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EXPORT SUPPLY AND IMPORT DEMAND IN HUNGARY (AN ECONOMETRIC ANALYSIS FOR 1968-1989)

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ABSTRACT

Export Supply and Import Demand in Hungary (an Econometric Analysis for 1968-1989)*

This paper investigates two behavioural relations for the Hungarian economy, which are vital for formulating future economic policy packages: the export supply and the import demand functions. The specifications of the equations, based on well-known functions of economic theory, take into account the characteristics of the special regulatory environment for enterprises throughout the period (1968-1989). Special attention is paid to export and import subsidies and to import restrictions. As a result of subsidies, the implicit deflators (price indices) derived from national accounts statistics can be misleading and lead to the misspecification of econometric equations. Consequently, previous attempts to estimate price, production and income elasticities were bound to fail or result in biased estimations. In fact, most of the empirical analyses known to the authors reported insignificant parameter estimates and indecisive results.

By taking into account the special regulatory environment, in particular subsidies and restrictions, the present analysis identifies stable and well-defined behavioural relations. The equations developed by the present study clearly outperform those which, although derived from the same theoretical framework, do not allow for these special factors. These functions will be incorporated into a complete model of the Hungarian economy, which will allow us to carry out specially designed simulation exercises to investigate the impact of different alternative monetary and exchange rate policies.

JEL classification: F14
Keywords: export supply function, import demand, Hungary

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NON-TECHNICAL SUMMARY

During the last two decades, the Hungarian economy's responsiveness in foreign trade has substantially developed. Economic transformation in Hungary will further change the behavioural characteristics of economic agents. The results presented in this paper identify stable and sensible equations, however. This suggests that even in an environment that is changing relatively quickly, it is possible to build econometric models. Moreover, policy-makers have few alternative sources of information with which to design policy packages.

Managing foreign debt will undoubtedly be at the top of the agenda for Hungarian policy-makers for quite some time to come. Monetary and exchange rate policies and export subsidy packages – should they opt for these sorts of instruments – must be designed to accommodate balance of payments targets. Notwithstanding the importance of other items, this paper concentrates on the foreign trade balance. A properly designed policy package relies on an understanding of the ways in which domestic prices, exchange rates and different forms of subsidies and taxes influence export supply and import demand. Previous empirical studies failed to provide either a stable econometric relationship or reliable estimates of price, income and output elasticities. Without this information, economic policies were bound to overshoot (or undershoot) and thus contribute to unnecessary excess volatility.

The framework presented in this paper takes into account some of the special characteristics of the Hungarian economy during the period (1968-89), which have not been accounted for in other empirical (or theoretical) work. In particular, by explicitly allowing for subsidies given to rouble and non-rouble exports, we identify their impacts on non-rouble exports. This allows for more realistic (and stable) estimates of price elasticities.

There were many other factors (e.g. credit preferences, preferential wage regulations for exporting firms and preferential treatment of these firms in import licensing) which had an important and sizeable impact on export supply behaviour (see Gács, 1980a and 1980b, Obláth, 1988). It is almost impossible to quantify these factors, however. Moreover, if they had had a significant impact, independent of that of subsidies, our equations would have been misspecified.

In the case of import demand, the modified price index allowing for import subsidies and taxes was also necessary to obtain reliable and stable estimates of income and price elasticities. The other crucial element was import restrictions, which played a decisive role especially during the 1980s. This helped us to establish a stable import demand function and to secure more reliable parameter estimates.

The two equations discussed in the present paper could also be very useful to the design of more coherent policy packages. They identify the differences in the way in which, and the extent to which, different policy tools influence exports and imports. Policy-makers are desperate to understand how and to what extent the policy instruments they plan to use (or are already using) influence the economy.

Econometrics is necessarily backward-looking in the sense that it establishes relationships on data that relate to the past. Whether it is possible to understand the future from the past is even more crucial for economies undergoing substantial transformation. In the present context, the question is whether one can get meaningful and reliable estimates for price and income elasticities of export supply and import demand.

Previous work suggested that this was not possible. This paper claims that if correction is made for specific features of export and import policies, stable relationships and therefore meaningful and stable estimates can be obtained. If this claim is justified, these estimates may be priceless pieces of information for policy-makers. Significant price elasticities are by no means an argument against or in favour of devaluation (or appreciation), however. It should be kept in mind that what matters are always relative prices; the ratios between domestic and export (or import) prices. They can improve or deteriorate due either to exchange rate movements or to domestic price movements that are not induced by exchange rate movement. Therefore, monetary and fiscal policy, as well as other factors thought to influence the domestic price level, have their impact on relative prices.

1. The regulation of exports and imports in Hungary during 1968-1989

Changing role of foreign trade

The traditional centrally planned economy can be regarded as a closed economy, where foreign trade plays very limited role. Domestic and foreign prices are separated by multiple exchange rate system, foreign trade is carried on by specialized foreign trade organizations. Therefore, neither domestic producers, nor consumers are informed about foreign market supply and demand conditions.

In 1968 the New Economic Mechanism (NEM) slightly modified this closed economy nature of the Hungarian economy. Moreover, the first and second oil-price shocks and the missed adjustment between the two shocks changed necessarily and dramatically the role of foreign trade. In the early years of the NEM, the general approach to foreign trade still preserved the traditional characteristics: (a) the CMEA was intended to assure the long term comparative advantage and international cooperation for the country; (b) hard currency imports having only used in case of necessary inputs for CMEA exports, intermediate inputs for production and investment; (c) exports to hard currency area were considered as residual. The competition between home and foreign markets was very poor, mainly missing.

The compounded effect of voluntarist inward-looking economic policy and the changes on the international market (radical terms of trade changes and foreign credits with negative real interest rates) was foreign indebtedness. In 1979, the economic policy changed the course, dollar exports became the first priority combined with strict import rationing. Hungary managed to pay the debt service even during the 1982-3 international debt crisis period. Relieving from the debt trap, macro-economic policy managed to enter second time the same river in 1985-87: due to the acceleration of economic growth, the already high level of dollar debts had almost doubled within two years. It proved that the survival of the debt crisis has not created in itself the basis for economic growth, the crisis became deeper than ever.

Regulation of foreign trade.

During the 21 year period under investigation, the macro-economic policy was unable to foresee the foreign trade processes. This uncertainty made necessary for policy makers to use devices which gave the feeling (illusion) of being able to intervene at any time in situations, where membership of international organizations (GATT, IBRD, IMF) demanded certain adjustment. Such ambiguous adjustment characterised also the period after the unification of exchange rates: widespread taxes and subsidies separated the domestic prices from foreign prices exactly the same way as before. The only regulatory innovation was how to hide these taxes and subsidies, or how to call them in a way which makes international bodies swallow them. Let us just mention, for example, that for decades the CMEA import tariffs were called as 'differentiated production turnover taxes' (KÜTEFA), and the export subsidy as 'differentiated production turnover tax refunding'. In certain respect they were justified by the large structural gap between CMEA and world market prices. The gap could not be bridged by exchange rate alignments.

The overall taxation and subsidization were accompanied by general import licensing, and by wage and credit preferences for exporting firms. The rationing scheme depended obviously on the balance of payments and on the bargaining position of the firm with central authorities. Very rich and well-documented description of the import rationing scheme, the bargaining

between the intermediator and enterprises, and their effects can be found in Gács (1980a), (1980b). These measures were intended to supplement the effect of taxes and subsidies, and to maintain the feeling of the central planner that in case of urgency the necessary devices were at their disposal.

2. Export and import subsidies in market economies

The neoclassical trade theory considers no export subsidies, that is free trade as the optimal policy in case of small open economy. (In the context of a large open economy, however, this theory tells that the optimal policy may be to impose a positive tariff or import subsidy).

In case of market failures and second best policies, the export subsidy may improve welfare. The oligopolistic market may defer price and marginal cost, and there is an advantage to a country from capturing a larger share of the world market (Brander and Spencer, 1985; Spencer and Brander, 1983).

The problem with the oligopolistic models is that they are sensitive to changes in the assumptions concerning the nature of firm interdependence, the number of firms and the presence of general equilibrium factor market repercussions (Cheng, 1988; Eaton and Grossman, 1986). Henriques and Sadorsky (1990) showed that when world markets are imperfectly competitive, domestic welfare maximization does not necessarily imply either a positive or a negative export subsidy. The optimal subsidy depends directly on the method of financing the government chooses. This implies that the government policy makers must have information not only regarding technology and market structure, but also regarding the effects associated with the method of financing. Neary (1988) shows that increasing returns to scale and monopoly power assure non zero optimal export subsidies in the first-best policy package, but the general thrust is that economic theory provides little justification for the widespread use of export subsidies.

In policy packages, the main argument in favour of export subsidy is the high concentration of exports in a few commodities, and the vulnerability and variability that these imply mainly in developing countries. The export subsidy was considered as one of the policy prescriptions to avoid balance of payments crisis. Another argument is built on Keynesian assumptions, the increased taxes derived from economic activity induced by more manufactured exports could finance the subsidies, and even result in fiscal surplus. Balassa (1975) proposed to use export subsidies instead of price increasing and consumption pattern distorting tariffs. Nogues (1990) argues against export subsidies, which create budget deficit, inflation, and unstable real exchange rate, and may provoke countervailing duties.

The traditional alternative to devaluation is the so-called uniform commercial policy which means an equiproportionate subsidy on all exports, combined with a tariff at the same rate on all imports. Laker (1981) showed that the two policies have exactly the same effects on the equilibrium values of all variables, as expressed in domestic currency, except (i) the initial level of foreign exchange holdings, (ii) the balance of payments during the adjustment process, and (iii) the net accumulation of foreign exchange reserves. However, when expressed in foreign currency, both the balance of payments and the initial and final foreign exchange position are invariant under the two policies.

Experiences with such fiscal proxies have shown that it is difficult to establish this equivalence in practice. First, the tax and subsidy schemes are often applied only to a subset of current account transactions. The widespread use of dual exchange rate system should be mentioned here. The economic rationale to operate the dual exchange rate in certain CMEA countries was that the price system was totally different from that of market economies (Augusztinovics, 1987). Second, the scheme is not always applied on a uniform basis. Third, the administrative costs of implementing such scheme may be significantly greater than in case of an exchange rate change. Finally, the scheme may lead to corruption, evasion, or misuse, particularly if the tax and subsidy rates rise sharply.

In spite of these theoretical and practical considerations, public policy generally prefers the fiscal solution, because of the political pressures against open devaluation. However, it is very seldom that it is applied uniformly to all foreign trade transactions. Another practical consideration concentrates on how to replace the tariff revenue with other taxes. Rousslang (1987) compared the estimates of excess burdens of US tariffs with those of marginal increases in US federal income and excise taxes that would be required to replace the tariff revenue. He found that, per dollar revenue generated, the overall excess burden of US tariffs is smaller than that of marginal increases in either of these alternative taxes. This was also true for most of the individual industry tariffs. According to these results, if practical alternative taxes are also inefficient relative to tariffs in other countries, multilateral tariff eliminations would reduce world welfare if they were unable to compensate for this effect.

3. Previous empirical results on export and import functions for Hungary

Early empirical modelling works on foreign trade concentrated on the real side of economic relationships, neglecting the effect of prices, and partly that of income. This reflected the needs and objectives of central planning methods: the real side of the macro-economy was regarded of primary importance, and prices were treated as consequences of the preceding.

According to the economic reasoning and the level of development, the most important analytical tool was the traditional input-output analysis. Later on, this traditional approach was gradually supplemented by econometric equations and models.

In Simon (1978), the sectoral rouble and dollar exports and imports volumes were explained mainly by real variables with only one exception of rouble exports of metallurgy, where the relative export price became significant. The estimation period of the equations was 1960-76.

Tarafás and Szabó (1985), using time series methods, showed that the exchange rate has no effect on export supply. On the supply side, the export volume is a function of time trend and domestic demand. The authors were unable to find any specification in which the export price would have been better explanatory variable than the time trend. On the demand side, the real exchange rate was significant.

In the disequilibrium model of Hulyák (1988), the export supply is a loglinear function of the relative export price (the ratio of export prices to domestic prices) and of a variable of the productive capacities. Preliminary tests yielded insignificant parameter for relative price term, suggesting the usual hypothesis that in CPE's domestic and foreign prices are formed independently from each other. Only the response to absolute export price could be measured in

the observation period. In addition to price and capacity variables, an attempt was made to measure the effects of export subsidies as another explanatory variable in the supply function. The export demand is a loglinear function of relative prices (Hungarian export prices to the export prices of the rest of the world) and the real income of trading partners.

The estimation period was 1970-85. In the estimation gross output was used instead of capacity. Both (absolute) price and subsidy became significant. According to the author the small size of coefficient for export subsidies does not support its explanatory power. The disequilibrium adjustment factors were insignificant in both price and quantity equations. In the demand function the coefficient of neither the price nor the import (used instead of income) was significantly different from zero. The estimation for food economy showed better statistics, with the only exception of the subsidies, which became insignificant. The adjustment parameter of the demand function remained insignificant.

In a later paper Hulyák (1990) tried to investigate the causality link between inflation and exchange rate. The annual model's estimation period was 1975-88. The final statement is that '...no evidence is given that the devaluation has been effective on volume processes, especially on the exports. The bidirectional causality analysis between devaluation and domestic inflation gives rather a surprising result. It suggests that devaluation does not cause inflation, while inflation does lead to the devaluation of the home currency' (p. 13).

In spite of data and methodological problems, the quarterly model results showed a different landscape: 'Quarterly time series of exports and imports and those of terms of trade and the balance of trade are causally influenced by quarterly adjustments of the exchange rate.' (p. 14).

In Szentgyörgyvári (1991), the estimation period is 1983Q3 to 1990Q4. The volume of export supply is a function of its one period lagged value, real money supply, volume of gross industrial output, and nominal effective exchange rate index of the Hungarian currency. The export price index depends on domestic producers' prices, the index of world prices of non-fuel commodities and one-period lagged trade weighted index of domestic wholesale prices of Hungary's most important trade partners. The import demand depends on the nominal stock of money and on home currency import prices. The production function for industrial output includes own one and two periods lagged values, real money supply and industrial employment as explanatory variables.

In the model of Nemenyi (1991), the first estimation period is 1970-87 (Nemenyi, 1990), and a re-estimation was carried out for 1970-89. The growth rate of export volume depends on one-year lagged export volume, one year lagged ratio of domestic price of exports to world market price index (from 1983 equals to 0), one year lagged ratio of rouble and dollar export price indices corrected by subsidies (from 1983), and on the value and growth rate of the index of export demand (computed as the weighted average of main partners' import growth index, where weights are the shares of the given partner in Hungarian exports). Import demand is a function of domestic demand, one year lagged foreign trade balance, the ratio of the non-rouble import price index (modified by net import taxes) to domestic producer prices, and the ratio of enterprises not expecting capacity utilization problems.

4. An export supply function for Hungary

The specification used in this study is basically a usual supply function, based on a framework in which firms are maximizing profit, taking into account exogenously given prices. There are however some points where this framework is extended. First, exports is not treated as a homogenous category. Rouble and non-rouble exports are separated, and the present study is solely confined to the analysis of export supply in non-rouble markets. As it is widely known, trade in the rouble area was strongly determined by central interventions. Although formally, the central economic administration had no power to interfere with enterprises' production and exports decisions, in order to fulfil contracts between governments, there were several hidden mechanisms for the authorities to do so. It is important to recognize that any sort of such intervention had an influence not only on the rouble exports, but also on the non-rouble exports. This is simply due to the fact that most firms entered both markets (Halpern, 1991).

Second, export subsidies are explicitly taken into account. As described in Section 1., export subsidies played an increasingly important role in economic policies in Hungary, geared to achieve positive trade balance in the non-rouble area, and designed to provide enough incentive for firms to meet rouble export targets. This was accompanied by sizeable changes in the transferable rouble dollar cross rate, being another important instrument of economic policies. Thus, firms' profits, as well as their decisions upon supply in the different markets (domestic, rouble and non-rouble export markets) were strongly influenced by the amount and allocation of export subsidies. That is why the ratio of implicit dollar export exchange rate (official nominal exchange rate plus unit export subsidies minus unit export taxes) is introduced as an additional explanatory variable.

Third, not only current production, but also inventories are taken into account. As previous studies indicate (Ábel and Székely, 1989), inventories played an important role in enterprises' production decisions in Hungary. On the input side, they represented supply side constraints, while on the output side, production smoothing was detectable throughout the period under investigation. Therefore, any behavioral relationship related to production decisions should account for these impacts.

Taking into account the factors mentioned above, the specification used for estimation is

$$(1) \quad \log(ESQ) = \alpha + \beta \log(XQ) + \gamma \log(P_{ESQ}/P_{XQ}) + \delta \log(SUB) + \epsilon \log(KQ)_{-1} + u,$$

where[1] ESQ is real non-rouble exports, XQ is real gross domestic output, P_{ESQ} is the implicit price index for non-rouble exports, P_{XQ} is the implicit price index for domestic gross output (the price ratio above is denoted by PR2 in Table 1), SUB is the ratio of dollar implicit export exchange rate (official nominal exchange rate plus unit export subsidies minus unit export taxes) to rouble export implicit exchange rate, and KQ_{-1} is the real stock of inventories at the beginning of the current period.

[1]For a detailed description of the variables used in the estimations see Section A in the Annex.

The results[2] are presented in Table 1. The estimations are for the period 1969-1989. The beginning of the estimation period, similarly to the import function below, is determined by the introduction of the new economic mechanism in 1968. As discussed earlier, this reform package is widely regarded as one which substantially changed enterprise behaviour in the Hungarian economy. Thus, it would be quite misleading to include any period before 1968.

The performed tests, with the exception of the LM test for AR(2), show no sign of misspecification. The results for AR(2) are conflicting. While the LM chi-square test is significant at 5% level, the LM-F test is not. Estimating the equation with AR(2), the log-likelihood ratio tests supports neither AR(1) against OLS, nor AR(2) against AR(1) (the test statistics values are 2.5478 and 3.4815 respectively). Thus, we conclude that the estimated equation presented in Table 1 can be regarded as one which is free of misspecification.

The parameter estimates are all significant, having correct signs and being in the regions accepted by economic theory. The parameter estimate, the t-ratio and the LM test for variable deletion for variable SUB clearly show the importance of export subsidies. The estimated relative price elasticity (γ) indicates a quite reasonable degree of price sensitivity of Hungarian firms. Relative price sensitivity is also captured by variable SUB, showing that the cross rate between transferable rouble and dollar, as well as the relative changes in export subsidies for rouble and non-rouble exports had quite a strong impact on export supply. Both ratios were important policy instruments, although their importance varied remarkably during the period under investigation.

The present work is a continuation of the analysis by Halpern (1989). In that paper, the export function

$$(2) \quad \log(ESQ) = \alpha + \beta \log(XQ) + \gamma \log(P_{ESQ}/P_{EW}) + \delta \log(SUB) + \epsilon \, DUM78 + u$$

is estimated, where P_{EW} is the implicit price index for world exports (the price ratio above is denoted by PR in Table 1) and DUM78 is a dummy variable (1 for 1978, 0 otherwise). This specification combines supply side (XQ and SUB) and demand side (P_{ESQ}/P_{EW}) factors in explaining exports. Other empirical studies for Hungary (e.g., Tarafás and Szabó 1988) specified pure demand equations. However, as reported by Halpern (1989, p. 296), pure demand equations (world demand for Hungarian exports) do not perform very well.

The specification in the present study is purely confined to supply side factors, based on a profit maximizing framework, in which firms are supposed to be price takers. Thus, it may be of some interest to test whether supply side factors alone can provide a satisfactory description of export flows. A series of non-nested tests carried out for equations[3] (1) and (2) (see Table 1) support none of the specifications, suggesting that demand side factors played a role in explaining Hungarian exports, as well.

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[2] Calculations presented throughout this paper were carried out by using DFIT 2.0 licensed at the University of Cambridge, Dept. of Applied Economics. For the definitions of estimation and hypothesis testing procedures available in DFIT, and used here see the Reference Manual of DFIT 2.0. Data series used are described and listed in the Annex.

[3] Unfortunately, the other studies mentioned are not reproducible for us. Thus, no formal test can be applied to confront these equations with the one presented in this study.

5. An import demand function for Hungary

Our starting point is the import demand function developed by Welsch (1987), which is based on a dynamic linear expenditure system.[4] However, the original specification, as well as the way in which it is applied for a former CPE is somewhat modified in order to suit the focus of the present study. First, differently from previous applications for former CPEs (Gajda, 1990), imports form rouble and non-rouble relations (the former being basically the intra-CMEA trade) are treated separately. While non-rouble imports of goods and services are described by the above import demand equation, imports from the rouble area is treated exogenously. As a consequence of the latter, the income variable is also modified, it no longer contains the income spent on imports from the rouble area.

Second, the price index of non-rouble imports is also redefined. For reasons described earlier in Section 1, the implicit price deflator derived from national accounts statistics is at best misleading. It does not reflect the subsidies and tariffs attached to non-rouble imports, and thus, does not measure the actual prices Hungarian enterprises face when deciding upon imports. As we shall see later, this is a fairly important point. Models neglecting this distortion can easily be outperformed by the models presented here.

Finally, the specifications previously used for former CPEs did not account for non-price influences (import restrictions) exerted by the central economic administration upon non-rouble imports. The importance of this point and the actual mechanism through which this control was carried out has already been discussed in Section 1. Our idea is that the extent of pressure (import restrictions) the central economic administration imposed upon non-rouble import demand was related to (a function of) the degree of indebtedness (as measured by the ratio between net non-rouble foreign debts and export earnings in the previous period).[5] Moreover, it is also assumed that import restrictions worked in a way that attempted to lower the marginal propensity by a given (and estimated) amount for a varying part of the income available for imports in the economy. The part of the income under pressure is assumed to be proportional to the degree of indebtedness (measured as defined above).

Taking the usual specification of this sort of import demand function, and taking into account the necessary modifications discussed so far, we arrive at the following equation

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[4] This specification was used for a wide range of economies (Welsch, 1990, Gajda, 1990, Székely and Welsch, 1986), and proved to be a robust specification performing rather well in a highly non-linear and complex simultaneous model environment as well (Dobrinsky and Székely, 1990).

[5] Naturally, some other indicators could have been used as well. An obvious candidate is the debt service ratio which is widely used, and which was in fact closely monitored by international capital markets throughout the 1980s. Our original intention was to use this ratio, but due to well known reasons, reliable figures for this ratio are only available for the period 1982 onward.

Table 1 Estimation results for export supply equation (1)

Dependent variable: LESQ Estimation method: OLS
21 observations used for estimation from 1969 to 1989

Regressor	Coefficient	Standard Error	T-Ratio
CONS	-5.2802	.9996	-5.2822
LXQ	1.1849	.1908	6.2095
LPR2	.5734	.1268	4.5206
LSUB	.3473	.0605	5.7371
LKQ(-1)	.2428	.0896	2.7097

R-Squared	.9945	F-statistic F(4, 16)	722.3142
R-Bar-Squared	.9931	S.E. of Regression	.0333
Residual Sum of Squares	.0178	Mean of Dependent Variable	4.9503
S.D. of Dependent Variable	.4017	Maximum of Log-likelihood	44.4833
DW-statistic	2.5942		

Notes: For the definitions of the variables see equation (1) in the text.

Diagnostic Tests

Test Statistics	LM Version		F Version	
A: Serial Correlation				
AR(1)	CHI-SQ(1)=	2.8045	F(1, 15)=	2.3120
AR(2)	CHI-SQ(2)=	6.2761*	F(2, 14)=	2.9838
B: Functional Form	CHI-SQ(1)=	.9534	F(1, 15)=	.7134
C: Normality	CHI-SQ(2)=	1.2343		
D: Heteroscedasticity	CHI-SQ(1)=	1.8264	F(1, 19)=	1.8098
E: ARCHC	CHI-SQ(1)=	.3147		
F: Variable deletion				
LM	CHI-SQ(1)=	14.1308*		
F statistic			F(1, 16)=	32.9139*

Notes: A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values
E: Autoregressive Conditional Heteroscedasticity Test of Residuals
F: Variable Deletion Tests (LM and F statistic) for LSUB
*: Significant at 5% level

Alternative Tests for Non-Nested Regression Models

Dependent variable is LESQ 21 observations used from 1969 to 1989
Regressors for model M1: CONS LXQ LPR2 LSUB LKQ(-1)
Regressors for model M2: CONS LXQ LPR LSUB DUM78

Test Statistic	M1 against M2	M2 against M1
N-Test	-4.6613	-4.6314
NT-Test	-3.2107	-3.1807
W-Test	-2.4891	-2.4432
J-Test	2.7510	2.8122
JA-Test	2.6835	2.3340

Encompassing	F(2, 14)=	5.5955	F(2, 14)=	3.9517		
Model M1:	DW	2.5942	R-Bar-Sqd	.9931	Log-lkhd	44.4833
Model M2:	DW	1.8569	R-Bar-Sqd	.9929	Log-lkhd	44.1361
Model M1+M2	DW	2.6206	R-Bar-Sqd	.9949	Log-lkhd	48.8357

Akaike's Information Criterion of M1 versus M2= 0.3472 favours M1
Schwarz's Bayesian Information Crit. of M1 vrs M2= 0.3472 favours M1
Notes: For the definitions of variables in models M1 and M2 see equations (1) and (2) in the text.

(3) $$MSQ = \alpha + \beta\, MSQ_{-1} + \gamma\, (GDP^{*}P_{GDP}+MSQ^{*}P^{*}_{MSQ})/P^{*}_{MSQ} - \delta\, GDP_{-1}{}^{*}P_{GDP}/P^{*}_{MSQ},$$

where[6] MSQ is real non-rouble imports, GDP is real GDP, P_{GDP} is the implicit price deflator for GDP, and P^{*}_{MSQ} is the adjusted implicit price index for imports, taking into account subsidies.

Introducing import restrictions in the way described above leads to the following additional term

(4) $$\gamma'(DEX/ESQ^{*}P^{*}_{ESQ})_{-1} * (GDP^{*}P_{GDP}+MSQ^{*}P^{*}_{MSQ})/P^{*}_{MSQ},$$

where DEX is net foreign debts in hard currencies, ESQ is real non-rouble exports of goods and services, and P^{*}_{ESQ} is the implicit price deflator for non-rouble exports. Parameter γ' is expected to have a negative sign. The justification for interpreting import restrictions as a mechanism which attempted to moderate non-rouble import, rather than setting an exogenous upper limit to it is given in Section 1. As described there, it was rather a sort of bargaining between the central economic administration and enterprises than a strictly exogenous regulation exercised by the administration (Gács, 1980a).

Thus, the final specification for estimation is

(5) $$MSQ = \alpha + \beta\, MSQ_{-1} + \gamma\, (GDP^{*}P_{GDP}+MSQ^{*}P^{*}_{MSQ})/P^{*}_{MSQ} -$$

$$\gamma'(DEX/ESQ^{*}P^{*}_{ESQ})_{-1}\, (GDP^{*}P_{GDP}+MSQ^{*}P^{*}_{MSQ})/P^{*}_{MSQ} - \delta\, GDP_{-1}{}^{*}P_{GDP}/P^{*}_{MSQ}.$$

The estimation was carried out for the period 1969-1989. For reasons discussed in the previous section, it is not advisable to extend the estimation period beyond 1968. Figures for 1990 are not yet available.

Estimation results are presented in Table 2. The performed tests reveal no sign of misspecification. The parameters are all significantly different from zero, having the expected signs and being in the regions suggested by economic theory. A nested model selection test clearly rejects (3) against (5), that is, the results seem to support the idea that import restrictions had a significant influence on import demand. A series of non-nested tests were carried out to see whether the introduction of the modified import price index (P^{*}_{MSQ}) is justified. The alternative model was the one in which the unmodified implicit import price index (P_{MSQ}) was used, but otherwise was the same as equation (5). The tests seem to support the original specification given in equation (5). Thus we are inclined to accept equation (5) as a satisfactory description of Hungarian import demand during the period under investigation.

In order to separate the investigation of the price index used and that of the import restriction term, equation (3) was also estimated and similarly to equation (5) it was confronted with the equation, in which the unmodified price index (P_{MSQ}) was used. The non-nested test performed (see Table A2 in the Annex) clearly favour equation (3), showing again the importance of import subsidies. These results also allow for assessing the impact of neglecting import

[6] For a detailed description of the variables included see the Annex.

restrictions on other parameter estimates. Leaving out import restrictions leads to an underestimation of the habit formation coefficient, and thus, to an underestimation of the price elasticity.

The average short-run price elasticity based on equation (5) for the period of estimation is -0.5869. This is slightly lower than the estimate given in Székely and Welsch (1986), which is -0.634. This is a result of the lower parameter estimate for the habit formation parameter for imports. However, it is difficult to judge, how much of this difference is due to the changes in the specification, for the estimation periods are different (1961-1982 versus 1969-1987). Moreover, the study mentioned above estimated the equations for total imports. The long-run price elasticities (-1.033 and -1.043), however, are by construction similar.

The price elasticity estimated here is in line with estimations for market economies (e.g. France, UK, Italy, see Székely and Welsch, 1986) with similar degrees of openness (as measured, for example, by the ratio between imports and GDP).

6. Conclusions and policy implications

During the last two decades, the Hungarian economy underwent substantial developments concerning her responsiveness in foreign trade. Economic transformation in Hungary will no doubt further change the behavioural characteristics of economic agents. The results presented in this paper, however, seem to identify stable[7] and sensible equations.[8] This fact suggests that even in a relatively fast changing environment it is possible to build econometric models. Moreover, economic policy makers have not got too many alternative sources of information in this respect when designing policy packages.

Managing foreign debt will undoubtedly be on the top of agenda for Hungarian economic policy makers for quite some time to come. Monetary and exchange rate policies and export subsidy packages - should they opt for this sort of instruments - will have to be designed to accommodate targets on balance of payment. Notwithstanding the importance of other items, this paper is concerned with the foreign trade balance. A properly designed policy package relies on the understanding of the ways domestic prices, exchange rates and different formes of subsidies and taxes influence export supply and import demand. Previous empirical studies, due to reasons set out earlier, failed to provide either stable econometric relationship, or reliable estimates of price, income or output elasticities. Lacking these information, economic policies were bound to over(or under)shoot, and thus, contribute to an unnecessary excess volatility.

The framework presented in the paper takes into account some of the special characteristics of the Hungarian economy during the period under investigations (1968-89) not accounted for so far by other empirical (or theoretical) work. In particular, by explicitly taking into account subsidies given to rouble and non-rouble exports, we managed to identify their impacts on non-rouble exports. At the same time, this made possible to give more realistic (and

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[7] Figures for 1990 and 1991 are not yet available. Thus, we cannot judge whether the equations presented above preserved their structural stability during the last two years. When the figures become available, it will be an interesting exercise to test for this assumption.

[8] Naturally, time series analyses must be complemented with investigations based on cross-sections and pooled cross-sections of observations for micro units (enterprises) (see Halpern, 1991b).

stable) estimate of price elasticities.

As mentioned above, there were many other factors (e.g., credit preferences and preferential wage regulations for exporting firms and preferential treatment of these firms in import licensing) which had an important and sizeable impact on export supply behaviour (see, e.g., Gács, 1980a and 1980b, Oblath, 1988). However, it is almost impossible to quantify these factors. Moreover, if they had had a significant impact independent from that of subsidies, it should have made our equations misspecified.

In case of import demand, the modified price index taking into account import subsidies and taxes was also necessary to get reliable and stable estimates for income and price elasticities. The other crucial element here was that import restrictions, which played a very decisive role especially during the 1980s, were taken into account. This also helped in establishing a stable import demand function and getting more reliable parameter estimates.

The two equations discussed in the present paper can also be very useful in designing more coherent policy packages. They identify the differences in the way in which, and the extent to which different policy tools influence exports and imports. Economic policy makers are in a desperate need to understand how and to what extent the policy instruments they plan to use (or are already using) influence the economy.

Econometrics, due to its nature, is backward looking in the sense that it establishes relationship on data related to the past. The general question, whether it is possible at all to understand the future from the past, is even more crucial for economies undergoing substantial transformation. In the present context, the question is whether one can get meaningful and reliable estimates for price and income elasticities of export supply and import demand.

Previous work suggested that this was not possible. This paper claims that if correction is made for specific features of export and import policies, stable relationship, and therefore, meaningful and stable estimates can be achieved. If this claim is justified, these estimates can be priceless pieces of information for economic policy makers. Significant price elasticities, however, are by no means argument against or for devaluation (or appreciation). It should be kept in mind that what matters are always relative prices, that is the ratios between domestic and export (or import) prices. Consequently, it can improve or deteriorate both due to exchange rate movements (or the lack of them) and to domestic price movements not (or only marginally) induced by exchange rate movement. Therefore, monetary and fiscal policy, as well as other factors thought to influence domestic price level have their impact on relative prices.

Table 2 Estimation results for import demand equation (5)

Dependent variable: MSQ Estimation method: OLS
19 observations used for estimation from 1969 to 1987

Regressor		Coefficient	Standard Error	T-Ratio
CONS	α	-46.6517	22.4429	-2.0787
MSQ(-1)	β	.4320	.1629	2.6516
GDPC	γ	.2833	.0675	4.1996
GDPR	γ'	-.0122	.006570	-1.8572
GDPA	δ	-.1916	.0756	-2.5360

R-Squared	.9498	F-statistic F(4, 14)	75.6723
R-Bar-Squared	.9372	S.E. of Regression	8.4231
Residual Sum of Squares	1135.2	Mean of Dependent Variable	150.4333
S.D. of Dependent Variable	33.6232	Maximum of Log-likelihood	-71.6929
DW-statistic	2.0877	Durbin's h-statistic	-.3021

Notes: For the definitions of the variables see equation (5) in the text.

Diagnostic Tests

Test Statistics	LM Version		F Version	
A: Serial Correlation				
AR(1)	CHI-SQ(1)=	.1595	F(1, 15)=	.1148
AR(2)	CHI-SQ(2)=	.3806	F(2, 14)=	.1292
B: Functional Form	CHI-SQ(1)=	.0091	F(1, 15)=	.0065
C: Normality	CHI-SQ(2)=	.6908	Not applicable	
D: Heteroscedasticity	CHI-SQ(1)=	.0050	F(1, 19)=	.0046
E: ARCHC	CHI-SQ(1)=	.0245		
F: Variable deletion				
LM	CHI-SQ(1)=	3.7244*		
F statistic			F(1, 16)=	3.4494*

Notes: A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values
E: Autoregressive Conditional Heteroscedasticity Test of Residuals
F: Variable Deletion Tests (LM and F statistic) for GDPR
*: Significant at 5% level

Alternative Tests for Non-Nested Regression Models

Dependent variable is MSQ 21 observations used from 1969 to 1989
Regressors for model M1: CONS MSQ(-1) GDPC GDPR GDPA
Regressors for model M2: CONS MSQ(-1) GDPC1 GDPR1 GDPA1

Test Statistic	M1 against M2	M2 against M1
N-Test	-.6792	-3.4957
NT-Test	-.4395	-2.6233
W-Test	-.4204	-2.0746
J-Test	.5277	2.2418
JA-Test	.5249	2.2394

Encompassing	F(2, 13)=	.3608	F(2, 13)=	1.8169		
Model M1:	DW	2.0877	R-Bar-Sqd	.9372	Log-lkhd	-71.6929
Model M2:	DW	2.3455	R-Bar-Sqd	.9178	Log-lkhd	-74.5297
Model M1+M2	DW	1.9289	R-Bar-Sqd	.9287	Log-lkhd	-70.8530

Akaike's Information Criterion of M1 versus M2= 2.8368 favours M1
Schwarz's Bayesian Information Crit. of M1 vrs M2= 2.8368 favours M1
Notes: For the definitions of variables in models M1 and M2 see equations (5) and (3) in the text.

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ANNEX

A. Description of data

Variables and their data sources:

XQ: gross output at 1981 prices, national accounts: 'A gazdaság fejlödésének föbb mutatói 1988' and 'Föbb nemzetgazdasági folyamatok' KSH (CSO) Budapest 1990, (bn HUF);

I investments, national accounts (bn HUF);

C consumption, national accounts (bn HUF);

KQ stock of inventories at 1981 constant prices, national accounts (bn HUF);

MSQ dollar imports at 1981 constant prices, national accounts (bn HUF);

ERQ rouble exports, national accounts (bn HUF);

ESQ dollar exports, national accounts (bn HUF);

GDP GDP, national accounts (bn HUF);

MRQ rouble imports at 1981 constant prices, national accounts (bn HUF);

PXQ gross output implicit price index (1981=1), national accounts;

PESQ dollar exports implicit price index (1981=1), national accounts;

PMRQ rouble imports implicit price index (1981=1), national accounts;

DEX the ratio of dollar exports to net dollar debts, own computations using for 1968-81 various estimations on net dollar debt and CSO data for dollar exports; from 1982 computations based on the Yearbook of Hungarian National Bank (1990);

LSUB ratio of dollar implicit (or de facto) export exchange rate (official nominal exchange rate + export subsidies - export taxes) to rouble export implicit exchange rate, own computations for 1968-75 using various CSO publications, for 1976-87 'Devizaegys-gre jut- forint-rt-k alakul-sa' KSH Budapest (various years), for 1988-89 own estimation based on data of all exporting firms.

P*MSQ overall cost (official nominal exchange rate + import duties + import taxes - subsidies) of one 1981 HUF dollar import (1981=1), own computations for 1968-75 using various CSO publications, for 1976-87 'Devizaegységre jutó forintérték alakulása' KSH Budapest (various years).

	XQ	GDP	I	C	ERQ	ESQ	MRQ	MSQ	KQ
1967	995.8	256.8	61.4	184.0	38.4	29.6	62.0	79.0	46.6
1968	1063.6	281.1	72.1	196.4	43.6	30.1	67.4	68.9	53.7
1969	1119.6	210.1	82.0	210.1	49.1	39.4	64.0	74.7	57.6
1970	1200.3	332.4	100.3	228.5	52.1	49.3	81.4	98.8	61.5
1971	1269.8	360.7	113.1	247.4	58.5	51.4	96.2	117.6	82.8
1972	1362.5	391.0	116.8	262.1	73.4	61.9	93.1	109.5	83.4
1973	1437.1	429.0	123.1	282.2	81.5	84.3	95.8	114.0	79.2
1974	1517.9	448.6	139.2	308.3	85.5	103.0	111.0	134.0	93.7
1975	1609.8	481.1	161.0	335.2	103.1	97.0	128.3	129.0	107.4
1976	1687.6	528.7	168.2	359.2	104.8	100.4	124.2	139.6	125.5
1977	1812.5	580.1	197.7	390.4	124.0	116.6	132.2	157.6	139.7
1978	1936.0	628.0	214.4	426.1	125.1	118.8	144.6	182.1	185.7
1979	1979.3	682.0	220.8	470.9	135.6	147.7	152.5	162.3	190.1
1980	1991.9	721.0	207.7	515.3	124.3	157.6	153.3	158.2	200.5
1981	2054.7	779.9	206.6	556.8	136.0	172.3	147.6	168.9	215.3
1982	2110.2	847.9	213.9	599.3	144.3	177.6	148.6	155.9	225.6
1983	2138.9	896.4	220.0	642.1	165.6	195.1	152.6	154.5	227.3
1984	2204.8	978.5	225.4	695.8	182.5	219.5	151.7	158.7	231.2
1985	2217.8	1033.7	232.1	753.8	208.0	228.2	152.3	182.4	234.3
1986	2274.1	1088.8	261.2	811.5	221.3	210.3	157.7	186.0	241.5
1987	2370.0	1226.4	303.5	904.8	221.6	242.8	164.4	189.3	235.9
1988	2373.4	1409.5	295.6	1011.9	214.1	316.3	169.8	185.5	243.1
1989	2348.0	1706.0	345.0	1203.7	222.4	399.2	157.7	200.8	243.8

	PXQ	PESQ	PEW	LSUB	DEX	PMRQ	P'MSQ
1967	.5637	.6004	.	.	.	.6368	.4581
1968	.5977	.5923	1.3465	1.5350	.5684	.6600	.4581
1969	.6130	.6210	1.3574	1.5722	.2501	.6995	.5098
1970	.6210	.6378	1.3426	1.5847	.7411	.6751	.5524
1971	.6400	.6615	1.3428	1.5693	1.0667	.6863	.5673
1972	.6545	.6892	1.3333	1.4506	.8857	.6966	.5963
1973	.6776	.7913	1.4340	1.2377	.5083	.6998	.6390
1974	.6991	.9414	1.2346	1.2500	.7090	.7075	.7390
1975	.7389	.8556	1.1443	1.1525	1.0136	.8926	.8161
1976	.7781	.8060	1.1194	1.3518	1.2141	.8809	.8086
1977	.7998	.8378	1.0726	1.3220	1.3948	.9408	.8391
1978	.8291	.8346	1.0941	1.2990	2.1138	.9511	.8682
1979	.8510	.9123	1.0652	1.2520	1.7841	.9614	.9308
1980	.9442	.9710	1.0196	1.1835	1.6229	.9170	.9908
1981	.9987	1.0000	1.0000	1.3041	1.6704	1.0000	1.0000
1982	1.0408	.9847	.9722	1.4013	1.5436	1.0740	1.0081
1983	1.0948	1.0333	.9207	1.6175	1.5580	1.1600	1.0887
1984	1.1499	1.0899	.8850	1.7852	1.4156	1.2240	1.1623
1985	1.2077	1.1026	.8690	1.8247	1.7601	1.2980	1.1529
1986	1.2506	1.0612	.8763	1.6839	2.3066	1.3830	1.2382
1987	1.3160	1.1498	.8259	1.7158	2.6132	1.3120	1.3412
1988	1.4425	1.3390	.8547	1.8243	2.2267	1.2211	1.5168
1989	1.6588	1.6177	.8807	2.1264	2.2055	1.2967	1.7835