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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.

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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 Gabor (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)].

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

[2]Knight (1983), Williamson (1991), Etzioni (1991), and Roe and Roy (1989) all compare country experiences across the region.

In parallel with economic analysis is a growing literature concerned with the political transition within Eastern Europe. While some have attempted to developed 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.[3] 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

[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.[4] 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

[4]There 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

	Population 1989	GDP per Capita, 1989	Share of total exports: to USSR and East Europe	non-convertible currency
	millions	US$	percent	percent
Bulgaria	9.0	1,730	72%	—
Czechoslovakia	15.6	3,235	55%	62%
Hungary	10.6	2,742	67%	39%
Poland	37.9	1,802	70%	36%
Romania	23.2	—	39%	—

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:
GDP and population data are for 1989 and come from World Bank, World Development Report 1991. Exports come from the CIA, Handbook of Economic Statistics, 1991 (preliminary) and the IMF, International Financial Statistics.

Table 2 — Eastern European External Debt, 1989

	Commercial	Official	BIS/IMF	Total
		$ billions		
Bulgaria	8.8	1.2	0.0	10.0
Czechoslovakia	5.9	1.9	0.0	7.8
Hungary	15.7	3.2	1.8	20.7
Poland	13.4	26.3	0.0	39.7
Romania	0.2	0.2	0.0	0.4

Notes:
BIS is the Bank for International Settlements.
Sources:
CIA, Handbook of Economic Statistics, 1991 (preliminary).

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.[5] 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.[6]

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

[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)].[8] 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

[8]The current model was updated with data from the Osterreichiches Volkseinkommen, 1989 by Fritz Breuss.

Table 3 — Comparative Aggregate Data: Hungary, Austria, and the European Community (EC)

	Hungary	Austria	EC
GDP ($US billions, 1989)	29.1	126.5	4689.9
Per Capita GDP ($US, 1989)	2,742	16,642	14,413
Export share in GDP (percent)	17.8	40.0	30.0
Export shares by country (percent)			
to Hungary	—	1.3	0.2
to Austria	12.3	—	2.4
to the EC	46.3	65.1	—
to the rest of the world	41.4	33.6	97.4
Total population (millions)	10.6	7.6	325.4

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 4 — Sectoral Structure: Hungary, Austria, and EC, Base Solution

Commodity	Sectoral shares (percent) in: GDP: Hungary	Austria	EC	Employment: Hungary	Austria	EC
Agriculture and Food	23.9%	8.9%	5.2%	30.4%	4.3%	2.8%
Building and Construction	10.1%	7.4%	7.0%	7.8%	7.6%	8.2%
Intermediates	19.6%	21.9%	24.9%	5.7%	13.9%	21.6%
Manufacturing	13.9%	7.2%	11.2%	8.6%	5.0%	9.7%
Light Manufactures	8.4%	8.2%	8.5%	9.2%	9.9%	7.3%
Productive Services	12.7%	33.4%	30.8%	18.5%	36.3%	36.4%
Non Productive Services	11.4%	13.0%	11.9%	19.9%	22.9%	14.1%

	Imports: Hungary	Austria	EC	Exports: Hungary	Austria	EC
Agriculture and Food	12.5%	6.7%	11.7%	25.4%	3.9%	9.1%
Building and Construction	2.8%	0.2%	2.4%	3.2%	0.5%	2.7%
Intermediates	34.1%	49.9%	24.4%	32.4%	40.4%	50.2%
Manufactures	30.0%	23.9%	12.5%	19.9%	16.5%	17.1%
Light Manufactures	14.2%	13.3%	40.5%	12.2%	22.7%	15.6%
Productive Services	6.5%	5.7%	3.3%	6.8%	15.6%	5.2%
Non Productive Services	0.0%	0.3%	5.2%	0.0%	0.3%	0.0%

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.[9] 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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[9]See 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.[10] 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

[10]Enterprise 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.[11] 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.[12] 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

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[11]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 Devarajan, Lewis, and Robinson (1990).

[12]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).[13] 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) analyzè 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, $PX_{i,k}$, which is effectively a weighted average of the prices of output sold in the domestic market, $PD_{i,k}$, and in each export market, $PE_{i,k,c1}$. 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, $PM_{i,k}$, and the domestic good price, $PD_{i,k}$.[15] 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" ($PD_{i,k}$) to those for tradeables ($PM_{i,k,c1}$ and $PE_{i,k,c1}$) — 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.

[15]PX is a CET aggregation of PD and PE, while P is a translog or Stone aggregation of PD and PM.

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.[16] 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.

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[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

Commodity	Hungary	Austria	EC
Agriculture and Food	14.7%	3.0%	32.0%
Building and Construction	1.1%	0.8%	0.0%
Intermediates	4.9%	1.1%	7.0%
Manufacturing	18.0%	2.5%	3.0%
Light Manufactures	12.0%	2.6%	6.0%
Productive Services	2.0%	0.5%	0.0%
Non Productive Services	0.0%	0.4%	0.0%

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

Sector	Ruble trade share of output		Sectoral tax rate	Factor market distortion index	
	Exports	Imports		Labor	Capital
Agriculture	5.3%	1.3%	-5.1%	71.6	192.3
Construction	0.7	1.5	9.7	166.3	206.9
Intermediates	3.3	20.4	8.8	141.5	133.0
Manufacturing	37.0	24.9	9.4	132.2	250.2
Light mfg	10.9	7.4	1.9	81.1	168.3
Productive svc	1.6	2.0	-0.4	105.8	86.8
Other svc	0.0	0.0	-1.7	95.1	26.5

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 7 — Description of Scenarios

No.	Scenario	Description
1.	Ruble trade elimination	Eliminate all Ruble trade in Hungary.
2.	Hungarian domestic liberalization	Scenario 1 plus eliminate differentiated sectoral taxes and subsidies, replace them with a uniform value added tax, and eliminate factor market distortions.
3.	Austria-Hungary integration	Scenario 2 plus eliminate all sectoral tariffs and import rationing between Hungary and Austria.
4.	Partial EC integration	Scenario 3 plus eliminate all non-agricultural tariffs between Austria, Hungary, and the EC.
5.	Full EC integration	Scenario 4 plus eliminate agricultural tariffs and quotas between Austria, Hungary, and the EC; and adopt EC tariffs with respect to rest of world.

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.[17]

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

[17]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.

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)

	Scenarios: 1 ruble trade elimination	2 domestic liberalization	3 AU-HU integration	4 partial EC integration	5 full EC integration
Mobile capital model					
Real GDP	-1.0	10.4	10.4	10.6	10.5
Real exports	23.2	47.1	49.5	54.1	56.6
Real imports	6.8	22.4	23.6	25.9	27.9
Real exchange rate	12.8	7.1	7.7	8.1	6.6
Terms of trade	-12.8	-20.2	-21.4	-21.8	-21.7
Factor prices					
Wage	-4.5	-2.3	-2.1	-1.2	-0.9
Rental	-1.8	-2.7	-2.4	-1.4	-1.0
Fixed capital model					
Real GDP	-1.6	0.3	0.3	0.3	0.1
Real exports	22.7	23.9	25.9	29.7	31.8
Real imports	7.6	9.7	10.6	12.5	14.6
Real exchange rate	12.7	12.6	13.4	14.2	11.8
Terms of trade	-11.5	-13.2	-14.4	-14.9	-14.6
Factor prices					
Wage	-6.5	-7.9	-7.7	-6.7	-6.4
Rental	-1.4	-1.3	-1.0	0.3	0.4

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)

	Scenarios:				
	1 ruble trade elimination	2 domestic liberalization	3 AU-HU integration	4 partial EC integration	5 full EC integration
Mobile capital model					
Real GDP	0.0	0.0	0.0	0.1	0.0
Real exports	0.0	0.0	0.0	1.3	0.0
Real imports	0.3	0.6	0.7	3.3	2.4
Real exchange rate	-0.1	-0.3	-0.4	-2.1	-3.1
Terms of trade	4.2	9.5	9.6	11.4	11.2
Factor prices					
Wage	0.1	0.2	0.2	1.3	0.5
Rental	0.1	0.2	0.3	1.2	1.1
Fixed capital model					
Real GDP	0.0	0.0	0.0	0.1	-0.1
Real exports	0.0	0.0	0.1	1.3	0.2
Real imports	0.3	0.3	0.4	3.1	2.3
Real exchange rate	-0.2	-0.2	-0.3	-1.9	-3.1
Terms of trade	2.3	4.2	4.3	6.0	5.7
Factor prices					
Wage	0.1	0.1	0.2	1.3	0.9
Rental	0.1	0.1	0.1	1.1	0.2

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)

	Scenarios: 1 ruble trade elimination	2 domestic liberalization	3 AU-HU integration	4 partial EC integration	5 Full EC integration
			Bilateral exports		
HU.AU	17.4	31.2	34.7	37.6	37.9
HU.EC	16.8	22.9	23.8	28.7	41.4
HU.RT	32.1	79.0	82.8	87.7	79.3
AU.HU	22.5	46.3	58.6	55.0	54.0
AU.EC	-0.1	-0.3	-0.4	3.9	4.4
AU.RT	-0.5	-1.1	-1.3	-5.9	-10.4
EC.HU	7.8	13.7	12.9	19.2	21.9
EC.AU	0.1	0.3	0.3	3.3	5.8
EC.RT	0.0	0.0	0.0	0.0	0.0
			Bilateral terms of trade		
HU.AU	-16.4	-31.0	-31.9	-32.7	-32.1
HU.EC	-14.9	-27.2	-28.4	-28.4	-28.0
HU.RT	-9.3	-9.3	-10.4	-11.1	-11.5
AU.HU	12.7	24.0	26.0	26.4	26.9
AU.EC	4.1	9.4	9.5	12.3	12.5
AU.RT	4.0	9.2	9.3	9.0	8.2
EC.HU	3.7	5.6	5.4	6.6	6.2
EC.AU	0.6	1.2	1.2	1.4	1.7
EC.RT	0.5	1.1	1.1	0.4	0.1

Notes:
AU is Austria, HU is Hungary, EC is the Economic Community, and RT is the rest of the world.

Table 11 — Bilateral Trade and Prices, Fixed Capital Model
(percent change from base run)

	Scenarios:				
	1 ruble trade elimination	2 domestic liberalization	3 AU-HU integration	4 partial EC integration	5 Full EC integration
			Bilateral exports		
HU.AU	11.4	13.6	17.0	19.7	19.6
HU.EC	13.3	12.5	13.4	17.7	30.8
HU.RT	36.7	39.8	42.6	46.0	36.5
AU.HU	24.4	27.5	37.8	34.2	32.8
AU.EC	-0.2	-0.2	-0.3	4.0	4.4
AU.RT	-0.5	-0.6	-0.7	-5.2	-9.2
EC.HU	9.3	9.4	8.5	14.2	16.8
EC.AU	0.2	0.2	0.2	3.2	5.9
EC.RT	0.0	0.0	0.0	0.0	0.0
			Bilateral terms of trade		
HU.AU	-12.1	-17.2	-18.2	-19.0	-18.3
HU.EC	-12.7	-16.5	-17.8	-17.8	-17.3
HU.RT	-10.0	-8.4	-9.6	-10.4	-10.6
AU.HU	11.3	14.1	15.8	16.2	16.8
AU.EC	2.2	4.2	4.2	7.0	6.9
AU.RT	2.1	4.1	4.1	3.8	3.0
EC.HU	4.0	4.0	3.8	4.8	4.6
EC.AU	0.4	0.6	0.7	0.8	1.1
EC.RT	0.3	0.6	0.6	-0.2	-0.5

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)

	Scenarios:				
	1 ruble trade elimination	2 domestic liberalizaation	3 AU-HU integration	4 partial EC integration	5 full EC integration
			Mobile capital model		
Agric	-0.4	-5.7	-6.1	-6.5	-3.6
Construct	1.0	12.4	12.7	13.2	12.3
Intermed	22.8	54.4	54.5	55.6	54.5
Mfg	-23.7	6.5	7.1	8.1	6.1
Light mfg	-6.4	4.7	4.5	4.8	3.8
Prod svc	-0.6	6.5	6.5	6.5	6.3
Other svc	-4.4	-6.3	-6.6	-7.1	-7.4
			Fixed capital model		
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)

	Scenarios: 1 ruble trade liberalization		2 domestic liberalization		3 AU-HU integration		4 partial EC integration		5 full EC integration	
Hungary	HU.AU	HU.EC	HU.AU	HU.EC	HU.AU	HU.EC	HU.AU	HU.EC	HU.AU	HU.EC
Agric	40.8	40.1	-2.3	-3.6	8.6	-1.8	14.8	-1.5	17.5	60.5
Intermed	14.5	14.4	43.6	43.4	45.5	44.2	48.0	52.1	47.8	50.3
Mfg	-0.7	-0.8	17.4	17.2	18.8	17.6	20.5	19.4	20.0	18.6
Light mfg	6.4	6.3	9.6	9.4	12.1	9.9	13.7	14.8	13.2	13.5
Austria	AU.HU	AU.EC	AU.HU	AU.EC	AU.HU	AU.EC	AU.HU	AU.EC	AU.HU	AU.EC
Agric	-35.1	-0.4	9.6	-0.9	56.1	-1.1	46.7	-6.0	51.2	54.5
Intermed	38.1	0.1	58.6	0.0	63.8	-0.1	62.0	7.1	60.6	5.3
Mfg	22.8	-0.2	42.2	-0.4	60.5	-0.5	52.2	1.3	49.0	-1.0
Light mfg	-3.6	-0.5	19.8	-1.0	31.2	-1.1	27.4	4.5	24.0	0.9
EC	EC.HU	EC.AU	EC.HU	EC.AU	EC.HU	EC.AU	EC.HU	EC.AU	EC.HU	EC.AU
Agric	-33.2	0.5	6.3	1.3	3.7	1.5	2.8	7.1	58.8	24.2
Intermed	14.3	0.1	15.5	0.1	14.7	0.1	18.3	2.4	19.0	4.5
Mfg	9.5	0.2	14.6	0.3	14.1	0.3	22.8	3.6	21.8	4.7
Light mfg	-5.5	0.2	6.1	0.0	5.2	0.5	15.1	5.5	14.7	8.2

Table 14 — Sectoral Exports, Fixed Capital Model
(percent change from base run)

	Scenarios: 1 ruble trade elimination		2 domestic liberalization		3 AU-HU integration		4 partial EC integration		5 full EC integration	
Hungary	HU.AU	HU.EC	HU.AU	HU.EC	HU.AU	HU.EC	HU.AU	HU.EC	HU.AU	HU.EC
Agric	41.6	41.4	16.4	15.8	28.5	18.0	36.1	19.6	31.7	84.3
Intermed	5.0	4.9	14.1	13.9	15.5	14.5	17.1	20.4	16.0	19.1
Mfg	1.7	1.6	7.7	7.6	9.0	7.9	10.4	9.7	9.8	8.9
Light mfg	7.7	7.6	8.7	8.6	11.2	9.1	13.0	14.2	11.8	12.7
Austria	AU.HU	AU.EC	AU.HU	AU.EC	AU.HU	AU.EC	AU.HU	AU.EC	AU.HU	AU.EC
Agric	-36.3	-0.1	-27.0	-0.3	10.4	-0.6	3.8	-4.2	4.8	53.9
Intermed	41.4	-0.1	43.0	-0.1	47.5	-0.2	45.0	6.4	45.1	5.9
Mfg	21.6	-0.2	25.3	-0.2	41.3	-0.3	33.0	1.6	32.8	1.0
Light mfg	-4.4	-0.3	0.6	-0.4	10.3	-0.5	7.0	5.8	7.1	4.9
EC	EC.HU	EC.AU	EC.HU	EC.AU	EC.HU	EC.AU	EC.HU	EC.AU	EC.HU	EC.AU
Agric	-34.2	0.4	-18.8	0.6	-21.1	0.9	-22.6	5.7	25.4	19.2
Intermed	19.8	0.1	17.1	0.1	16.2	0.2	19.9	2.5	20.6	2.7
Mfg	8.1	0.1	8.4	0.2	7.8	0.2	15.5	3.4	15.9	3.7
Light mfg	-6.4	0.1	-4.0	0.2	-4.9	0.2	3.8	5.2	4.7	5.6

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).[19]

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

[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.

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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 betweeen slashes ("/") are data.

```
*#################### Definition of sets ######################

  SETS
  cty1     universe              /AU    Austria
                                  HU    Hungary
                                  EC    European Community
                                  RT    Rest of world /

  k(cty1)  COUNTRIES             /AU    Austria
                                  HU    Hungary
                                  EC    European Community /

I SECTORS OF PRODUCTION /
                ag              agrculture, 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
               /ag.au, ag.hu, ag.ec /

 iff  factors of production / capital     capital
                              labor       labor

 hh  households               /hhall /

 ins  institutions            /labr      labor
                               ent       enterprises /

 iel(i,k)  = not ie2(i,k) ;
 ied(i,k)  = ie2(i,k) ;
 iedn(i,k) = not ied(i,k) ;

 iqr(i,k,cty1)  = no ;
 iqrn(i,k,cty1) = not iqr(i,k,cty1) ;

 ALIAS(i,j) ;
 ALIAS(k,l) ;
 ALIAS(cty1,cty2,cty3) ;
 ALIAS(la,lb) ;
 ALIAS(iff,f) ;

 SET pt(k,cty1)      /      au. (hu,ec,rt)
                            hu. (au,ec,rt)
                            ec. (au,hu,rt)     / ;

 SET pt2(cty1,cty2) /       au. (hu,ec,rt)
                            hu. (au,ec,rt)
                            ec. (au,hu,rt)
                            rt. (au,hu,ec)     / ;

 SET pt3(cty1,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,cty1)        domestic price of exports
   PINDEX(k)           numeraire price index
   PM(i,k,cty1)        domestic price of imports
   PWE(i,cty1,cty2)    world price of exports from cty1 to cty2
   PWM(i,cty1,cty2)    world price of imports into cty1 from cty2
   PX(i,k)             average output price
   PVA(i,k)            value added price
   TM2(i,k,cty1)       tariff equivalent of CAP policies

*## PRODUCTION AND TRADE BLOCK

   E(i,cty1,cty2)      exports from cty1 to cty2
   M(i,cty1,cty2)      imports into cty1 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,cty1)       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,cty1)        net foreign savings
   FBAL(k)             current account balance
   INDTAX(k)           indirect tax revenue
   SSTAX(k)            factor taxes
   TARIFF(k,cty1)      tariff revenue
   ESUB(k,cty1)        export subsidy expenditure
   ESUBR(k)            ruble trade balance, net of tariffs and subsidies
   YH(hh,k)            household income
   YINST(ins,k)        institutional income
   WALRAS              Walras law for system
   WALRAS2(k)          Walras law for each country
   GDTOT(k)            government real consumption
   GD(i,k)             governmend demand by sector
   GOVSAV(k)           government saving
   GOVREV(k)           government revenue
   HHT(k)              govt transfers to households
   GPROF(k)            govverment'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,cty1)        tariff rates on imports
 te(i,k,cty1)        subsidy rates on exports
 tm2(i,k,cty1)       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,cty1)     CES import function share parameter
 gamma(i,k,cty1)     CET export function share parameter

 smq0(i,k,cty1)      share parameter in Stone price index
 aq(i,k)             constant in translog price index
 aqs(i,k)            constant in Stone price index

 amq(i,k,cty1)       constant in AIDS function
 betaq(i,k,cty1)     income coefficient in AIDS function
 gammaq(i,k,cty2)    price coefficient in AIDS function

 cles(i,hh,k)        household consumption shares
 gles(i,k)           governmentt 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)              enterprise savings rates
 sstr(iff,k)         factor income tax rate
 hhtr(hh,k)          household income tax rate
 entr(k)             enterprise income tax rate
 vatr(i,k)           value added tax rate
 itax(i,k)           indirect tax rate

*#################### Equation Declaration ################

 EQUATIONS

*## PRICE BLOCK

   PMDEF(i,k,cty1)     definition of domestic import prices
   PEDEF(i,k,cty1)     definition of domestic export prices
   PDDEF(i,k,cty1)     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,cty1)    export supply
   EDEMAND(i,k)         export demand from rest of world
*  ARMINGTON(i,k)       composite good aggregation function
*  COSTMIN(i,k,cty1)    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,cty1)       AIDS import share equation
   AIDS2(i,k,cty1)      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,cty1)    tariff revenue
   ESUBDEF(k,cty1)      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
   VATAXEQ(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
   FMEQUIL(iff,k)       factor market equilibrium

*## BALANCE OF TRADE EQUILIBRIUM

   CAEQ(k,cty1)         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

*################# EQUATION ASSIGNMENT ##############################

*## 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(i,k,cty1) =E= PD(i,k) ;

 ABSORPTION(i,k)..    P(i,k)*X(i,k) =E= PD(i,k)*XXDD(i,k) +
                        SUM(cty1, (PM(i,k,cty1)*M(i,k,cty1)))$tr(i) ;

 SALES(i,k)..         PX(i,k)*XD(i,k) =E= PD(i,k)*XXD(i,k) +
                              SUM(cty1, (PE(i,k,cty1)*E(i,k,cty1)))$tr(i) ;

 SALES2(i,k)..        XXDD(i,k) =E= XXD(i,k) - ER(i,k) ;

 PINDEXDEF(k)..       PINDEX(k) =E= SUM(i, PXDWT(i,k)*PX(i,k)) ;

 ACTP(i,k)..          PVA(i,k) =E= (1.0 - itax(i,k))*PX(i,k)
                                        - SUM(j, io(j,i,k)*P(j,k)) ;

*## PRODUCTION BLOCK

*Cobb-Douglas Production Function

 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) ;

 INTEQ(i,k)..    INT(i,k)  =E= SUM(j, IO(i,j,k)*XD(j,k));

 CET(i,k)$ie1(i,k)..    XD(i,k) =E=  AT(i,k)*(SUM(cty1$E0(i,k,cty1),
                                     GAMMA(i,k,cty1)*E(i,k,cty1)**(-RHOT(i,k)))
                                     + (1-SUM(cty1, GAMMA(i,k,cty1)))*XXD(i,k)
                                     **(-RHOT(i,k)))**(-1/RHOT(i,k)) ;

 CET2(i,k)$ie2(i,k)..    XD(i,k) =E= XXD(i,k) + SUM(cty1, E(i,k,cty1)) ;

 ESUPPLY(i,k,cty1)$(E0(i,k,cty1)$ie1(i,k))..   E(i,k,cty1)/XXD(i,k) =E=
                 (PD(i,k)/PE(i,k,cty1)*GAMMA(i,k,cty1)/(1 -
                  SUM(cty2$PT(k,cty2),GAMMA(i,k,cty2))))**(1/(1+RHOT(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(cty1$M0(tr,k,cty1),
*                                    DELTA(tr,k,cty1)*M(tr,k,cty1)
*                                 **(-RHOC(tr,k))) + (1- SUM(cty1$PT(k,cty1),
*                                    DELTA(tr,k,cty1)))*XXDD(tr,k)
*                                    **(-RHOC(tr,k)))**(-1/RHOC(tr,k)) ;

* ARMINGTON2(trn,k)..    X(trn,k) =E= XXDD(trn,k) ;
```

```
* COSTMIN(tr,k,cty1)$MO(tr,k,cty1)..  M(tr,k,cty1)/XXDD(tr,k) =E=
*                                    (PD(tr,k)/PM(tr,k,cty1)*DELTA(tr,k,cty1)/
*                                    (1 - SUM(cty2$PT(k,cty2), DELTA(tr,k,cty2))))
*                                    **(1/(1+RHOC(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)..     PM(i,k,k) =E= PD(i,k) ;

*## Translog price index
 TRLOGP(i,k)..    LOG(P(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)..    LOG(P(i,k)) =E=  LOG(AQS(i,k)) + SUM(cty2,
                                      SMQ0(i,k,cty2)*LOG(PM(i,k,cty2))) ;

 AIDS(i,k,cty1)..    SMQ(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)..    PM(i,k,cty1)*M(i,k,cty1) =E=
                                                  smq(i,k,cty1)*P(i,k)*X(i,k) ;

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


*## INCOME BLOCK

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

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

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

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

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

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

 YINST1(k)..    YINST("labr",k) =E= SUM(la, (1.0 - sstr(la,k))*YFCTR(la,k));

 YINST2(k)..    YINST("ent",k)  =E= YFCTR("capital",k)*(1.0-sstr("capital",k))
                                  + EXR(k)*FKAP(k) - ENTSAV(k) - ENTAX(k) + ENTT(k)
                                  + SUM(cty1, PREM(k,cty1)) - GPROF(k)
                                  - SUM(i, (XD(i,k)*(1 - vatr(i,k))*PVA(i,k)) ;

 HHY(hh,k)..    YH(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)..    ENTAX(k) =E= ENTR(k)*(YFCTR("capital",k) + ENTT(k)) ;
```

```
SSTAXEQ(k)..    SSTAX(k) =E= SUM(iff, sstr(iff,k)*YFCTR(iff,k));

HTAXEQ(k)..     HTAX(k) =E= SUM(hh, hhtr(hh,k)*YH(hh,k)) ;

VATAXEQ(k)..    VATAX(k) =E= SUM(i, vatr(i,k)*PVA(i,k)*XD(i,k)) ;

GOVREVEQ(k)..   GOVREV(k) =E= SUM(cty1, TARIFF(k,cty1) ) + INDTAX(k)
                              + SSTAX(k) + HTAX(k) + GPROF(k)
                              + ENTAX(k) + VATAX(k) + FBOR(k)*EXR(k);

GOVSAVEQ(k)..   GOVSAV(k) =E= GOVREV(k) - SUM(i, GD(i,k)*P(i,k)) - HHT(k)
                             - ENTT(k) - SUM(cty1, ESUB(k,cty1)) - ESUBR(k) ;

HSAVEQ(k)..   HSAV(k) =E= SUM(hh, mps(hh,k) * ((1.0-hhtr(hh,k))*YH(hh,k)));

ENTSAVEQ(k)..   ENTSAV(k) =E= esr(k)*YFCTR("capital",k) ;

TOTSAVE(k)..   ZTOT(k) =E= GOVSAV(k) + HSAV(k) + ENTSAV(k) + EXR(k)*FSAVE(k) ;

FORSAVE(k)..   FSAVE(k) =E= FBAL(k) - FKAP(k) - FBOR(k) - REMIT(k);

*## EXPENDITURE BLOCK

CDDEQ(i,k)..   P(i,k)*CDD(i,k) =E= SUM(hh, CLES(i,hh,k)*YH(hh,k)
                                   *(1.0-hhtr(hh,k))*(1.0-mps(hh,k)));

GDEQ(i,k)..   GD(i,k) =E= gles(i,k)*GDTOT(k) ;

INVEST(i,k)..   ID(i,k) =E= zshr(i,k)*ZFIX(k) ;

INVEST2(k)..   ZTOT(k) =E= SUM(i, P(i,k)*(ID(i,k)+DST(i,k))) + WALRAS2(k) ;

*## MARKET CLEARING
*## PRODUCT MARKETS

 EQUIL(i,k)..   X(i,k) + MR(i,k) =E= INT(i,k) + CDD(i,k) + GD(i,k)
                                   + ID(i,k) + DST(i,k) ;

*## FACTOR MARKETS

FMEQUIL(iff,k)..   SUM(i, FDSC(i,iff,k)) =E= FS(iff,k) ;

*## BALANCE OF TRADE

CAEQ(k,cty1)..   SUM(tr, PWM(tr,k,cty1)*M(tr,k,cty1)) =E=
                     SUM(tr, PWE(tr,k,cty1)*E(tr,k,cty1)) + FSAV(k,cty1) ;

FBALEQ(k)..   FBAL(k) =E= SUM(cty1, FSAV(k,cty1)) ;

*## TRADE CONSISTENCIES AND FIXED WORLD PRICES

TRCON7..   WALRAS =E= SUM((tr,k), PWM(tr,k,"rt")*M(tr,k,"rt") -
                       PWE(tr,k,"rt")*E(tr,k,"rt")) - SUM(k,FBAL(k)) ;

TRCON10(tr,cty1,cty2)$PT3(cty1,cty2)..   PWE(tr,cty1,cty2) =E=
                                                  pwm(tr,cty2,cty1) ;

TRCON(tr,cty1,cty2)..   M(tr,cty1,cty2) =E= E(tr,cty2,cty1) ;

PWM.FX(tr,k,"rt") = PWM0(tr,k,"rt") ;
PWE.FX(i,k,"rt")$iedn(i,k) = PWE0(i,k,"rt") ;
```

```
*################ MODEL CLOSURE ################################

*## FACTOR MARKET CLOSURE

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

  FS.FX(iff,k)              = FS0(iff,k) ;
  WFDIST.FX(i,iff,k)        = WFDIST0(i,iff,k) ;

*## 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 implictly
* set by arbitrage conditions.  Bilateral trade banaces are not fixed.
* The model has variables to finance the balance of trade (FBOR, REMIT,
* FKAP and FSAVE).  FSAVE is determined residually.

  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) ;

*## TARIFF EQUIVALENT OF CAP POLICY

TM2.FX(tr,k,cty1)$iqrn(tr,k,cty1)  = TM20(tr,k,cty1) ;

*## RUBLE TRADE CONSTRAINTS
* Ruble trade flows are fixed exogenously

  ER.FX(i,k)            = ER0(i,k) ;
  MR.FX(i,k)            = MR0(i,k) ;

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

  GDTOT.FX(k)           = GDTOT0(k) ;
  GD.FX(i,k)            = GD0(i,k) ;
  HHT.FX(k)             = HHT0(k) ;
  ENTT.FX(k)            = ENTT0(k) ;
  GPROF.FX(k)           = GPROF0(k) ;

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

*  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) ;

*## NUMERAIRE PRICE INDEX

  PINDEX.FX(k)          = PINDEX0(k) ;
```