Economic Modelling 75 (2018) 70–80

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.journals.elsevier.com/economic-modelling

# Using empirical Armington and demand elasticities in computable equilibrium models: An illustration with the CAPRI model

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ARTICLE INFO

*Keywords:*
Switzerland
Agriculture
Impact assessment
Free trade

ABSTRACT

Computable equilibrium models play a significant role in ex-ante policy evaluations of free trade agreements. Previously, such models have generally used elasticities from the literature, although those estimates are mostly obsolete or else estimated using different aggregation levels to those used in the models. Furthermore, the same elasticities are used for all countries. These drawbacks highlight the importance of using empirically validated elasticities. In order to demonstrate the extent of the identified drawbacks, we use the Common Agricultural Policy Regionalized Impact (CAPRI) model and empirically assess the Armington and demand elasticities for Switzerland. We then compare the results of a free trade agreement between Switzerland and the European Union with the old and the estimated elasticities derived from the CAPRI model. The results differ remarkably from each other, which supports the importance of the estimated elasticities used in computable equilibrium models in terms of making policy assessments more reliable.

## 1. Introduction

Swiss consumers exhibit a high preference for buying homegrown agricultural products. Indeed, Feige et al. (2016) show that almost half the Swiss population declares themselves to have a strong tendency toward buying Swiss products. The importance of Switzerland's agricultural sector is also reflected in the high direct payments and other subsidies offered by the government to farmers. The Swiss producer support estimate, which indicates how high the policy transfers to agricultural producers are, is around 58% of the gross farm receipts (GFR). For the European Union (EU), the producer support estimate as a percentage of the GFR accounts for only 21%, while it is around 9% for the USA (Organization for Economic Co-operation and Development, OECD (2016)).

Given the high importance of the agricultural sector, as well as the high involvement of Switzerland's government in that sector, assessing both the ex-ante outcomes of agricultural policy instruments and the implications of free trade agreements plays a crucial role in the implementation of such instruments. In terms of predicting the ex-ante implications of both, computable general/partial equilibrium models (CE models) play an important role. In order to assess the effects of such policies and agreements, CE models make use of elasticities. Substitution elasticities and price elasticities of demand are key to acquiring reliable results with the help of such models. Substitution elasticities, which are also known as Armington elasticities[1] (Armington, 1969) are particularly important, since the assumption that products from different countries of origin are imperfect substitutes accounts for the observed bilateral trade flows (i.e., Switzerland exports and imports cheese at the same time) in such models. Price elasticities of demand are also a basic requirement when seeking to achieve reliable results using such ex-ante impact assessment models, since a change in trade policy, for example, the implementation of a new free trade agreement or policy regulation, always has an impact on the structure of production and, hence, on demand. Therefore, more realistic elasticities increase the assessment power of CE models.

Previously, most CE models have made use of Armington and demand elasticities obtained from the literature (Saito, 2004; McDaniel and Balistreri, 2003; Britz et al., 2014), although only relatively few studies estimate the Armington elasticities for several different countries and sectors (mainly the manufacturing sector). There are some studies concerning the USA (Blonigen and Wilson, 1999; Reinert and Roland-Holst, 1992; Gallaway et al., 2003), as well as studies relevant to certain European countries (Welsch, 2006; Olekseyuk and Schürenberg-Frosch, 2016) or OECD countries

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[1] The potential for substitution between goods from different countries of origin is referred to as Armington elasticities, a concept defined by Armington (1969).

https://doi.org/10.1016/j.econmod.2018.06.006
Received 22 March 2018; Received in revised form 4 June 2018; Accepted 5 June 2018
Available online 29 June 2018

(Erkel-Rousse and Mirza, 2002). The prior studies show very different results, even for the same countries and industries, depending on the period of time, aggregation level and import price indicator, as well as the estimation level. Kapuscinski and Warr (1999) discuss the Armington elasticities for certain primary goods such as fruits or milk in the Philippines. Overall, the elasticities show a strong home bias toward these products. Table 8 provides a brief overview of the results of the different studies. The Armington estimates for agricultural products show overall lower elasticities when compared to those for investment and high value-added goods. The fact that the home bias might be large in the culturally loaded agricultural sector definitely plays a role here. In his study, Welsch (2006) shows, with the help of French data from 1970 to 1997, that the Armington elasticities developed dynamically over the decades. The elasticities have been decreasing since the 1990s after reaching peak values in the 1980s. Nevertheless, most CE models use values taken from the literature, which date back to before the 1990s. Therefore, reconsidering and using new estimates in CE modeling is important in terms of avoiding incorrect policy implications derived from ex-ante modeling with the help of such models. Olekseyuk and Schürenberg-Frosch (2016) emphasize the importance of the aggregation level in the determination of the correct elasticities for CE models. Using the same level of sectoral disaggregation for the estimation procedure serves to improve the predictive power because the estimates increase with the level of disaggregation. The same is true for the price elasticities of demand for food. They have been researched, for example, in the USA, to quite a detailed extent already (Andreyeva et al., 2010), although in contrast to empirical work concerning food demand conducted in other countries, there has been little research so far on the food consumption and expenditure of Swiss households (Bernegger and Strasser, 1986; Abdulai, 2002). However, there are some newer econometric studies, such as that by Aepli (2014).

Overall, these identified drawbacks highlight the importance of using empirically validated Armington elasticities when seeking to derive policy implications from CE models. Our aim is therefore to provide a simple estimation method that is in line with the majority of CE models, and especially one that is in line with the Common Agricultural Policy Regionalized Impact (CAPRI) model, in order to improve the ex-ante predictive power of the implications of policy measures such as free trade agreements. We use the CAPRI model because, among the different available agricultural sector models, it is one of the most consolidated and most broadly used options, particularly in the Swiss context.

In contrast to all the previously published studies, we use scanner data regarding consumption prices. Further, we are able to use scanner data, which refers to data directly derived from the retail sector. In terms of the demand elasticities, the CAPRI model uses estimates from the study by Muhammad et al. (2011), which are based on the established international comparison program data (ICP). We profit from a data set that is more detailed and contains data from the Swiss Household Budget Survey conducted between 2006 and 2011.

We use a simple free trade agreement between the EU and Switzerland in order to analyze the differences between models with different elasticities, namely:

1. The model including the Armington and demand elasticities derived from the literature that has previously been implemented;
2. A model that only includes the estimated Armington elasticities;
3. A model that only includes the estimated demand elasticities; and
4. A model that includes both the new estimated Armington and demand elasticities.

The remainder of this paper is structured as follows. In the following section we briefly discuss why we use the CAPRI model for our analysis, and we present the most important aspects of the model. Section 3 introduces the theoretical framework, as well as the values of the substitution and demand elasticities that are implemented in the CAPRI model, while section 4 provides a short description of the data we use for the estimation of the elasticities. In section 5, we discuss the estimation model and report the estimation results. In section 6, we apply the new estimations to the CAPRI model, and we use a simple free trade scenario to compare the results under the old substitution elasticities with the newly derived results. In this way, both the old and the new, estimated, elasticities are implemented within the same modeling framework (Britz et al., 2014). Therefore, a systematic and direct comparison of the effect of the new elasticities is possible. As a test scenario, we use a simple free trade scenario between the EU and Switzerland, and we discuss the impact on a product-specific level as well as on a more aggregate level (product groups). Section 7 then presents a discussion of the changed results in the CAPRI model and concludes the study.

## 2. Why choose the CAPRI model?

The CAPRI model[2] is a partial equilibrium model that, amongst other things, analyzes the effects of trade liberalization. It is a simulation model for the agricultural sector, and it comprises a large database that is unified, complete and consistent. The data come from various sources, including national statistics. Data concerning farm and market balances and foreign trade are integrated, as well as data concerning herd size or crop production. The CAPRI model is a comparative static computational equilibrium model developed by the University of Bonn in 1997. It is divided into market and supply modules. CE models such as the CAPRI model link all the various parts of integrated economies. As we are interested in the outcome changes (old vs. new elasticities) of a free trade scenario between the EU and Switzerland, we only make use of the market module: the CAPRI model covers 40 trading blocs and around 50 agricultural products. The model is continually updated and developed. In the past, the CAPRI model has been used to evaluate the impact of several free trade agreements (Kita and Adenäuer, 2015; Piketty et al., 2009). For instance, the European Commission used the CAPRI model to assess a free trade agreement with Mercosur. More recently, the Swiss government used the model to analyze the elimination of tariffs with the EU and Mercosur (Mack et al., 2017).

Bilateral trade within the CAPRI model is based on the Armington assumption. In other words, goods from different countries of origin are considered to be imperfect substitutes. Since consumers also exhibit a preference for variety, they prefer, for example, buying Swiss and French cheese to buying only Swiss cheese. This implies that Switzerland exports cheese to France and, at the same time, also imports cheese from France. Demand and supply follow the laws of demand and supply, that is, as prices decrease, consumers buy and suppliers supply less. In a state of equilibrium, demand plus exports equals production and imports.

The CAPRI model depicts Swiss trade policy in the form of tariffs, tariff rate quotas, as well as minimum border prices. In addition to Swiss trade policy, Swiss agricultural policy in the form of direct payments is also modeled in the CAPRI model.

Overall, with the help of the CAPRI model, we can trace how an adaptation of the Armington and demand elasticities influences the results of a free trade scenario. This is important not only for the Swiss case, but also for several other trading blocs. Valid policy implications can only be drawn with the help of solid models. An analysis using the CAPRI model provides an overview of the impacts of free trade scenarios on changes in the net production, imports, and exports, as well as human consumption changes. Each single item can be broken down into the different agricultural products integrated in the CAPRI model.

Previously, the CAPRI model has made use of the same Armington elasticities for each country, which were derived from the literature and synthetically adapted. Furthermore, some synthetic adapta-

[2] More information on CAPRI and a stable release version can be downloaded from: http://www.capri-model.org/dokuwiki/doku.php?.

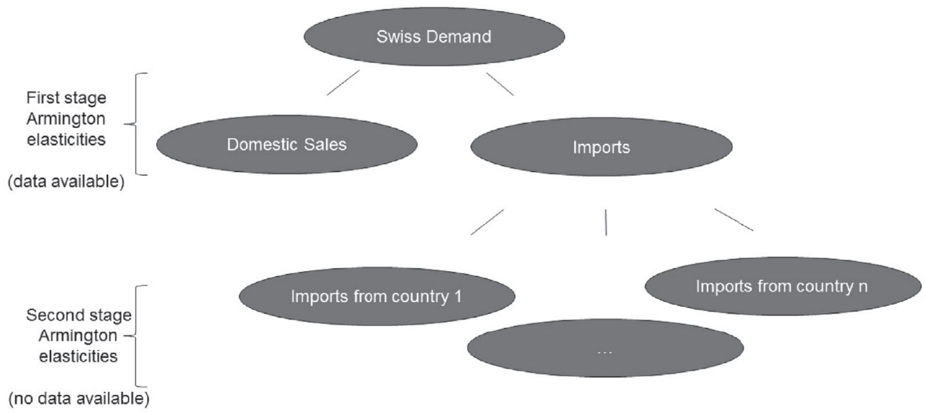


**Fig. 1.** Structure of Armington elasticities within the CAPRI model (Britz et al., 2014).

tions have been implemented for Switzerland. Additionally, its price elasticities of demand are derived from the literature. They are based on a study by Muhammad et al. (2011), who use a 2005 ICP dataset and report the Frisch price elasticities for 144 countries and broad food categories, namely cereals, meats, fish, dairy, oils and fats, fruits and vegetables, beverages and tobacco, as well as other foods (also see Britz et al. (2014)).

The degree of the impact of free trade agreements is highly dependent on the potential to substitute domestic versus imported goods. The more domestic consumers prefer buying domestic products, which suggests they find it harder to substitute a domestic good with an imported one, the lower the magnitude of the effects of an international free trade agreements will be. Conversely, the more elastic the demand is, the more imports increase when prices fall due to free trade.

## 3. Theoretical framework

### 3.1. Armington Elasticities

The Armington assumption Armington (1969) holds that domestic and foreign goods are imperfect substitutes, that is, the goods are differentiated based on their country of origin. In the following, we seek to estimate the elasticity of substitution between Swiss domestic and foreign agricultural goods. For instance, we question whether foreign dairy products are a worse substitute for Swiss dairy products than, for example, foreign fruits are for Swiss fruits.

We follow the approach of Armington (1969) and much of the ensuing literature in assuming that consumer utility is given in the form of a constant elasticity of substitution (CES) sub-utility function in order to model the demand for domestic and imported versions of a certain product. This assumption is in line with the CAPRI model.

Overall, the CAPRI model handles Armington elasticities in two stages (see Fig. 1). During the first stage, the model divides consumption into domestic and foreign demand, while in the second stage, the imports are divided according to their place of origin. The relation between domestic prices and the average import price is decisive for the first-stage subdivision. During the second stage, the import quantities are allocated based on the different trading partners. Therefore, the average import price is also determined at this stage.

In the CAPRI model, the substitution elasticity between domestic sales and imports is mostly synthetic, and it generally follows the literature. Values are given and implemented at the product level in the CAPRI model (see Table 3 for the exact values). For example, the substitution elasticity of cheese is relatively small in comparison to that of sugar, since cheese is a product that is harder to substitute with imported cheese than sugar is to substitute with imported sugar, which is a fairly homogeneous product.

Nevertheless, the empirical assessments that have been undertaken for certain agricultural products support a tendency for lower elasticities than those implemented in the CAPRI model at the moment. As mentioned previously, Kapuscinski and Warr (1999) derive elasticities for the Philippines using data from the mid-1970s through to the late 1980s.[3] For the aggregate categories bananas and other fruits and nuts, vegetables, milk and dairy products, as well as meat products, sugar milling and refining products, and corn, they estimate elasticities of between 0.08 and 1.6, except for sugar and corn, for which the substitution elasticities are indeed higher and range between 3.69 and 5.22, which are still below the values integrated into the CAPRI model.

### 3.2. Price elasticities of demand

The price elasticities of demand measure the sensitivity of consumers to changes in prices. Such elasticities give the percentage change in demand for a product in the case of a 1% change in the price for the particular good. Usually, price elasticities of demand for consumer goods and services are estimated between −0.5 and −1.5 (Andreyeva et al., 2010). A price elasticity larger than −1 is elastic. If the demand for a good is inelastic (price elasticity between −1 and zero), the changes are small in the case of increasing prices. In particular, the necessities of daily life and goods with fewer substitutes are inelastic and have lower elasticities.

In contrast to the approach of Muhammad et al. (2011), we follow Deaton and Muellbauer (1980) and use the Almost Ideal Demand System (AIDS) for the estimation of the price elasticities of demand. This system fulfills the axioms of choice, and it is quite easy to assess because a non-linear estimation can be avoided. The assumptions are in line with those of the CAPRI model.

Another advantage of utilizing the AIDS is that we derive compensated and uncompensated elasticities, while Muhammad et al. (2011) estimate the parameters in the Florida-PI and the Florida-Slutsky models by means of the maximum likelihood using the score method. They report Frisch price elasticities that have to be adapted in order to be used in the CAPRI model. The key disadvantage of these elasticities is that they assume marginal utility to be constant rather than utility. Therefore, these elasticities typically lie between the Marshallian and Hicksian elasticities that are used in the CAPRI model (Britz et al., 2014). The adaptations that had to be made for usage in the CAPRI

[3] The dataset they use consists of data concerning the quantity and prices of imports and domestic production. The sectors/product categories are arranged in a way that is consistent with the CE model they use (Apex model) (Kapuscinski and Warr, 1999).

**Table 1**
Elasticity of demand at the group level currently used in the CAPRI model (Britz et al., 2014; Muhammad et al., 2011).

| Product (group) | Expenditure elasticity (unconditional) | Frisch own-price elasticity (unconditional) |
|---|---|---|
| Cereals | −0.09 | 0 |
| Meats | 0.5 | −0.33 |
| Dairy | 0.47 | −0.35 |
| Oils & fats | 0.02 | −0.01 |
| Fruits & vegetables | 0.28 | −0.21 |

model are quite rough.[4]

The table above reports the price elasticity of demand used in the CAPRI model at the group level for cereal, meats, dairy, oils and fats, and fruits and vegetables (Muhammad et al., 2011). Overall, the elasticities are low and lie between zero and −0.35. Therefore, all the product categories are inelastic (see Table 1).[5]

Demand only reacts a little to changes in prices. For cereals, the Frisch own-price elasticity is zero, which means that demand is completely inelastic and changes in prices do not trigger changes in demand. For dairy products, the own-price elasticity is at its lowest.

The expenditure elasticity measures the sensitivity of expenditure on consumption. Therefore, it measures the extent to which the demand for a good changes when the real income of a household changes. A high estimated expenditure elasticity for a consumption good implies that most of an additional dollar of income is spent on that consumption good. In line with the own-price elasticities, the expenditure elasticities for dairy products and meat are the highest, which means that an additional dollar of income increases the demand for these product categories the most, while the demand for cereals does not react to such changes.

## 4. Data

### 4.1. Armington Elasticities

We use the monthly consumption data of Nielsen Switzerland from 2010 to 2016. Overall, we have 72 observations for each product. The data contain scanner data for several kinds of fruits, vegetables, and milk products. For each single product, the retail price of the domestic as well as the average price of the imported good are given. Prices are directly measured in retail stores at the cash register with the help of the barcode scanner (scanner data). Furthermore, we have data concerning the quantities (tons) of the imported and the corresponding Swiss agricultural products. To the best of our knowledge, we are the first to make use of scanner data rather than having to use a price index when estimating Armington elasticities. Using scanner data is not yet common, and we benefit from a unique dataset in Switzerland that offers several advantages when compared to price indices. Such indices always lead to indices biases due to a lack of data. Usually, the actual prices are not available with actual information regarding quantities. The common Laspeyres index is, for example, used due to a lack of knowledge of actual quantities (Boesch et al., 2009).

Unfortunately, the database contains only information about some CAPRI model products. Table 2 details the products for which information is available. As there are no data that differs between the import origins of agricultural products, we are not able to estimate the substitution elasticities between goods imported from different destinations (i.e., how the elasticity between Swiss and French fruits differs from the elasticity between Swiss and Italian fruits). Therefore, we can only estimate the first-stage elasticities (see Fig. 1) and hence assume that the second-stage elasticities are twice as high (Britz et al., 2014)).

**Table 2**
Product data base (data from 2010 to 2016) from Nielsen data bank.

| CAPRI product group | Product given in Nielsen data base |
|---|---|
| Fruits: Apples, pears and peaches | Apples: GALA |
| Fruits: Apples, pears and peaches | Apples: Golden Delicious |
| Fruits: Apples, pears and peaches | Pears: Conference |
| Fruits: Apples, pears and peaches | Pears: Kaiser |
| Fruits: Apples, pears and peaches | Pears: Williams |
| Other arable field crops: Potatoes | Potatoes: Charlotte |
| Other arable field crops: Potatoes | Potatoes: Other potatoes |
| Other arable field crops: Tomatoes | Tomatoes: Cocktail tomato |
| Other arable field crops: Tomatoes | Tomatoes: Other tomatoes |
| Dairy products | Fresh milk products: Yogurt |
| Dairy products | Fresh milk products: Curd |

### 4.2. Price elasticities of demand

We use a sample from the Swiss Household Budget Survey (Swiss Federal Statistical Office, 2013) from 2006 until 2011. The Swiss Household Budget Survey is a repeated cross-section. The data are aggregated across households, and we are left with monthly data for six years. It is important to note that at the aggregate level no zero consumption is observed. Table 9 displays the product coverage.

An issue with household-level data is that not all households always consume all products, while those observed consumption patterns are non-random. In other words, there is unobserved selection into consumption (e.g., vegetarian households do not buy meat, non-smokers do not purchase cigarettes, and so on). Due to the zero consumption of some products by some households, it is difficult to estimate the theoretically consistent price elasticity of demand.[6]

In order to estimate the price elasticity of demand for the top level, that is, food, beverages (non-alcoholic), tobacco, and others (all consumption expenditure excluding food, beverages, and tobacco), we use information concerning the development of prices from the decomposed consumer price index (CPI) provided by the Swiss Federal Statistical Office (SFSO).[7]

## 5. Econometric methodology

### 5.1. Econometric specification

#### 5.1.1. Armington Elasticities

We base our empirical model on the work of Blonigen and Wilson (1999), who start from the following CES sub-utility function for the product category $j$ (e.g. cheese)

$$U_j = \left[\beta_j M_j^{(\sigma_j-1)/\sigma_j} + (1-\beta_j) D_j^{(\sigma_j-1)/\sigma_j}\right]^{\sigma_j/(\sigma_j-1)}$$

where $M_j$ denotes the quantity of the imported, and $D_j$ the quantity of the domestic product category $j$ (e.g. $M$ denotes the quantity of imported cheese whereas $D$ denotes the quantity of domestically produced cheese that is consumed in Switzerland). The elasticity of substitution is denoted by $\sigma_j$, whereby a lower $\sigma_j$ means less substitution

[4] It is assumed that Frisch price elasticities lie exactly between the compensated and uncompensated price elasticities (Britz et al., 2014).

[5] Demand elasticities are applied on the quality corrected Arm. aggregator and not on the demand in physical unit in the CAPRI model.

[6] Note that eggs cannot be considered because there is no information available regarding quantities. Wine has been included; however, we do not think that this is a suitable demand model due to the special characteristics of wine (e.g., vintage and origin in terms of vinyard and country seem crucial).

[7] As with wine, we do not think that the proposed demand model is suitable for tobacco due to the addictive nature of nicotine. However, for implementation in the CAPRI model, we require estimates for tobacco.

between imports and domestic goods in product category $j$. It is important to note that this specification assumes that the utility derived from consumption in product category $j$ can be separated from the consumption in product category $k \neq j$. In other words, the utility derived from the consumption of cheese is separable from the utility derived from the consumption of beef. The CES specification further implies that preferences are homothetic, that is the share of income spent on the domestic and imported goods does not change with income. These specifications match those made in the CAPRI model. Shiells and Reinert (1993) estimated Armington elasticities for North America using three different models: A GLS using Cobb Dougles price aggregator, a maximum likelihood model using the CES price aggregator as well as a simultaneous equation estimation using a Cobb Douglas price aggregator and a distributed lag model. They find the different estimates of the different methodologies quite insensitive to shifts among the three estimation procedures. Furthermore, the CES function - which is used by most CE modelers - has the advantage that it obeys regularity conditions such as global concavity and that it requires only one estimated parameter.

In the following, we drop the index $j$ in the interest of its legibility. The first-order condition is given by

$$\frac{M}{D} = \left[\left(\frac{\beta}{1-\beta}\right)\frac{P_D}{P_M}\right]^{\sigma}$$

where $P_D$ and $P_M$ denote domestic and import prices in product category $j$, respectively. Taking logs yields

$$\ln\left(\frac{M}{D}\right) = \sigma \ln\left(\frac{\beta}{1-\beta}\right) + \sigma \ln\left(\frac{P_D}{P_M}\right), \forall j. \tag{1}$$

It should be recognized that the specification of (1) neglects the general-equilibrium effects (such as the effects of the possibility of substituting French cheese with Italian cheese) due to the separability of the (sub-)utility function.

As we have monthly data, we include month dummies in order to absorb seasonal effects. Furthermore, we include year dummies to allow for a flexible time trend. This changes equation (1) to:

$$\ln\left(\frac{M_t}{D_t}\right) = \alpha + \sigma \ln\left(\frac{P_{t,D}}{P_{t,M}}\right) + \delta_t m_t + \delta_i y_i + \varepsilon_t \tag{2}$$

with $t = 2, ..12$ and $i = 2011, .., 2015$

whereby $m$ denotes the monthly differences and $y$ denotes the differentiation between years. Equation (2) is used to identify $\sigma$ for each product $j$ using the variation in the relative prices $P_D/P_M$ over time so as to explain the variation in the relative consumption $M/D$ over time and $\epsilon$ as the normally distributed error term.

We estimate equation (2) using generalized least squares with an iterative Cochrane-Orcutt procedure to correct for autocorrelation in line with the approach Blonigen and Wilson (1999) and use the Prais-Winsten regression together with the Cochrane-Orcutt transformation. The Prais-Winsten regression uses the generalized least-squares method to estimate the parameters in a linear regression model in which the errors are serially correlated. When using this approach, the errors are assumed to follow a first-order autoregressive process. Using the Cochrane-Orcutt transformation leads to dropping the first observation (instead of performing the Prais-Winsten transformation of the first observation). Overall, the Cochrane-Orcutt method uses a lag definition and loses the first observation in the iterative method (Prais and Winsten, 1954; Cochrane and Orcutt, 1949; Davidson and MacKinnon, 1993). To test for autocorrelation we use the Durbin Watson statistic after having fit a linear model by means of ordinary least squares (OLS). We also use two other tests for serial correlation in the error distribution, namely the Breusch-Godfrey LM test and Durbin's alternative test for autocorrelation. For products that do not show any signs of serial correlation, we use simple OLS to estimate the substitution elasticity.

In addition to the tests for serial correlation and autocorrelation, we consider the possibility of stationarity issues that could have a significant influence on the estimation results (Engle and Granger, 1987). Therefore, we test on unit-root stationarity and co-integration in the data. First, we check the order of integration of the series ($M/D$ and $P_M/P_D$) with help of the weighted symmetry check (Dickey-Fuller test) if data are stationary (I(0)). If that is the case, we use a parsimonious geometric lag model, as used in the study by Gallaway et al. (2003) since such a model easily can extract short- and long-run elasticities, which is an advantage in CE models. CE models often have a medium term time horizon. Therefore, the ability to compare short- and long-run estimates is helpful in assessing the results of a policy measure that is analyzed with help of such a model.

If data are not stationary (I(1)) but rather co-integrated, we use a form of an unrestricted version of the error-correction model (Hendry et al., 1984), and we are able to derive long-run estimates as well: In line with Gallaway et al. (2003), we use the following estimation equation:

$$\Delta \ln \frac{M_t}{D_t} = \sigma \ln \frac{\beta}{1-\beta} + \sigma \ln \frac{P_{t,D} - P_{(t-1),D}}{P_{t,M} - P_{(t-1),M}} + \sigma_1 \ln \frac{M_{t-1}}{D_{t-1}} + \sigma_2 \frac{P_{(t-1),D}}{P_{(t-1),M}} + \epsilon_t \tag{3}$$

In case of data not being stationary and both series not being co-integrated or if only one series (either $M/D$ or $P_M/P_D$) is stationary, it is only possible to derive short-run estimates. Again, we include month dummies in order to absorb seasonal effects and year dummies to allow for a flexible time trend.

#### 5.1.2. Price elasticities of demand

We choose the almost ideal demand system because Deaton and Muellbauer (1980) show that under certain conditions it can be consistently aggregated. Thus, we estimate the demand elasticities at the product level, which is the same level at which the demand equations in CAPRI are formulated. Furthermore, using aggregated data has the advantage that we avoid having to deal with zero observations. Elasticities based on household-level data are, in general, more sensitive to model specification than estimates from product-level (aggregate) data. Deaton and Muellbauer (1980) show that aggregation across households is possible if, for an individual household $h$ the AIDS demand function for good $i$ in budget form is described by

$$w_{ih} = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log\left(x_h/k_h P\right)$$

where $w_{ih}$ is the budget share of good $i$ for household $h$, $x_h$ is the household's ($h$'s) total expenditure, and $\log P$ is a price index defined by

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_j \sum_k \gamma_{kj} \log p_k \log p_j.$$

Parameters $k_h$ capture household characteristics, and they take into account taste variations across households.

Aggregating across households $h$ gives the following aggregate or market demand function in budget form for good $i$

$$\overline{w}_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log\left(\overline{x}/kP\right) \tag{4}$$

where $\overline{w}_i = \sum_h p_i q_{ih} / \sum_h x_h$, the aggregate index $k$ is defined by $\log\left(\overline{x}/k\right) \equiv \sum_h x_h \log\left(x_h/k_h\right) / \sum_h x_h$, and $\overline{x}$ is the aggregate level of total expenditure $x_h$.

The following set of restrictions is imposed on the demand system (4):

$$\sum_i \alpha_i = 1; \quad \sum_i \gamma_{ij} = 0; \quad \sum_i \beta_i = 0; \tag{5}$$

$$\sum_j \gamma_{ij} = 0 \tag{6}$$

$$\gamma_{ij} = \gamma_{ji} \tag{7}$$

Provided that (5)–(7) hold, equation (4) represents a system of demand functions that add up to the total expenditure, $\sum_i \overline{w}_i = 1$, which are

**Table 3**
Empirically estimated Armington elasticities in comparison to currently assumed in CAPRI.

| Product/Product group | Bloningen approach[a] | Short-run elasticity | Long-run elasticity[b] | Currently assumed elasticity |
|---|---|---|---|---|
| Apple | 2.75 | 3.25 | – | – |
| Pears | 0.4 | 0.95 | 0.36 | – |
| *Apple, Pears (and peaches)/Fruits* | 0.2 | 0.76 | – | 0.3 |
| Potatoes | 1.76 | 1.75 | −1.17 | 1.5 |
| Tomatoes | 1.67 | 1.56 | – | 8 |
| Vegetables | 1.06 | 1.02 | – | 8 |
| Yogurt | 1.72 | 1.64 | −5.41 | – |
| Curd | 2.1 | 1.53 | 2.84 | – |
| Fresh milk products | 1.12 | 1.36 | −0.70 | 1.5 |

[a] See equation (3) in line with Blonigen and Wilson (1999).
[b] See equation (4) in line with Gallaway et al. (2003).

**Table 4**
Elasticity of demand at aggregated product level.

| product group | New estimates | | Muhammad et al. (2011) estimates | |
|---|---|---|---|---|
| | expenditure elasticity | compensated own price elasticity | expenditure elasticity | compensated own price elasticity |
| Meat | 1.1 | −0.67 | 0.5 | −0.33 |
| Dairy | 0.85 | −0.64 | 0.47 | −0.35 |
| Oils | 0.74 | −0.09 | 0.02 | −0.01 |
| Fruits and Vegetables | 1.11 | −0.57 | 0.28 | −0.21 |
| Cereals | 0.76 | −0.52 | −0.09 | 0 |

homogeneous of degree zero in prices and total expenditure, and which satisfy Slutsky symmetry.

Based on equation (4) we estimate the following model

$$\overline{w}_{it} = \alpha_{it}^{*} + \sum_{j} \gamma_{ij} \log p_{jt} + \beta_i \log\left(\overline{x}_t / P_t\right) + \varepsilon_{it} \tag{8}$$

where $t$ denotes the time (month-year) and we redefine $\alpha_{it}^{*} = \alpha_i - \beta_i \log k$ and add an i.i.d. error term $\varepsilon_{it}$. It should be recognized that $\alpha_{it}^{*} = 0$ is required for the adding up to hold. We include a full set of month and year dummies as proxy for $\log k$, i.e. we allow the intercept $\alpha_i^{*}$ to change over time. This allows tastes and/or income shares to change over time and should take care of any aggregation bias.[8]

We detrend and deseasonalize the data to test whether they are (trend-)stationary (see Wooldridge (2009)), that is, if the detrended and deseasonalized data are integrated of order zero or I(0). To detrend and deseasonalize the data, we follow the approach of Baum (2008), and regress the budget shares $w$ and prices $p$ on the month and year dummies, predict the residuals, and add the original mean of the series to them. We then test whether the detrended and deseasonalized series is stationary using the augmented Dickey-Fuller test in Stata.

We estimate model (8) in Stata using the iterated linear least-squares estimator developed by Blundell and Robin (1999), and impose homogeneity and symmetry. Month and year dummies are also introduced.

### 5.2. Results

#### 5.2.1. Armington Elasticities

Table 3 reports the estimates derived from the models described in the previous section. We estimate the substitution elasticities between Swiss domestic and imported goods. The first estimates are either estimated with simple OLS or, whenever necessary, the estimates that correct for autocorrelation and errors that are serially correlated (see equation (2). Furthermore, we report the results that correct for stationarity issues as well as co-integration in the dataset. When possible, we also report the estimates for the long-run elasticities in line with the approach of Gallaway et al. (2003).

In general, when using the Bloningen approach, the results are quite similar to the results where adjustments for Switzerland have been made. Overall, fruits seem to be quite a heterogeneous product. Indeed, the substitution elasticities are ≤0.5. Furthermore, the values for vegetables (e.g., tomatoes) are quite a bit lower than the ones used in the CAPRI model. Long-run elasticities either cannot be estimated or are below zero. Therefore, we decide to use the elasticity estimates derived using the Bloningen approach. The benefit of this approach is that the assumptions are in line with the CAPRI model. Therefore, such an improvement of the CAPRI model is easily feasible.

Overall, the estimated Armington elasticities are lower than before, which means that consumers exhibit a stronger preference for domestic goods and hence substitution is becoming harder in comparison to the currently synthetic elasticities. Therefore, under a free trade agreement with the EU, we can expect lower imports when using the new elasticities. Only in the case of potatoes should imports rise, since the elasticity is rising for this product (from 1.5 to 1.76).

#### 5.2.2. Price elasticities of demand

We estimate the own-price elasticity of demand at the top level, as well as across and within groups. Estimated demand elasticities will be different from the ones used by CAPRI because of modifications taking place in the trimming. The modified old and new elasticities can be found in the appendix in Table 10. The tendencies of the elasticities are - as expected- the same. Elasticities of products that are assessed to be more elastic are getting more elastic within the model as well.

On an aggregated level, we see that for meat products our estimate of the compensated own-price elasticity of demand is about −0.7, which is about twice as high as that found in the study by Muhammad et al. (2011) (see Table 4). For dairy products, we estimate an elasticity of about −0.6, which is about 50% higher. In the case of oils and fats, our estimate for the elasticity is approximately −0.09, which is higher by a factor of seven. Finally, our estimate for fruits and vegetables is about −0.6, which is three times higher than the current estimates integrated into the CAPRI model. Our estimate for cereals of −0.5 cannot

[8] See Mittelhammer et al. (1996) for an extensive discussion about aggregation bias in AIDS. Wooldridge (2009) shows that if we include month and year dummies in the regressions, they can be interpreted as regressions using both detrended and deseasonalized series (i.e. it is equivalent to using detrended and deseasonlized series in the regressions).

**Table 5**
Results for imports: Percentage Changes in comparison to Baseline Scenario.

| Product group | Simple_FTA (in t) | Scen_Arm (% Δ) | Scen_Dem (% Δ) | Scen_DemArm (% Δ) |
|---|---|---|---|---|
| Apples, Pears and Peaches | 56 | −5.8 | 0 | −5.9 |
| Potatoes | 50 | 10 | −2 | 7.8 |
| Tomatoes | 56 | −3.1 | −2.9 | −6 |
| Fresh milk products | 23.6 | −17.7 | 2.3 | −15.8 |
| Meat | 363 | 0.3 | 6 | 6 |
| Dairy | 85 | −4.5 | 0.9 | −5.8 |
| Oils | 59 | 0 | 1 | 1 |
| Vegetables | 1028 | −0.5 | −5.4 | −5.8 |
| Cereals | 811 | 0 | 1.2 | 0.2 |

**Table 6**
Results related to human consumption - percentage changes in comparison to the baseline scenario.

| product group | Simple_FTA (in t) | Scen_Arm (% Δ) | Scen_Dem (% Δ) | Scen_DemArm (% Δ) |
|---|---|---|---|---|
| Apples, Pears and Peaches | 161 | −0.9 | 0 | −0.9 |
| Potatoes | 343 | 0.2 | −1.1 | −0.9 |
| Tomatoes | 88 | −0.5 | −2.4 | −2.9 |
| Fresh milk products | 877 | 0.1 | 0.8 | 0.5 |
| Meat | 730 | 0 | 3.8 | 3.9 |
| Dairy | 1288 | 0.2 | 0.1 | −0.4 |
| Oils | 53.62 | −0.1 | 1.0 | 0.9 |
| Vegetables | 1370 | 0 | −4.4 | −4.4 |
| Cereals | 655 | 0 | −1.2 | −0.6 |

be compared, since the relevant estimates of Muhammad et al. (2011) were zero, which implies a totally inelastic demand. In sum, our estimates of the (compensated) own-price elasticity of demand, as well as our estimates of the expenditure elasticity, are on average higher than those currently used in the CAPRI model (especially for oils and fats). This means that the demand is becoming more elastic; hence, we should observe bigger reactions in the case of a free trade agreement. The elasticities on the product level for rape seed oil, sunflower oil and soy oil are becoming more inelastic, and we should observe lower reactions. The same is true for tomatoes (see Table 11 in the appendix for further detailed information regarding the demand elasticities).

## 6. Application: implementation in the CAPRI model

We use a free trade scenario between Switzerland and the EU in order to analyze the changes resulting from the estimated elasticities. We present the results for product groups at the aggregated level, as well as for some specific products where data were available to assess the Armington elasticities (apples, pears, and peaches, potatoes, tomatoes, and fresh milk products). We compare the results for imports, human consumption, and exports under a free trade scenario with the EU.

We show the results for three different cases in comparison to our reference, which is the simple FTA scenario using the old elasticities (Simple_FTA):

1. A scenario with only the new Armington elasticities (Arm).
2. A scenario with only the new demand elasticities (Dem).
3. A scenario with the new Armington and demand elasticities (Dem_Arm).

Table 5 displays the results for the three different scenarios in comparison to the simple FTA scenario (in percentage changes).

For imports, the changes are as expected. The “Scen_Arm” scenario shows that for the specific products where we changed the Armington elasticities, the imports decline, although in the case of potatoes the imports increase.[9] Furthermore, changing only the demand elasticities shows that products that are becoming less elastic show a less strong effect on the import side, for example, tomatoes. Conversely, meats are imported to a greater extent[10] (stronger reactions for beef and pork in consumptions and lesser decrease in consumption of poultry meat). The last scenario with both new elasticities (“Scen_DemArm”) sums up both effects. Overall, the import reactions change by −6% to +16%, which is a remarkable amount.

The changes related to human consumption (in physical units) are quite low for the new Armington elasticities, although they are quite high for the scenario with the new demand elasticities.[11] Overall, in the “DemArm” scenario, we can observe smaller reactions for dairy products, vegetables, and cereals, as well as higher reactions for meats and oils (see Table 6).

The reactions of the export changes are quite large for the considered products in terms of the percentage changes. This is due to the low absolute levels in the simple FTA scenario without changes in the elasticities (see appendix Table 15).

## 7. Conclusion

CE models that formulate ex ante assessments on the possible outcomes of free trade agreements between different trading blocs represent a common tool for policy assessment. Therefore, it is important to obtain reliable results from such models. Unfortunately, many CE models, including the CAPRI model, make use of synthetic elasticities or elasticities from the literature. These elasticities are often equal across all trading blocs. The use of such elasticities will thus lead to biased results when assessing the impacts of free trade agreements.

We estimate new Armington elasticities as well as new demand elasticities consistent with the model, and we introduce them into the CAPRI model. This allows us to assess the bias that stems from only using elasticities from the literature. Hence, our dataset for the demand elasticities is much broader when compared to the dataset we use to

[9] This is in line with the results Table 13 shows.

[10] This is consistent with the results of Table 14 in the appendix.

[11] In line with Table 14 in the appendix, we can observe the biggest changes for meats.

estimate the Armington elasticities. The proposed estimation framework offers the advantage of producing estimates that are consistent with demand theory in the CAPRI model (where we also consider aggregate demand) and easy to implement in Stata. The downside is that it uses aggregate time-series data to identify the price elasticity of demand from variations over time. Since we aggregate from household data, we lose information, which is inefficient. Furthermore, it is important to avoid running spurious regressions due to the possibility of the non-stationarity of the data. We attempt to remedy this by testing the time-series properties of the data, as well as by appropriately detrending and deseasonalizing the data. In sum, we present a simple yet theoretically sound solution that produces sensible and relatively robust estimates that can be used in the CAPRI model.

Overall, we show that the estimated elasticities differ in relation to the old synthetic estimates. The new results also differ substantially from those derived using the old elasticities under a simple free trade scenario between Switzerland and the EU. In sum, CE models are quite sensible to a change in elasticities. Making use of estimates from other countries or sectors results in quantitatively as well as qualitatively different results. Therefore, it must be clearly stated in giving policy advice how sensitive models are to the level of elasticity choice and doing sensitivity analyses are always best practice.

## Appendix

**Table 7**
Armington Elasticities in CAPRI (Britz et al., 2014).

| Product (group) | Substitution elasticity between domestic sales and imports | Substitution elasticity between import flows |
|---|---|---|
| Cheese, fresh milk products | 2 | 4 |
| Other vegetables | 1.5 | 1.5 |
| Other fruits | 3 | 3 |
| Sugar | 12 | 12 |
| All other products | 8 | 10 |

**Table 8**
Different studies assessing Armington elasticities for different commodities and regions.

| Commodities | Reinert and Roland-Holst (1992)[a] | Shiells and Reinert (1993)[a] | Erkel-Rousse and Mirza (2002)[b] | Bilgic et al. (2002)[a] | Gallaway et al. (2003)[c] | Olekseyuk and Schürenberg-Frosch (2016)[b] |
|---|---|---|---|---|---|---|
| Agriculture, Forestry, Fish & Hunting | na | na | na | 1.47 | na | na |
| Manufactured Food, Beverage, and Tobacco Product Manufacturing | 1.05 | 0.34 | 0.75–3.9 | 0.52 | 0.0–3.14 | 0.16–1.47 |
| Oil & Gas Extraction, Mining and Support Activities for Mining | 1.01 | na | na | 1.84 | na | na |
| Textile, Apparel, and Leather Product Manufacturing | 0.82–0.86 | 1.62–2.6 | 0.63–6.3 | 0.29–0.63 | 0.04–1.36 | 1.12–1.62 |
| Wood and Paper Products | 1.35 | 1.8 | 1.02–5.79 | 1.18 | 0.4–1.12 | 0.62–2.43 |
| Chemical Products Manufacturing | 0.4–1.1 | 1.5–7 | 0.76–12.7 | 0.84–2.9 | 0.3–1.29 | 0.32–1.33 |
| Primary Metal and Metal Product Manufacturing | 0.92 | 2.6 | 0.92–5.15 | 1.75 | 0.19–2.76 | 0.84–1.62 |
| Machinery and Equipment Manufacturing | 0.35–0.97 | 0.45–7.46 | 0.78–7.55 | 0.4–0.85 | 0.2–1.66 | 0.91–1.01 |

[a] For US.
[b] For diff. OECD countries.
[c] Only short-run elasticities considered.

**Table 9**
Product data base for price elasticities of demand (Swiss Federal Statistical Office, 2013).

| group | name | description | HABE description | HABE name |
|---|---|---|---|---|
| meat | BEEF | beef | Rindfleisch | 511201 |
| | PORK | pork | Schweinefleisch | 511203 |
| | SGMT | sheep & goat meat | Schaf- und Ziegenfleisch | 511205 |
| | POUM | poultry | Gefluegel | 511206 |
| | OMEA | other meat | Fleisch (ohne Rindfleisch, Schweinefleisch, Schaf- und Ziegenfleisch, Gefluegel) | 5112 |
| dairy | WMIO | whole milk | Vollmilch | 511401 |
| | SMIP | skimmed milk | Milchdrink und Magermilch | 511402 |
| | CHES | cheese | Hart- und Halbhartkaese, Weich- und Frischkaese | 511403, 511404 |
| | CREM | cream | Rahm | 511405 |
| | FRMI | fresh milk products | Quark, Joghurt sowie andere Milchprodukte | 511406, 511407, 511408 |
| | BUTT | butter | Butter | 511501 |
| oils | MARG | margarine | Margarine | 511502 |
| | RAPO | rape seed oil | Andere Pflanzenfette, andere pflanzliche Speiseoele | 511503, 511505 |
| | OLIO | olive oil | Olivenoel | 511504 |
| fruit | CITR | citrus fruit | Zitronen, Orangen | 511601, 511602 |
| | APPL | apples and pears | Aepfel, Birnen und Quitten | 511604, 511605 |
| | TAGR | table grapes | Trauben | 511608 |
| | OFRU | other fruit | Fruechte (ohne Zitronen, Orangen, Aepfel, Birnen und Quitten, Trauben) | 5116 |
| | SUGA | sugar | Zucker | 511801 |
| vegetables | TOMA | tomatoes | Tomaten | 511705 |
| | PULS | pulses | Bohnen und Erbsen | 511706 |
| | POTA | potatoes | Kartoffeln | 511714 |
| | OVEG | other vegetables | Gemuese (ohne Tomaten, Bohnen und Erbsen, Kartoffeln) | 5117 |

(*continued on next page*)

**Table 9** *(continued)*

| group | name | description | HABE description | HABE name |
|---|---|---|---|---|
| cereals | RICE | rice | Reis | 511101 |
| | WHEA | wheat | Teigwaren, Brot, Weizenmehl | 511102, 511103, 511106 |
| | OCER | other cereals | uebrige Mehle | 511107 |
| beverages | COFF | coffee, tea and cocoa | Kaffee, Tee und Kakao | 5121 |
| | SODA | soda | Mineralwasser, Limonaden und Saefte | 5122 |
| | SPIR | spirits | Branntweine | 5211 |
| | WINE | wine | Weine | 5212 |
| | BEER | beer | Bier | 5213 |

**Table 10**
Modified new and old demand elasticities that are effectively used in the CAPRI model due to trimming.

| Product group | Old elasticities | New elasticities | Tendency |
|---|---|---|---|
| Beef | −0.56 | −0.79 | More elastic |
| Pork | −0.39 | −0.76 | More |
| Poultry | −0.69 | −0.74 | More |
| Cheese | −0.15 | −0.95 | More |
| Butter | −0.38 | −0.8 | More |
| Rape seed oil | −0.98 | −0.48 | Less |
| Sunflower oil | −0.98 | −0.48 | Less |
| Soya oil | −1.2 | −0.5 | Less |
| Apples | −0.45 | −0.64 | More |
| Tomatoes | −0.47 | −0.3 | Less |
| Potatoes | −0.45 | −0.94 | More |
| Wheat | −0.15 | −0.6 | More |
| Eggs | −0.22 | −0.59 | More |
| Fresh milk products | −0.15 | −0.92 | More |
| Pulses | −0.5 | −0.71 | More |

**Table 11**
Predicted budget and compensated own-price elasticities for the diverse products.

| Group | name | description | exp. elasticity | comp. own price elasticity |
|---|---|---|---|---|
| meat | BEEF | beef | 1.6 | −1.21 |
| | PORK | pork | 1.67 | −1.1 |
| | SGMT | sheep | 0.94 | −1.41 |
| | POUM | poultry | 0.55 | −0.63 |
| dairy | WMIO | whole milk | 1.35 | −2.0 |
| | SMIP | skimmed milk | 0.27 | −1.90 |
| | CHES | cheese | 1.05 | −0.62 |
| | CREM | cream | 1.39 | −0.7 |
| | FRMI | fresh milk products | 0.83 | −0.53 |
| | BUTT | butter | 1.06 | −0.73 |
| oils | MARG | margarine | 0.13 | −0.38 |
| | RAPO | rape seed oil | 0.57 | −0.46 |
| | OLIO | olive oil | 1.65 | −0.45 |
| fruit | CITR | citrus fruit | 0.85 | −0.02 |
| | APPL | apples and pears | 0.93 | −0.51 |
| | TAGR | table grapes | 1.11 | −1.03 |
| | OFRU | other fruit | 1.06 | −0.33 |
| | SUGA | sugar | 0.73 | −0.94 |
| vegetables | TOMA | tomatoes | 1.04 | −0.20 |
| | PULS | pulses | 2.04 | −0.62 |
| | POTA | potatoes | 1.22 | −0.90 |
| | OVEG | other vegetables | 0.93 | −0.15 |
| cereals | RICE | rice | 1.20 | −1.06 |
| | WHEA | wheat | 1.02 | −0.12 |
| | OCER | other cereals | 0.37 | −1.09 |
| beverages | COFF | coffee, tea and cocoa | 0.55 | −0.23 |
| | SODA | soda | 0.69 | −0.28 |
| | SPIR | spirits | 0.52 | −0.53 |
| | WINE | wine | 1.58 | −0.05 |
| | BEER | beer | 0.87 | −0.59 |

**Table 12**
Elasticities of demand at top level.

| Product group | expenditure elasticity | compensated own price elasticity |
|---|---|---|
| Food | 0.54 | −0.2 |
| Beverages | 0.56 | −0.12 |
| Tobacco | 0.51 | 1.43 |
| Other | 1.02 | −0.04 |

**Table 13**
Results for imports: Percentage Changes in comparison to reference scenario (no FTA) for some products with changes in Armington elasticities.

| Product group | Reference (in t) | Baseline_FTA (% Δ) | Scen_Dem (% Δ) |
|---|---|---|---|
| Apples, Pears and Peaches | 46 | 22.3 | 15.3 |
| Potatoes | 28 | 80.4 | 98.5 |
| Tomatoes | 36 | 54.1 | 49.2 |
| Fresh milk products | 11 | 109 | 72 |

In order to check if changes in the scenarios are consistent with our expectations, we specifically analyze the effects of the new Armington elasticities and demand elasticities by comparing the results of imports and human consumptions between the simple FTA scenario and FTA with new Armington, respectively the FTA scenario with the new demand elasticities. Those results are always in comparison to the reference scenario. The reference scenario is a scenario without changes in the actual agricultural policy (no FTA).

Table 13 shows that the results for the imports of the scenario with the new Armington elasticities are as expected in comparison to the simple FTA when looking for both scenarios at the changes in comparison to the reference (no changes in agricultural policy). Substitution with the new elasticities is getting harder and therefore we should observe less imports in comparison to the synthetic elasticities: As expected, imports decrease for all products due to lower values of Armington elasticities. Except for potatoes, where the elasticity increased.

For the effects of the demand elasticities we look at the "quality corrected" consumption results because this is what emerges immediately from the demand functions. The final results may be affected in addition by Armington effects. Table 14 shows the same for human consumption and the new demand elasticities. Clearly, the results are in line with the expectations as well. For tomatoes and oils we have increased the own price elasticities (demand is getting less elastic) and indeed we see a smaller demand growth when comparing the results to the simple FTA with no changes in elasticities. For e.g. meats and eggs elasticities have been revised downwards (demand is getting more elastic) and indeed we obtain a stronger impact from the liberalization scenario.

**Table 14**
Results for Human Consumption (quality corrected): Percentage Changes in comparison to reference scenario (no FTA) for some chosen products.

| Product group | Reference (in t) | Baseline_FTA (% Δ) | Scen_Dem (% Δ) |
|---|---|---|---|
| Tomatoes | 80 | 5 | 2.6 |
| Rape seed oil | 20 | 4.3 | 2.4 |
| Sunflower seed oil | 20 | 5.2 | 2.8 |
| Potatoes | 342 | −0.5 | −1.6 |
| Beef | 128 | 3.7 | 6.2 |
| Pork meat | 221 | 1.8 | 4 |
| Eggs | 70 | 0.6 | 3 |

**Table 15**
Results for exports: Percentage Changes in comparison to Baseline Scenario.

| Product group | Simple_FTA (in t) | Scen_Arm (% Δ) | Scen_Dem (% Δ) | Scen_DemArm (% Δ) |
|---|---|---|---|---|
| Apples, Pears and Peaches | 10 | −21 | 0 | −21 |
| Potatoes | 1.73 | 13.29 | 8.1 | 21.4 |
| Tomatoes | 5.6 | −17.5 | 6.3 | −11.3 |
| Fresh milk products | 0.2 | 5.3 | 0 | 863 |
| Meat | 95 | 0.2 | −4.4 | −4.5 |
| Dairy | 112.6 | −1.6 | 3.7 | 8.8 |
| Oils | 21.06 | −1.3 | 0 | −1.3 |
| Vegetables | 37.7 | −7 | 10.1 | 2.9 |
| Cereals | 28 | 0.2 | 68.22 | 0.8 |

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