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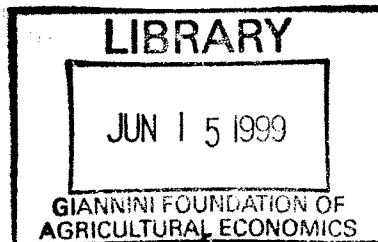**Publication Date**
1998-05-04

796
Rev.

DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS AND POLICY/
DIVISION OF AGRICULTURE AND NATURAL RESOURCES
/ UNIVERSITY OF CALIFORNIA AT BERKELEY/

WORKING PAPER NO. 796, Rev.

FOOD IMPORT DEMAND IN THE CZECH REPUBLIC

by

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May 1998

Food Import Demand in the Czech Republic

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revised May 4, 1998

Giannini Foundation Working Paper #796

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Abstract

This paper provides an overview of Czech food import demand in the transition period of the 90's. It also provides econometrical estimates of own- and cross-price elasticities and group expenditure elasticities of Czech import demand for a number of foods. Based on the Hausman test for endogeneity, which supports the hypothesis that Czech import prices were exogenously determined outside of the Czech economy, we estimated five demand models as direct-demand systems of the AIDS type. The econometric estimation of elasticities was based on bi-monthly data from March 1993 to August 1997.

Food Import Demand in the Czech Republic

1   Introduction

Considering the deep level of governmental involvement and the distortions in the agricultural markets of the European Union, the question of agricultural trade between Eastern and Western Europe has obviously become one of the most important problems in the whole international trade debate surrounding the process of economic transition. The importance of agriculture in East - West relations is also accentuated by the huge share of agricultural employment in Central and Eastern European Countries (CEECs).

During the transition period, there has been an interesting contrast in the views of the future of the agricultural trade flows between CEECs and Western countries. Many Western policymakers and researchers have claimed that there is a threat of vast flows of cheap food from CEECs to the EU countries. This view has been shared by many economists in parts of the CEEC, especially in Poland and Hungary. Of course, from their point of view this has not been viewed as a threat to EU farming, but rather as a much-welcomed opportunity to promote their domestic growth and improve their trade balance. On the contrary, in some countries, notably in Czechoslovakia and later in the Czech Republic, the prevailing opinion has been that the more efficient EU agriculture will pose a significant threat to the survival of domestic farming in the medium and long terms.

In accordance with its general philosophy of free market liberalism, the Czech government did not take significant sectoral measures to protect Czech agriculture from foreign competition. For domestic producers, the most important measure of protection from foreign competition was the devaluation of the Czech currency,

which had an economy-wide impact. Because there is a higher inflation rate in the Czech Republic than in the EU, the pro-export influence of the exchange rate gets slowly wiped out. So we see an increase in imports of agricultural goods of Western European origin into the Czech Republic.

An elementary comparison between the percentage of traded quantities versus produced quantities of major agricultural products between transition economies and Western European countries shows that agriculture in transition economies is still much less open than in the EU, where there are presumably efficient nondistorted trade flows, at least inside the EU. (Characteristically, among the three Visegrad countries, the Czech Republic is more open than Poland or Hungary according to this criteria.) This means that farmers, food manufacturers, consumers, and agricultural policymakers in the CEEC should prepare themselves for ever increasing levels of food and agricultural imports flowing into their countries, especially after their accession into the EU.

To understand the many intertwined implications of international trade, it is not enough to rely on simple comparisons between the developed markets of the EU and the developing markets of the CEEC. Complex models like the TAPD model of Rausser et al. (1995) or the GTAP model of Hertel et al. (1995) are needed to provide this insight.

In order to create rich structural and empirically-based models which would really be able to answer pressing questions of economic policy and research, a number of structural parameters must be used in these models.

Some of the most important parameters in virtually all complex models of the agriculture and food sector are import demand elasticities. They are also staple parameters of international trade models. While many papers, studies and monographs provide estimates of import demand elasticities for the US and other developed and developing countries [Stern, Francis and Schumacker (1976),

Carter and Gardiner (1988), Herrmann, Mittelhammer, and Lin (1993), Huang (1993)], no corresponding estimates for transition economies are available.

The major purpose of this paper is to provide estimates for the agricultural and food sector of the Czech economy using the commodities-based Almost Ideal Demand System (AIDS) specification, which has so far been used only in the context of domestic demands and which is new to commodity cross-price import demand estimations.

There are several approaches to the estimation of trade elasticities, as summarized in Gardiner and Dixit (1986). Our approach could be characterized in their terminology as belonging to the class of direct estimation methods.

2 The Empirics of Czech Food Trade

2.1 Historical Development

In the pre-reform period up to the end of 1989, Czechoslovakian foreign trade was based on administrative regulations under the state monopoly on foreign trade. Under that regime there was generally no need to introduce complicated tariff and nontariff schemes favouring domestic producers over imports from abroad. The general goal of food trade policy at that time was to achieve the highest possible degree of self sufficiency in the staple foods of the temperate climatic zone. The main rationale behind this goal was the political and strategic objective of avoiding food dependency on Western countries.

The year 1990 marked a period of transition from the old centrally-planned regime to the new market-determined regime. Up to the end of June 1990 the old centrally-determined prices of food were in force in the Czechoslovak food market. At the beginning of July 1990, there was an increase in the level of

prices, but the new prices were again centrally determined and stable.

In 1990 food imports were still nominally under the control of the state-owned monopolistic trade organizations. But a lot of enterprising people saw the potential for profit and started to import food, sometimes illegally or half legally. The general social and economic climate of the changes in social institutions and the non-organized nature of new trading activities can be seen from the fact that we do not have any reliable numbers on the commodity structure of Czechoslovakian international trade for food commodities in 1990.

The year 1991 began with price liberalization in January, which marked the end of the period of administratively-determined stable prices. Food imports were still placed under the same low, pre-reform tariffs and no specific measures were taken in the agro-food trade which differentiated it from the treatment of other goods. The main instruments keeping the Czechoslovak market from being flooded with foreign goods were a pro-export exchange rate devaluation and the inability of foreign producers and traders to exploit the new market quickly.

A new system of market protection was introduced in Czechoslovakia in the beginning of 1992. This new system was a step away from the foreign trade liberalism of 1991. It was based on substantially higher tariffs in general and especially for sensitive commodities like agricultural products and food. The tariffs were supplemented by import levies for selected agricultural products. These levies were termed "variable levies," but actually the overwhelming majority of them were not changed over time, so in fact they became part of a stable tariff protection. This means that it was technically very easy to tariffy them in 1995, as required by the Uruguay Round Agreement.

The newly elaborated customs classification was harmonized with the EU Customs Nomenclature (CN) code, and, for the majority of agro-food products, market protection by tariffs was set roughly at the EU level. This increase in

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domestic market protection was partly offset by the elimination of the import surcharge at the end of 1992.

These changes illustrated a change in the approach of Czechoslovak agricultural policy makers from liberalism and free-marketism, understood as the natural opposite of a centrally planned economy, towards a policy that was more attuned to the political and economic realities of agricultural policy-making, as represented by the Common Agricultural Policy of the EU.

The period 1993–97, from which our data for the calculation of import demand elasticities were generated, could be roughly divided into two parts. The first part, 1993–95 was primarily characterized by the split of Czechoslovakia into the Czech Republic and the Slovak Republic. Despite this important political and institutional change, this period can also be characterized by economic growth and by a higher level of stability of economic and institutional conditions, which sets it apart from the chaotic transitional period of 1990–92. During the 1993–95 period agricultural foreign trade was not perceived by Czech policy makers and economists as a problematic area. This set the Czech Republic apart from other Central European transition economies, in which the policy concerns about imbalance of agricultural trade were quite strong. But beginning in 1996, this difference diminished as the unfavorable development of agricultural trade started to be matter of concern for Czech economists and policy makers. The period 1996–97 was macroeconomically characterized by a slow-down in the growth of the Czech economy. This was accompanied by a worsening of the trade balance connected with wiping-out the pro-export effect of the stable exchange rate introduced in 1991. The Czech government's reaction was a widening of the fluctuation band of the Czech Koruna, leading to the Koruna's depreciation and the introduction of new restrictive foreign trade measures. Some of these measures which were directly connected with agricultural imports were only temporary and

Table 1: The Share of Food Imports to Total Czech Imports (in %.)

Year	1986	1987	1988	1989	1990	1991
Share	8.3	7.9	8.3	8.0	7.8	9.0
Year	1992	1993	1994	1995	1996	1997
Share	8.2	8.2	9.2	8.4	7.4	7.3

Note: Share for 1997 is based on the first 8 months of 1997.

Source: Doucha and Vojtech (1995) , The Report on the State of the Czech Agriculture (1995, 1996) and Customs Statistics data.

were abolished two months after their introduction.

The relatively stable shares of food imports compared to total Czech imports, given in Table 1, show that food imports are basically determined by the same forces as the other imports. Nevertheless, there was a slight trend towards an increased share of food imports at the beginning of the transition, which was followed by a decrease to lower than pre-reform levels in 1996 and 1997.

The regional structure of Czech food imports changed sharply during the first years of the transition, when the share of imports from developed countries almost doubled between 1989 and 1992. Since 1992, the share of developed countries has been at a stable levels around 60 percent of the total Czech agricultural and food imports.

2.2 Commodity Structure of Czech Food Imports

The major feature of the commodity structure of Czech food imports is its relative stability, which can be seen from the shares in Table 2.

The sharpest and most significant change in the shares of food groups between the pre- and post-reform period was the decline in imports of feedstuffs and food-processing residuals reused for feeding animals. Other major changes between

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the pre- and post-reform period were concentrated in the rise in the share of the imports of processed edible preparations and food products, especially cereals, and in the rise in the share of animal and vegetable fats and oils.

The decrease in the import of animal feed was due to structural changes, the most important of which was the significant decrease of animal production in Czech agriculture. The increased demand for fats and oils was partly price-driven when these oils were substituted for butter and other milk-based products, which have been relatively more expensive since the reform. The other reason for the increased demand for oils and fats was the aggressive promotion of new types of spreads, which coincided with growing concerns for the consumption of so called "healthy" foods. Starting in 1993 the Czech producers of oils and fats managed to reorient their production program to the new products. Consequently, they captured a higher portion of consumer demand which led to a decrease in the share of imported fats and oils. The rise in the share of processed foods was a reflection of the satisfaction of the demand for foods previously inaccessible to Czech consumers, either because the foods were not sold in Czech shops, or because the average Czech consumer did not know about them. This is especially true for products like breakfast cereals, which were previously virtually unknown in the Czech Republic.

The time-series of import shares show that the major transitional changes were over by the end of 1992. These time-series indicate that the import demand for food groups in the period we used for the estimation of import demand elasticities already achieved a new long-term equilibrium which could last up to the accession of the Czech Republic into the EU. This stable character of the composition of Czech food imports was not disturbed by the slow-down in the growth of the Czech economy in 1996 and 1997.

The majority of imported foods were products which cannot be grown in

Table 2: Commodity Structure of Food Imports (in %.)

CN	Commodity grouping	1989	1991	1992	1993	1994	1995	1996	1997
1	Live animals	1	1	4	1	2	2	1	1
2	Meat and edible meat offal	1	1	3	1	3	2	2	2
3	Fish	5	2	3	2	3	3	3	2
4	Dairy products	1	1	2	3	2	3	3	3
5	Other animal products	1	1	1	1	1	1	1	1
6	Plants and flowers	0	1	2	2	2	2	2	2
7	Vegetable unprocessed	3	5	3	7	7	9	7	7
8	Fruit unprocessed	18	16	15	14	14	12	13	12
9	Coffee, tea, mate, and spices	7	8	6	6	7	7	5	5
10	Cereals	2	4	3	6	3	3	5	7
11	Cereal milling products	3	1	0	0	0	1	1	1
12	Oilseeds	5	4	4	3	3	3	3	3
13	Plant extracts	4	0	1	1	1	1	1	2
14	Plant plaiting materials	0	0	0	0	0	0	0	0
15	Animal or vegetable fats and oils	1	6	6	5	4	4	4	3
16	Preparations of meat, or of fish	4	2	2	3	3	3	3	3
17	Sugars and sugar confectionery	3	3	2	2	2	2	3	2
18	Cocoa and cocoa preparations	3	4	5	5	5	5	5	4
19	Preparations of cereals	0	1	2	4	4	4	4	4
20	Preparations of vegetables, fruit	4	2	2	4	6	6	6	5
21	Other edible preparations	2	2	5	6	7	9	8	9
22	Beverages, spirits, and vinegar	8	5	6	5	5	4	5	5
23	Fodder	18	18	15	11	9	9	10	10
24	Tobacco and preparations	5	9	9	7	9	6	7	9
	Total	100	100	100	100	100	100	100	100

Note: Share for 1997 is based on the first 8 months of 1997.

Source: Volosin et al. (1994), The Report on the State of the Czech Agriculture (1995, 1996) and Customs Statistics data.

the Czech Republic. The highest share belonged to fruits and vegetables, which accounted for 19 percent in 1997 (24 percent with the inclusion of processed fruits and vegetables). Contrary to a commonly-held belief, there was no significant increase in the import and consumption of fruits as compared to the pre-reform period. The share of unprocessed fruit compared to the total Czech foods imports decreased steadily over the whole transition period. The major change with respect to the pre-reform situation was a wider selection of different kinds of fruits and a more even supply, which eliminated the previous highly seasonal and rationed supply. This led to a significant shift in consumer demand towards tropical and semi-tropical fruits. While the total (domestic and imported) Czech per capita fruit consumption of 70.5 kg in 1989 increased only by 0.5 kg to 71 kg in 1996, the consumption of tropical and semi-tropical fruits over the same period increased from 16.9 kg to 31.5 kg (Stikova et al. 1997, p.50). The share of fresh vegetable imports grew continuously and, according to Drozen et al. (1995, pp.42–43), there is probably room for import increases. The Czech per capita consumption of vegetables (both fresh and processed) was 78.5 kg in 1996 (with an expectation of 79.5 kg in 1997) (Pischnothova 1997, p.15), which is still significantly lower than consumption in 1948 (92.2 kg) or 1960 (90.4 kg).

2.3   Consumer Attitudes Toward Imports

The preferences of Czech consumers with respect to domestic and foreign food products and their attitudes toward agricultural protectionism have been investigated since 1993 in a series of surveys by Stikova and Krejci (1994, 1995, 1996, 1997).

According to their sample of almost 1000 households in 1996, 13.4 percent of people would prefer a liberalized food-import market without any protection

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for Czech farmers. This was a decrease from 16.8 percent in 1993. 25.7 percent would prefer partially restricted food imports, with some protection for domestic producers. 44.4 percent of the questioned households would prefer agricultural protectionism. Characteristically, from 1993 up to 1995 the number of people in favor of a fully liberalized food-import market increased. In 1995 an all-time high of 21.1 percent in favor of full liberalization was achieved. However, since 1996 we have observed a marked increase of protectionist thinking among the Czech population.

Approximately half of the households were of the opinion that imported food products on the Czech market lead to excessive increases in prices and in the cost of living. This opinion was quite stable over the whole investigated period 1993–1996. Approximately 45 percent of the questioned sample thought that imports of foreign food products should be decreased. This percentage was almost the same as the proportion of people supporting agricultural protectionism. There was only a slight change between 1993 and 1996, towards a less favorable opinion about the desirability of imports of foreign food products.

When comparing domestic and imported products according to a number of specified attributes, the majority of sampled households differentiated between domestic and foreign products. But the degree of differentiation was far from uniform across the attributes. There was also a significant evolution over time in the attitude towards imported foods.

Before 1990 there was only a limited selection of imported food products in Czech food stores, and their prices were administratively determined not to vary greatly from the prices of corresponding Czech products. The demand for foreign goods was quite high and consumers considered them superior to domestic products. This consumer attitude persisted during the first few years of the transformation, but has no longer held true in the later years of transformation

from which we take our data for the estimation of import demand elasticities.

Over the transition period consumers have also become increasingly price-conscious when choosing foods. More rational, price-based consumer choices have been evident since the beginning of 1993 which is the starting point of our data set used for the calculation of import demand elasticities.

The general trend over time since the beginning of 1993 has been a movement towards preferring domestic products and away from believing that imported products are significantly better than domestic products in all respects. The data for 1996 showed that 80 percent of consumers considered Czech food products to be more affordably-priced than imported products. More consumers preferred Czech food products over the imported food products when considering the quality of the food components, the information provided by the labels on goods, taste, the selection in food stores, general quality, and the level of harmful residuals. Furthermore, most Czech consumers trusted that domestic producers used the proper ingredients in the production of food and did not cheat consumers by substituting cheaper ingredients. Imported goods still claimed advantages in some respects, primarily connected with packaging, which was considered to be better for imported foods than for domestic foods by 66 percent of consumers in 1996. The size of packages, the durability of goods, and the suitability of goods for special occasions and celebrations were other attributes for which the percentage of consumers who preferred imported products was higher than the percentage of consumers who preferred the Czech products. The higher percentage of people considering the consumer information provided by labels on goods to be better for Czech products than for imports in 1995 and 1996 resolved the apparent contradiction of previous years. During the period 1991–1994, consumers thought that foreign foods provided more complete information on the label, yet at the same time they were more afraid of foreign producers using inferior materials in

the production of foods. Of course, the perception of inferior materials is still very different for Czech consumers than for, say, U.S. consumers. For example, many Czech consumers believe foods prepared with low-fat materials cheat on traditional methods of preparation, which used high-fat milk or other animal fats.

These findings support our approach to treating imported food products as different from domestic goods, and they strengthen our price-based model of food demand.

3   Model Specification

While the first theoretically consistent estimations of demand systems were done using the linear expenditure systems, which was applied to Czech domestic food demand by Janda (1995), the majority of estimations in recent years have been done by systems belonging to the class of flexible functional forms. The most prominent of these are Almost Ideal Demand System (AIDS) models. In the context of domestic food demand in transition economies, AIDS models were used in studies by Balcombe and Davis (1996) in the case of Bulgaria, by Banse (1993) in the case of Hungary, and by Ratinger (1995) and Crawford, Laisney and Preston (1996) for estimating domestic consumer demand systems in the Czech Republic. Following the lead of Brenton and Winters (1992) we choose the AIDS method for estimating import demand elasticities in our paper.

While we are dealing with import demand elasticities, our approach corresponds more to the voluminous literature on AIDS domestic demand systems than to the sparse literature on AIDS international trade systems. Contrary to our commodity-based system, the recent international trade literature is based on the country of origin approach. The AIDS demand systems of Brenton and Winters (1992), and Shiells et al. (1993) always model an AIDS system for one

commodity with the different modelled goods defined as this one commodity supplied from different countries or groups of countries. The obvious disadvantage of this approach is that resulting elasticities do not reflect the cross-price links between commodities and consequently do not allow the modellers to build the import demand systems into partial or general equilibrium models at the level of commodity aggregation corresponding to domestic demand systems.

The AIDS demand system of Deaton and Muellbauer (1980) including the time trend term as in Chalfant, Gray and White (1991) leads to the following econometrically estimable demand functions in expenditure shares:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log \frac{m}{P} + \tau_i t + \epsilon_i, \tag{1}$$

where

$$\log P = \alpha_0 + \sum_{k=1}^{n} \alpha_k \log p_k + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \gamma_{jk} \log p_j \log p_k. \tag{2}$$

Dependent variable w_i is the expenditure share of good i to the sum of expenditures on all goods considered in a given model. Variables $q_1, \ldots, q_n$ and $p_1, \ldots, p_n$ are, respectively, imported quantities and unit values. Variable m is the total value of agricultural and food imports. Variable t is the time trend having the value 1 in the first period and increasing by 1 in every subsequent period. The term ϵ_i is disturbance term.

The Stone price index, which we use instead of $\log P$, given by Equation 2, to obtain the starting values for the full nonlinear AIDS systems is defined as:

$$\log P = \sum_{k=1}^{n} w_k \log p_k. \tag{3}$$

The expenditure elasticities of import demand e_i and compensated (Hicksian) price elasticities e_{ij} are computed from the estimated parameters of the AIDS

system as outlined in Pierani and Rizzi (1991) as:

$$e_i = \frac{1}{w_i}\beta_i + 1, \tag{4}$$

$$e_{ij} = \frac{1}{w_i}(\gamma_{ij} + \beta_i\beta_j \log \frac{m}{P}) + w_j - \delta_{ij}, \tag{5}$$

where δ_{ij} is the Kronecker delta ($\delta_{ij} = 1$ for $i = j$ and $\delta_{ij} = 0$ for $i \neq j$).

In computing the elasticities, we have computed the observation specific values (expenditure shares w_i, w_j, logarithms of expenditure $\log m$, and logarithmic price index $\log P$) as arithmetic averages of the sample values.

The main reason for the choice of the AIDS system to model import demand is the firm theoretical support for this system as opposed to some other approaches. In order to be fully consistent with underlying economic theory, the demand system has to satisfy the restrictions of a) adding up:

$$\sum_{i=1}^{n}\alpha_i = 1; \quad \sum_{i=1}^{n}\beta_i = 0; \quad \sum_{i=1}^{n}\gamma_{ij} = 0 \ \forall j; \quad \sum_{i=1}^{n}\tau_i = 0, \tag{6}$$

b) homogeneity of degree zero in prices:

$$\sum_{j=1}^{n}\gamma_{ij} = 0 \ \forall i, \tag{7}$$

c) symmetry:

$$\gamma_{ij} = \gamma_{ji} \ \forall i,j, \tag{8}$$

and d) negativity.

Negativity cannot be ensured by any restrictions on the parameters alone. But it can be easily verified at any sample point by checking the eigenvalues of the matrix $K = [k_{ij}]$ defined as:

$$k_{ij} = \frac{p_i p_j s_{ij}}{m} = e_{ij}w_i, \tag{9}$$

where s_{ij} is an element of the Slutsky matrix. The eigenvalues of matrix K have the same signs as those of the Slutsky matrix. If all of the eigenvalues are

non-positive, then Slutsky matrix is negative semi-definite and the underlying expenditure function satisfies the concavity property.

In order to impose negative semi-definiteness at given point we have used the approach based on imposing restrictions on the price coefficient matrix $\Gamma = [\gamma_{ij}]$. This method is described in Kohli (1991) and it was originally proposed by Wiley, Schmidt and Bramble (1973).

In the estimation of the AIDS system, linearization through the Stone price index is used in the overwhelming majority of applied studies. A series of recent articles [Moschini (1995), Hahn (1994), Buse (1994) and Pashardes (1993)] expressed considerable doubts about that practice. In view of their evidence, we have chosen to estimate our demand systems by a full nonlinearized AIDS system. Much like Eales and Unnevehr (1994) we use AIDS linearly approximated by the Stone price index only to obtain starting values for nonlinear full AIDS estimation.

The AIDS systems are usually specified as direct-demand systems. This means that prices are assumed to be predetermined. This assumption is equivalent to assuming that supplies are perfectly elastic and that demands adjust to clear the market. As emphasized by Moschini and Vissa (1993), in the context of domestic demand systems such conditions may hold for aggregate market data when modeling the demand for tradeable commodities in the case of a small open economy or when prices are administratively set. The perfect elasticity of supply and the market-clearing adjustments of demand seem to be very reasonable assumptions in the case of the food import demand of the Czech Republic, where the import prices are determined by markets outside the Czech Republic and the quantity imported has to adjust to prices. While the exogeneity of prices is taken as given and is not questioned in the majority of literature on demand systems, we follow the approach outlined in some papers dealing with inverse demand sys-

tems (Eales and Unnevehr 1993) and we test this assumption using a Hausman (1978) specification test.

In order to apply the Hausman test for endogeneity, we estimate each AIDS demand system twice. In both cases, homogeneity and symmetry are imposed on the estimates. The demand model is first estimated using a maximum likelihood procedure with a likelihood function, which is appropriate if prices are predetermined. Second, the demand model is reestimated with iterative Three Stage Least Squares (3SLS), in which instrumental variables are used to reflect the possible determinants of Czech import prices. If the Czech import prices are appropriately taken as predetermined for an import demand model, the two estimates are similar and the value of Hausman test is not significantly different from zero.

4   Empirical Results

The Czech food and agricultural imports data used in our study were based on the customs declarations data collected by the Czech customs authorities between the establishment of the Czech Republic on January 1, 1993 and August 1997. All data in the source files from the Czech Customs Directorate were given at the most detailed commodity level as coded by the 8-digit customs nomenclature (CN) code. These data were monthly aggregates according to trading countries. The most fundamental individual transaction-specific data was therefore not available.

In order to facilitate further analysis we once more aggregated these source data according to groups of goods and groups of countries. Because of problems in recording trade with Slovakia immediately after the split of Czechoslovakia, we have discarded the data for January and February 1993. In order to eliminate the possible spurious influences of the discrete character of trading, we considered as

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our time unit the periods of two months. Consequently we avoided the problem of zero levels of trading which sometimes happened when we experimented with monthly data. As a results of these data arrangements we obtained 27 bimonthly observations for our analysis.

The quantity data used as the input series into our computations were quantities in kilograms. The unit values for the good p_i were computed as

$$p_i = \frac{\sum_{j=1}^{r} p_{i.j} q_{i.j}}{\sum_{j=1}^{r} q_{i.j}}, \tag{10}$$

where $j = 1, ..., r$ were the detailed individual goods at the eight-digit level of the customs classification code, which together formed the composite good i. The price time-series used as an input for our computations were in Czech Koruna per kilogram.

The use of unit values in the studies of import demand have already been criticized by Kravis and Lipsey (1974), especially because of the substantial measurement errors presented in unit values. But a paper by Shiells (1991) showed that import demand elasticities based on unit values are quite close to estimates based on alternative price measurement schemes.

We have made separate estimations for five commodity systems, each comprising four food aggregates. The first four systems had relatively detailed specifications. The meat system comprised beef [defined as commodities in classes 201, 202, and 206 of Customs Nomenclature (CN)], pork (CN 203, 209, 1601,...,1603), poultry (CN 207), and fish (CN 302,...,307, 1604, 1605). The next subsystem, which we labeled as carbohydrates, consisted of potatoes (CN 701), rice (CN 1006), cereals (CN 1001,...,1005, 1007, 1008, 1101,...,1109), and bakery products (CN 1901,...,1905). As a third system, we have chosen to investigate the imports of fruits and vegetables as the single most important Czech import group. We have divided this group into raw vegetables (CN 702,...,709), processed vegeta-

bles (CN 710,..., 714), fresh fruits (CN 801,...,810), and processed fruits (CN 811,...,814). The fourth system was concerned with milk and sugar based products which are primarily considered by Czech consumers not as basic food items, but as tasty supplements for staple foods. The common feature of milk and sugar based products is that they are often viewed by many Czech consumers as food primarily bought for children. This group comprised milk (CN 401, 402), milk products (CN 403,...,406), sweet drinks (CN 2202), and sweets (CN 409, 1701,...,1704, 1806).

The fifth system was a more aggregated one. It included the composite commodities meat, carbohydrates, fruits and vegetables, dairy and sweets. These commodities were aggregations of the above-defined four food groups.

The actual maximum likelihood estimation of the AIDS import demand systems was done by the TSP procedure FIML. During the computation of AIDS elasticities, we used the AIDS model linearized with the Stone price index to obtain starting values for parameters of a full nonlinear AIDS model. This approach was especially useful in estimating highly nonlinear models with imposed concavity conditions.

Prior to estimating the elasticities, we first tested the validity of the theoretical restrictions on demand systems. In our tests of homogeneity and symmetry, we have used the likelihood ratio (LR) tests. The estimations of nonlinear demand systems for the symmetry and homogeneity restriction tests were done by FIML starting from the zero values of the parameters.

In testing homogeneity, the unrestricted system was given by the shares equations (1) with adding up restrictions (6) imposed. In testing symmetry, the unrestricted system was given by shares equations (1) with adding up (6) and homogeneity (7) restrictions imposed.

Comparing the critical values of $\chi_3^2(0.95) = 7.82$ and $\chi_3^2(0.99) = 11.34$ with

the values of the likelihood ratio statistics in Table 3, we see that with an un-adjusted likelihood ratio test homogeneity was never rejected. Symmetry was rejected at the 95 percent level only in the case of the dairy and sweets model, but even in this model symmetry was not rejected at the 99 percent level. Since the tests of restrictions in large demand systems are biased towards the rejection of a null hypothesis (Laitinen, 1978, Meisner, 1979) we have also computed the size-corrected likelihood ratio test suggested by Moschini, Moro, and Green (1994):

$$LR_0 = LR \left[\frac{MT - \frac{1}{2}(N_U + N_R) - \frac{1}{2}M(M+1)}{MT} \right], \qquad (11)$$

where M was the number of equations, T was the number of time-series observations, N_U was the number of parameters of the unrestricted (restricted) model, N_R was the number of parameters of the restricted model. Using this adjusted likelihood ratio test we did not reject homogeneity or symmetry at any conventional level of significance.

In testing for the concavity of the expenditure function we restricted ourselves only to the investigation of concavity at the sample mean. The concave property was violated for the meat and the dairy and sweets models. Subsequently we have enforced this property by imposing restrictions on the price coefficients matrix Γ at the sample mean.

In testing for the exogeneity of prices we used German agricultural prices as instruments. The German prices served as proxies for the world prices most relevant to the import prices facing the Czech Republic. We used the prices of 10 major agricultural commodities — cattle, pigs, eggs, broilers, butter, cheese, wheat, barley, maize, potatoes — which were published weekly in the English version of Agra Europe. We have converted these prices to Czech Koruna per kilogram. To consider possible lags in the influence of European prices, we also

Table 3: LR Statistics for Testing Homogeneity and Symmetry

Models	Homogeneity		Symmetry	
	Unadjusted LR	Adjusted LR	Unadjusted LR	Adjusted LR
Meat	4.36	2.99	2.15	1.55
Carbohydrates	2.95	2.02	7.70	5.56
Fruits & vegetables	2.87	1.97	4.09	2.95
Dairy & sweets	7.74	5.30	8.28	5.98
Foods	0.10	0.07	1.90	1.37

included these prices, lagged once and twice, in our set of instruments. This means that we used a set of 30 instrumental variables.

The Hausman test was insignificant in all five of the investigated models. This means that we can be confident that prices in our estimated models were really exogenously predetermined by influences outside of the sphere of Czech food import demand.

The estimated compensated price elasticities and expenditure elasticities with respect to expenditures on the group of commodities included in the individual estimated models are given in Table 4 together with the estimated coefficients of the trend terms. The overwhelming majority of price elasticities and all of the group expenditure elasticities (with the exception of the group expenditure elasticity for beef) were statistically significant. The significance of price elasticities was especially notable in the case of own-price elasticities, almost all of which were significant at the 95 percent level. The only exception was the own-price elasticity of potatoes which was significant at the 94 percent level, however.

The values of price elasticities were within the range usually reported in the literature on this subject or used as a range of parameters in the partial or general equilibrium models concerned with agricultural commodities. The exceptions were the cross-price elasticities of beef and fish ($e_{14} = 1.98$) and pork and fish

$(e_{24} = 2.19)$. Almost all the goods were identified as Hicksian substitutes in all five models. The exceptions were only potatoes and rice, for which the cross-price elasticities were not significant, and pork and beef which had high and significant negative cross-price elasticities. Apart from beef and pork, all other commodities exhibited the expected relation among own- and cross-price elasticities when the reactions to the own-price changes were stronger than the reactions to the changes in prices of other commodities.

In the meat group the highest own-price elasticity was exhibited by pork, which accounts for the highest share of Czech meat consumption. Also, meat as a composite commodity in the foods model exhibited the own-price elasticity higher than one. The lowest own-price elasticity was associated with fruits and vegetables, which were price inelastic ($e_{33} = -0.46$) as a group. Fresh fruits, especially, had a low absolute value of own-price elasticity. Together with the low group expenditure elasticities of fruits and vegetables as a composite commodity ($e_3 = 0.82$) and fresh fruits ($e_3 = 0.96$), this showed that demand for the imports of fruits and vegetables and especially fresh fruits was not very responsive to changes in prices and expenditures.

5 Conclusions

In our paper we aimed to create a set of import demand elasticity estimates which could be used in economic analysis and in building structural models of the Czech economy or which could be used as an approximation of import demand elasticities in modelling other Central European transition economies. Consequently, our emphasis was on obtaining "model-free" estimates consistent with economic theory, which could be used by other economists in building their own models. (By the term "model-free" we mean, that our estimates are not dependent on

Table 4: Group Expenditure and Price Compensated Elasticities

Meat	1	2	3	4	Expenditure	Trend
1- Beef	-0.95*	-1.26*	0.23	1.98*	0.32	-0.002
	(-0.48)	(0.34)	(0.33)	(0.23)	(0.23)	(0.001)
2- Pork	-0.56*	-1.63*	0.01	2.19*	1.11*	-0.010*
	(0.15)	(0.11)	(0.09)	(0.14)	(0.14)	(0.002)
3- Poultry	0.20	0.01	-0.90*	0.70*	0.82*	0.006*
	(0.27)	(0.16)	(0.18)	(0.27)	(0.27)	(0.002)
4- Fish	0.30*	0.75*	0.13*	-1.18*	1.10*	-
	(0.03)	(0.05)	(0.05)	(0.11)	(0.05)	-
Carbohydrates	1	2	3	4	Expenditure	Trend
1- Potatoes	-0.99	-0.38	0.90	0.47	1.54*	-0.002
	(0.51)	(0.25)	(0.46)	(0.62)	(0.48)	(0.002)
2- Rice	-0.22	-0.58*	0.63*	0.18	0.48*	0.001
	(0.15)	(0.28)	(0.18)	(0.27)	(0.14)	(0.001)
3- Cereals	0.17	0.21*	-1.08*	0.70*	1.69*	0.000
	(0.09)	(0.06)	(0.18)	(0.18)	(0.09)	(0.003)
4- Bakery	0.08	0.05	0.59*	-0.72*	0.47*	-
	(0.10)	(0.08)	(0.16)	(0.13)	(0.08)	-
Fruits & vegetables	1	2	3	4	Expenditure	Trend
1- Raw vegetables	-0.74*	0.08*	0.65*	0.001	1.05*	0.0008
	(0.21)	(0.03)	(0.20)	(0.02)	(0.33)	(0.0022)
2- Processed vegetables	0.28*	-1.05*	0.57*	0.19*	1.02*	0.0005
	(0.10)	(0.10)	(0.15)	(0.07)	(0.15)	(0.0004)
3- Fresh fruits	0.27*	0.07*	-0.35*	0.01	0.96*	-0.0002
	(0.09)	(0.02)	(0.09)	(0.01)	(0.13)	(0.0021)
4- Processed fruits	0.01	0.33*	0.08	-0.42*	1.19*	-
	(0.13)	(0.13)	(0.20)	(0.18)	(0.18)	-
Dairy & sweets	1	2	3	4	Expenditure	Trend
1- Milk	-0.97*	0.28*	0.13	0.56*	1.07*	-0.001*
	(0.02)	(0.08)	(0.09)	(0.13)	(0.27)	(0.000)
2- Milk products	0.03*	-0.73*	0.12*	0.57*	1.05*	0.002
	(0.01)	(0.06)	(0.04)	(0.06)	(0.14)	(0.002)
3- Sweet waters	0.03	0.28*	-0.87*	0.55*	1.11*	-0.007*
	(0.02)	(0.10)	(0.15)	(0.18)	(0.38)	(0.002)
4- Sweets	0.03*	0.25*	0.10*	-0.38*	0.95*	-
	(0.01)	(0.03)	(0.03)	(0.09)	(0.09)	-
Foods	1	2	3	4	Expenditure	Trend
1- Meat	-1.14*	0.38*	0.24	0.52*	1.15*	-0.001
	(0.21)	(0.09)	(0.16)	(0.13)	(0.14)	0.001
2- Carbohydrates	0.29*	-1.23*	0.67*	0.26*	1.13*	0.002
	(0.07)	(0.10)	(0.08)	(0.06)	(0.15)	0.001
3- Fruits& vegetables	0.09	0.32*	-0.46*	0.05	0.82*	-0.001
	(0.06)	(0.04)	(0.07)	(0.07)	(0.06)	0.001
4- Dairy & sweets	0.45*	0.30*	0.13	-0.88*	1.14*	-
	(0.11)	(0.07)	(0.17)	(0.10)	(0.11)	-

Notes:1. Numbers preceeding the names of commodities in the first column are used in columns labeled 1-4 to identify the appropriate food group equal to the group written for the given model in the row labeled by this number.

2. Standard errors are provided in parenthesis and elasticities significant at the 95 percent level are marked by an asterisk.

some special structure of a single international trade model of some specified class.) To this end, we provided the import demand elasticities based on the AIDS demand system approach with inclusion of the economic theory-based restrictions of homogeneity, symmetry, and negativity. The negativity restriction was implemented using the decomposition of the price coefficients matrix Γ.

Our estimation was based on the assumption, that for the Czech Republic as a small economy, the import prices of food and agricultural products are given exogenously. Using the Hausman specification test with German agricultural prices as instruments, we did not reject this assumption.

As a result of our estimation, we have obtained the set of one hundred estimates of own-price, cross-price and group-expenditure elasticities. In the overwhelming majority of cases our estimates were statistically significant and were within the range of values usually considered to be reasonable for food elasticities. All our commodity groups were found to be normal goods with positive group expenditure elasticities and almost all the goods were identified as Hicksian substitutes in all five models.

In order to get well-structured and generally interpretable estimates, we avoided the temptation to include explanatory variables other than unit values, quantities of imported foods, and time trend in our import demand regression equations. We hope that our estimates will be useable as an input into a synthetic method (Gardiner and Dixit 1986) of creating parameters for large structural models.

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