Hungary were to join the EC and adopt the common external tariffs of the EC (Scenario 5), more trade is diverted. Hungary increases overall exports to the EC, especially agriculture exports, at the expense of the rest of the world. Austria also diverts exports from the rest of the world to the EC. There is some structural change in Austria as a result of the removal of EC agricultural protection. Agricultural value added increases, but that of machinery and light manufacturing falls (not tabulated). Real wages in Austria also fall, relative to their level under partial EC liberalization (scenario 4). For all three countries, there is a large increase in bilateral agricultural trade.

Comparing the fixed and mobile capital models indicates that increased factor mobility enhances the adjustment process. For example, with mobile capital, trade increases more in response to changes in incentives than under fixed capital, and the wage improvement is greater. In all scenarios, however, the structural changes are far greater in Hungary from domestic liberalization than from trade agreements with Austria and the EC.

6. Conclusion

Hungary increases exports with each step of liberalization, but the biggest increases are from domestic restructuring, especially from the elimination of ruble trade. Increased integration is trade creating for Hungary with the exception of joining the EC, where some trade is diverted from the rest of the world. Austria and the EC are not greatly affected by increased integration with Hungary. Austrian exports increase most with more EC integration, rather than integration with Hungary. However, if Austria were to join the EC
with CAP level tariffs still in place, it would distort production to agriculture and cause a decline in real wages. The EC is too large in relation to both Austria and Hungary for liberalization to have much impact.

Although trade liberalization is necessary to promote competition in a small country, and Hungary's goal is increased integration with Western Europe, the transformation forced by the collapse of ruble area trade has much more impact. Trade liberalization matters much more to Hungary than to its trade partners. Hungary can gain even from an intermediate step of integration with Austria, but much more from EC integration. The implication for the EC is that Hungary's exports are so small that increases will not have much effect in the EC, but a large beneficial effect on Hungary. The phasing in of EC tariff and quota reductions over ten years, as planned in the agreements for associate EC status for Hungary, Poland, and Czechoslovakia may be overcautious. Austria also stands to gain from more integration with the EC, but less if the existing high agricultural tariffs associated with the CAP are adopted.

In general, our results indicate that Hungary's domestic restructuring will have a much more profound effect than any form of trade liberalization with Austria and the EC. However, the collapse of ruble trade and domestic restructuring require enormous changes in Hungary's trade structure, and integration with Austria and the EC will facilitate such restructuring. If Hungary can change its trade structure without engendering terms-of-trade losses, then the whole restructuring process will be much smoother. There are major efficiency gains to be achieved. The problem is to achieve them without the sort of catastrophic adjustment costs that have characterized the adjustment process in East Germany and Poland.
References


Appendix: The Hapsburg (Hungary-Austria-EC) CGE Model

Introduction

This appendix presents the equations of the Hapsburg (Hungary-Austria-EC) CGE model in the format of the software in which the program was written, GAMS. GAMS stands for "General Algebraic Modeling System" and the software is described in Brooke, Kendrick, and Meeraus (1988). For ease of exposition, the model equations are somewhat simplified. All sectors are shown with CET transformation functions between goods supplied to the domestic and export markets.

GAMS statements are case insensitive. However, we use a number of notation conventions to improve readability:

Variables are all in upper case. Variable names with a suffix 0 represent base-year values and are specified as parameters (or constants) in the model. Parameters are all in lower case. Sets are all in lower case.

In the GAMS language:

Parameters are treated as constants in the model and are defined in separate "PARAMETER" statements.
"SUM" represents the summation operator, sigma.
"PROD" represents the product operator, pi.
"LOG" is the natural logarithm operator.
"$" introduces a conditional "if" statement.
The suffix .FX indicates a fixed variable.
The suffix .L indicates the level or solution value of a variable.
The suffix .LO indicates the lower bound of a variable.
The suffix .UP indicates the upper bound of a variable.
An asterisk (*) in column one indicates a comment. Some alternative treatments are shown commented out.
A subset is denoted by the subset name followed by the name of the larger set in parentheses. In statements, the subset name is then used by itself.
A semicolon (;) terminates a GAMS statement.
Items between slashes ("/") are data.
The Hungary-Austria-EC CGE Model in GAMS

*Definition of sets*

**SETS**

ctyl universe

k(ctyl) COUNTRIES

I SECTORS OF PRODUCTION /

ag agriculture, forestry and food industry
bc building materials and construction
im mining, electricity, metallurgy and chemicals
ma machinery and equipment
lm light and other manufacturing
ps productive services
ns non-productive services /

iel(i,k) cet export sectors
ie2(i,k) competitive export sectors

iff factors of production / capital labor

hh households /hhall /

ins institutions /labr labor enterprises /

ied(i,k) = not ie2(i,k) ;
iedn(i,k) = not ied(i,k) ;
iqr(i,k,ctyl) = no ;
iqrn(i,k,ctyl) = not iqr(i,k,ctyl) ;

ALIAS(i,j) ;
ALIAS(k,l) ;
ALIAS(ctyl,cty2,cty3) ;
ALIAS(la,lb) ;
ALIAS(iff,f) ;

SET pt(k,ctyl) / au. (hu,ec,rt) hu. (au,ec,rt) ec. (au,hu,rt) / ;

SET pt2(ctyl,cty2) / au. (hu,ec,rt) hu. (au,ec,rt) ec. (au,hu,rt) rt. (au,hu,ec) / ;

SET pt3(ctyl,cty2) / au. (hu,ec) hu. (au,ec) ec. (au,hu) / ;
*Definition of variables*

**VARIABLES**

*## PRICE BLOCK*

- **EXR(k)**: exchange rate
- **P(i,k)**: price of composite good
- **PD(i,k)**: domestic price
- **PE(i,k,ctyl)**: domestic price of exports
- **PINDEX(k)**: numeraire price index
- **PM(i,k,ctyl)**: domestic price of imports
- **PWE(i,ctyl,cty2)**: world price of exports from ctyl to cty2
- **PWM(i,ctyl,cty2)**: world price of imports into ctyl from cty2
- **PX(i,k)**: average output price
- **PVA(i,k)**: value added price
- **TM2(i,k,ctyl)**: tariff equivalent of CAP policies

*## PRODUCTION AND TRADE BLOCK*

- **E(i,ctyl,cty2)**: exports from ctyl to cty2
- **M(i,ctyl,cty2)**: imports into ctyl from cty2
- **MR(i,k)**: ruble area imports
- **ER(i,k)**: ruble area exports
- **X(i,k)**: coomposite good supply
- **XD(i,k)**: domestic output
- **XXD(i,k)**: domestic sales
- **XXDD(i,k)**: domestic sales net of ruble exports
- **SMQ(i,k,ctyl)**: import value share (AIDS function)
- **INT(i,k)**: intermediate demand

*## FACTOR BLOCK*

- **FS(iff,k)**: factor supply
- **FDSC(i,iff,k)**: factor demand by sector
- **WF(iff,k)**: average factor price
- **YFCTR(iff,k)**: factor income
- **WFDIST(i,iff,k)**: factor price distortion constants

*## INCOME AND EXPENDITURE BLOCK*

- **CDD(i,k)**: final demand for private consumption
- **FSAV(K,ctyl)**: net foreign savings
- **FBAL(k)**: current account balance
- **INDTAX(k)**: indirect tax revenue
- **SSTAX(k)**: factor taxes
- **TARIFF(k,ctyl)**: tariff revenue
- **ESUB(k,ctyl)**: export subsidy expenditure
- **ESUBR(k)**: ruble trade balance, net of tariffs and subsidies
- **YH(hh,k)**: household income
- **YINST(ins,k)**: institutional income
- **WALRAS** (system): Walras law for system
- **WALRAS2(k)** (country): Walras law for each country
- **GDGTV(k)**: government real consumption
- **GD(i,k)**: government demand by sector
- **GOVSAV(K)**: government saving
- **GOVREV(k)**: government revenue
- **HHT(k)**: govt transfers to households
- **GPROF(k)**: government's share of distributed profits of firms
- **ENTT(k)**: govt transfers to enterprises
- **ID(i,k)**: investment demand by sector of origin
- **DST(i,k)**: inventory investment demand
- **ZTOT(k)**: aggregate nominal investment
ZFIX(k) fixed aggregate real investment
HSAV(k) aggregate Household savings
REMIT(k) remittance income to households
FKAP(k) foreign capital flow to enterprises
FBOR(k) foreign borrowing by government
FSAVE(k) foreign savings
ENTSAV(k) enterprise savings
ESR(k) enterprise savings rate
VATAX(k) value added taxes
ENTAX(k) enterprise taxes
HTAX(k) household taxes

Definition of parameters

PARAMETERS

tm(i,k,ctyl) tariff rates on imports
te(i,k,ctyl) subsidy rates on exports
tm2(i,k,ctyl) import tariff equivalent rates
pxdwt(i,k) price index weights
io(i,j,k) input output coefficients by country
rhoc(i,k) CES import aggregation parameter
rhot(i,k) CET export transformation parameter
etae(i,k) export demand elasticity for rest of world
ac(i,k) CES import function shift parameter
ad(i,k) production function shift parameter
alpha(i,iff,k) Cobb-Douglas factor share parameter
at(i,k) CET export function shift parameter
delta(i,k,ctyl) CES import function share parameter
gamma(i,k,ctyl) CET export function share parameter
smq0(i,k,ctyl) share parameter in Stone price index
aq(i,k) constant in translog price index
aq(i,k) constant in Stone price index
amq(i,k,ctyl) constant in AIDS function
betaq(i,k,ctyl) constant in AIDS function
gammaq(i,k,ctyl) price coefficient in AIDS function
cles(i,hh,k) household consumption shares
gles(i,k) government expenditure shares
zshr(i,k) investment demand shares
sintyh(hh,ins,k) institution to household income mapping shares
mps(hh,k) savings propensities by households
esr(k) factor income tax rate
ssstr(iff,k) household income tax rate
hhrtr(hh,k) enterprise income tax rate
entr(k) value added tax rate
vatr(i,k) indirect tax rate
itax(i,k)

Equation Declaration

EQUATIONS

PRICE BLOCK

PMDEF(i,k,ctyl) definition of domestic import prices
PEDEF(i,k,ctyl) definition of domestic export prices
PDDEF(i,k,ctyl) definition of domestic export price for substitutes
ABSORPTION(i,k)  value of domestic sales
SALES(i,k)  value of domestic output
SALES2(i,k)  value of domestic sales net of ruble trade
PINDEXDEF(k)  definition of general price level
ACTP(i,k)  value added price inclusive of subsidies

### PRODUCTION BLOCK

ACTIVITY(i,k)  production function
INTEQ(i,k)  Intermediate demand
PROFITMAX(i,iff,k)  first order conditions for profit maximum
CET(i,k)  CET function
CET2(i,k)  output with infinite elastic transformation
ESUPPLY(i,k,ctyl)  export supply
EDEMAND(i,k)  export demand from rest of world
* ARMINGTON(i,k)  composite good aggregation function
* COSTMIN(i,k,ctyl)  F.O.C. for cost minimization of composite good
PDAIDS(i,k)  price transformation for aids
* TRLOGP(i,k)  translog price index
STONEP(i,k)  Stone price index
AIDS(i,k,ctyl)  AIDS import share equation
AIDS2(i,k,ctyl)  definition of import expenditure shares
AIDS3(i,k)  demand for domestic good

### INCOME BLOCK

YFCTREQ(iff,k)  factor income
HHY(hh,k)  household income
TARIFFDEF(k,ctyl)  tariff revenue
ESUBDEF(k,ctyl)  export subsidy expenditure
ESUBRDEF(k)  net ruble trade inclusive of tariffs and subsidies
INDTAXDEF(k)  indirect taxes on domestic production
YINST1(k)  labor institution income
YINST2(k)  enterprise institution income
ENTAXEQ(k)  enterprise taxes
SSTAXEQ(k)  social security tax
HTAXEQ(k)  household taxes
VATAEQ(k)  value added tax
GOVREVEQ(k)  government revenue
GOVSAVEQ(k)  government savings
HSAVEQ(k)  household savings
ENTSAVEQ(k)  enterprise savings
TOTSAVE(k)  total savings
FORSAVE(k)  foreign savings

### EXPENDITURE BLOCK

INVEST(i,k)  fixed investment demand by sector
INVEST2(k)  total investment demand
CDDEQ(i,k)  consumer demand
GDEQ(i,k)  government expenditure

### MARKET CLEARING

EQUIL(i,k)  goods market equilibrium
PMEQUIL(iff,k)  factor market equilibrium

### BALANCE OF TRADE EQUILIBRIUM

CAEQ(k,ctyl)  trade balance by trade partner
FBALEQ(k)  aggregate trade balance by country

### TRADE CONSISTENCIES
TRCON(i,cty1,cty2) export import symmetry conditions
TRCON10(i,cty1,cty2) PWM to PWE consistency

*# PRICE BLOCK

PMDEF(tr,k,cty1)$pt(k,cty1).. PM(tr,k,cty1) =E= PWM(tr,k,cty1)*EXR(k)*(1 + TM(tr,k,cty1) + tm2(tr,k,cty1))

PEDEF(tr,k,cty1)$pt(k,cty1).. PE(tr,k,cty1) =E= PWE(tr,k,cty1)*EXR(k)*(1 + TE(tr,k,cty1))

PDDEF(i,k,cty1)$ie2(i,k)$pt(k,cty1).. PE(1,k,cty1) =E= PD(i,k)

*# PRODUCTION BLOCK

ACTIVITY(i,k).. XD(i,k) =E= AD(i,k)*PROD(iff$alpha(i,iff,k), FDSC(i,iff,k)**ALPHA(i,iff,k));

PROFITMAX(i,iff,k)$WFDIST0(i,iff,k).. WF(iff,k)*WFDIST(i,iff,k)*FDSC(i,iff,k) =E= XD(i,k)*(1- vatr(i,k))*PVA(i,k)*ALPHA(i,iff,k)

CET(i,k)$iel(i,k)..

CET2(i,k)$ie2(i,k)..

EDEMAND(i,k)$ied(i,k) E(i,k,"rt") =E= E0(i,k,"rt")*(PWE(i,k,"rt")/PWE0(i,k,"rt"))**(-etae(i,k))

* ARMINGTON(tr,k).. X(tr,k) =E= AC(tr,k)*SUM(ctyl$M0(tr,k,cty1), DELTA(tr,k,cty1)*M(tr,k,cty1)**(-RHOC(tr,k))) + (1-SUM(cty2$PT(k,cty2),DELTA(tr,k,cty2)))*XXDD(tr,k)**(-1/RHOC(tr,k))

* ARMINGTON2(trn,k).. X(trn,k) =E= XXDD(trn,k)
* COSTMIN(tr,k,cty1)$M0(tr,k,cty1) = M(tr,k,cty1)/XXDD(tr,k) =E= 
  (PD(tr,k)/PM(tr,k,cty1)*DELTA(tr,k,cty1)/
   (1 - SUM(cty2$PT(k,cty2), DELTA(tr,k,cty2)))/
   (1/1+RHOCT(tr,k))) ;

**# AIDS import demand equations. Alternative to CES equations. In AIDS**
**# version, Stone or translog price index can be used.**
**# Notation: domestically produced goods sold at home are indicated as**
**# imports from a country to itself.**

PDAIDS(i,k) =E= PD(i,k) ;

**# Translog price index**
TRLOGP(i,k) =E= AQ(i,k) + SUM(cty2, AMQ(i,k,cty2)
  *LOG(PM(i,k,cty2))) + (1/2)*SUM((cty1,cty2),
   GAMMAQ.L(i,k,cty1,cty2)*LOG(PM(i,k,cty1))
   *LOG(PM(i,k,cty2))) ;

**# Stone price index**
STONEP(i,k) =E= LOG(AQS(i,k)) + SUM(cty2,
  SQOQ(i,k,cty2)*LOG(PM(i,k,cty2))) ;

AIDS(i,k,cty1) =E= AMQ(i,k,cty1) + BETAQ(i,k,cty1)
  *LOG(X(i,k)) + SUM(cty2, GAMMAQ.L(i,k,cty1,cty2)
   *LOG(PM(i,k,cty2)));

AIDS2(i,k,cty1)$pt(k,cty1) =E= PM(i,k,cty1)*M(i,k,cty1) =E= 
  smq(i,k,cty1)*P(i,k)*X(i,k) ;

AIDS3(i,k) =E= PD(i,k) * XXDD(i,k) =E= SMQ(i,k,cty1) * X(i,k)*P(i,k) ;

**# INCOME BLOCK**

YFCTREQ(iff,k) =E= SUM(i, WF(iff,k)*WFDIST(i, iff,k)
  *FDSC(i,iff,k));

TARIFFDEF(k,cty1) =E= SUM(tr, TM(tr,k,cty1)*M(tr,k,cty1)
  *PWM(tr,k,cty1))*EXR(k) ;

ESUBDEF(k,cty1) =E= SUM(tr, TE(tr,k,cty1)*E(tr,k,cty1)
  *PWE(tr,k,cty1))*EXR(k) ;

ESUBRDEF(k) =E= SUM(i, PD(i,k)*ER(i,k) - P(i,k)*MR(i,k) ) ;

PREMIUM(k,cty1) =E= SUM(tr, TM2(tr,k,cty1)*M(tr,k,cty1)
  *PWM(tr,k,cty1))*EXR(k) ;

INDTAXDEF(k) =E= SUM(i, ITAX(i,k)*PX(i,k)*XD(i,k) ) ;

YINST1(k) =E= SUM(la, (1.0 - sstr(la,k))*YFCTR(la,k));

YINST2(k) =E= YFCTR("capital",k)*(1.0-sstr("capital",k))
  + EXR(k)*FKAP(k) - ENTSAV(k) - ENTA(k) + ENT(k)
  + SUM(cty1, PREM(k,cty1)) - GPROF(k)
  - SUM(i, (XD(i,k)*(1 - ratr(i,k)))*PVA(i,k) ;

HHY(hh,k) =E= SUM(ins, sintyh(hh,ins,k)*YINST(ins,k))
  + rhsh(hh,k)*EXR(k)*REMIT(k) + HHT(k)*thsh(hh,k) ;

ENTAXEQ(k) =E= ENTR(k)*YFCTR("capital",k) + ENTT(k) ;
SSTAXEQ(k)

HTAXEQ(k)

VATAEQ(k)

GOVREVEQ(k)

GOVSAVEQ(k)

HSAVEQ(k)

ENTSAVEQ(k)

TOTSAVE(k)

FOSAVE(k)

*## EXPENDITURE BLOCK

CDDEQ(i, k)

GDEQ(i, k)

INVEST(i, k)

INVEST2(k)

*** MARKET CLEARING

*** PRODUCT MARKETS

EQUIL(i, k)

*** FACTOR MARKETS

FNEQUIL(iff, k)

*** BALANCE OF TRADE

CAEQ(k, cty)

FBALEQ(k)

*** TRADE CONSISTENCIES AND FIXED WORLD PRICES

TRCON7

TRCON10(tr, cty1, cty2)

TRCON(tr, cty1, cty2)

PWM.FX(tr, k, "rt")

PWE.FX(i, k, "rt")
### FACTOR MARKET CLOSURE

* Factors are fully mobile with factor returns adjusting, base year
* factor distortions (WFDIST) fixed
* Alternative: Hungary has fixed capital.

\[
\begin{align*}
FS.FX(iff,k) &= FS0(iff,k) \\
WFDIST.FX(i,iff,k) &= WFDIST0(i,iff,k)
\end{align*}
\]

### FOREIGN MARKET CLOSURE

* The foreign balance (current account balance) is fixed exogenously
* and the exchange rate is the equilibrating variable. Each country has
* one exchange rate variable and one balance of trade constraint (FBAL).
* FBAL is defined for each country with respect to the aggregate of trade
* balances with all trading partners. Cross exchange rates are implicitly
* set by arbitrage conditions. Bilateral trade balances are not fixed.
* The model has variables to finance the balance of trade (FBOR, REMIT,
* FKAP and FSAVE). FSAVE is determined residually.

\[
\begin{align*}
FBAL.FX(k) &= FBAL0(k) \\
EXR.FX(k) &= EXR0(k) \\
FBOR.FX(k) &= FBOR0(k) \\
REMIT.FX(k) &= REMIT0(k) \\
FKAP.FX(k) &= FKAP0(k)
\end{align*}
\]

### TARIFF EQUIVALENT OF CAP POLICY

\[
TM2.FX(tr,k,ctyl) = TM20(tr,k,ctyl)
\]

### RUBLE TRADE CONSTRAINTS

* Ruble trade flows are fixed exogenously

\[
\begin{align*}
ER.FX(i,k) &= ER0(i,k) \\
MR.FX(i,k) &= MR0(i,k)
\end{align*}
\]

### GOVERNMENT CLOSURE

* Real government spending (GDTOT) is fixed exogenously, the government
* deficit (GOVSAV) is determined residually.

\[
\begin{align*}
GDTOT.FX(k) &= GDTOTO(k) \\
GD.FX(i,k) &= GD0(i,k) \\
HHT.FX(k) &= HHT0(k) \\
ENTT.FX(k) &= ENTTO(k) \\
GPROF.FX(k) &= GPROFO(k)
\end{align*}
\]

### INVESTMENT CLOSURE

* Total real investment is fixed exogenously, savings adjusts.
* The inventory component of investment (DST) is fixed exogenously.

\[
\begin{align*}
ZTOT.FX(k) &= ZTOT0(k) \\
ESR.FX(k) &= ESR0(k) \\
DST.FX(i,k) &= DST0(i,k) \\
ID.FX(i,k) &= ID0(i,k) \\
ZFIX.FX(k) &= ZFIX0(k)
\end{align*}
\]

### NUMERAIRE PRICE INDEX

\[
PINDEX.FX(k) = PINDEX0(k)
\]