THE WELFARE IMPACT OF TRADE LIBERALIZATION

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This paper analyzes the distributional welfare impact of trade liberalization reforms on heterogeneous households. We develop a static applied general equilibrium model, and using a Social Accounting Matrix and Household Expenditure Survey, we calibrate it to match Slovenian data. We simulate the case of Slovenia joining the EU and quantify its welfare impact on households that differ in terms of age, income, and education. Additionally, we compare this benchmark case with two alternative scenarios: (1) a free trade agreement between Slovenia and the EU and (2) a custom union arrangement where tariff revenues are rebated proportionally to the households. We find that while trade liberalization leads to falling consumer prices, increased production in the export sectors, and aggregate welfare gains, the differentiated welfare impacts across heterogeneous households vary in their degrees. (*JEL* D58, F14, F15)

I. INTRODUCTION

What are the effects of liberalized trade? This is a crucial question in the field of international economics. The wide consensus among economists is that free trade generates *aggregate* welfare gains through efficient reallocation of resources and production, reduction of prices, and exposure to foreign competition. In *aggregate* terms, economies that open benefit from doing so. Numerous studies in the literature have addressed this issue, assessing the qualitative and quantitative impact of trade liberalization at the aggregate level. Examples, among many, include the works of Brown, Deardorff, and Stern (1995) and Sobarzo (1995), which analyze the effects of the North American Free Trade Agreement (NAFTA) on the economies of Canada, Mexico, and the United States.[1]

While there is a relative degree of agreement regarding the overall impact of free trade, a topic that has not been analyzed quite as intensively in the literature deals with the *distributional* effects of trade liberalization reforms on the different types of households that comprise an economy. If households differ in terms of income, education, geographical location, or other sociodemographic characteristics, do these differences imply that they will be asymmetrically affected by a trade liberalization reform? While the economy as a whole gains from increased openness, some agents might benefit more than others from free trade, or, more drastically, some people might benefit from free trade while others are hurt by it. This issue is even more relevant if the trade liberalization process occurs between economies where at least one of the opening countries accounts for a large proportion of the bilateral foreign trade.

In this article, we aim at contributing to this relatively neglected issue in the literature by analyzing the distributional effects of trade liberalization on heterogenous households. To address this question, we construct a static applied general equilibrium model (AGEM), which has been the standard tool adopted to assess the impact of policy reforms, because it captures all the complicated linkages between the various agents that comprise an economy.

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1. For an extensive list of articles studying the economy-wide impact of NAFTA, see Kehoe and Kehoe (1994) and the references therein.

ABBREVIATIONS

AGEM: Applied General Equilibrium Model
FTA: Free Trade Agreement
HBS: Household Budget Survey
NAFTA: North American Free Trade Agreement
ROW: Rest of the World
SAM: Social Accounting Matrix

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By using an AGEM, we are also able to conduct sensitivity analyses and perform additional experiments that explore the implications of alternative trade liberalization arrangements. Since we explicitly model differentiated households, we are therefore able to identify the welfare consequences of trade liberalization on diverse agents. In one of the few related studies in the literature, Porto (2006) analyzes the general equilibrium distributional effects of trade policies using different waves of household survey data to directly estimate the impact of trade on the prices of different goods and factor inputs. While the purpose is similar, our methodology differs by combining the household survey data and the Social Accounting Matrix (SAM) for calibration of the structural model, and then performing numerical experiments to simulate and directly evaluate the general equilibrium distributional effects of different trade reforms.

In order to quantitatively measure the household impact of liberalized trade, we apply our model to the case of Slovenia, which joined the European Union (EU) in May 2004 along with nine other countries. Accession to the EU implies, among many other things, an important transformation for the foreign sector of the Slovenian economy. In particular, the accession requires Slovenia to adopt the EU's tariff schedule with the rest of the world, and removes its previous tariff structure. In principle, this implies an enormous trade liberalization reform for Slovenia: it removes all tariffs with its most important trade partner. Moreover, before joining the EU, Slovenia was a small open economy characterized by a relatively low-tariff schedule. By joining the EU, Slovenia must now adopt a more protectionist tariff profile, which will certainly impact its trade patterns. These reasons lead us to believe that this is a relevant case to measure the impact of trade liberalization reforms on diverse households.

The model we construct highlights a variety of households, differentiated by their income levels, skills, and age. Using several data sources, we calibrate the main characteristics that define the behavior of the agents in the model to match the Slovenian economy. Once the model has been constructed and all its parameters have been calibrated, we conduct a simple experiment, labeled as the "benchmark" experiment, that consists of Slovenia and the EU simultaneously eliminating the tariffs that they impose on their respective imports. Additionally, at the moment of accession, Slovenia adopts the EU tariff profile toward the rest of the world. We then track the changes in consumption patterns and through real income indices are able to identify the welfare gains or losses that arise from this reform.

We find that for Slovenia, consumption goods prices fall in the food and beverages, textiles, leather, and transport sectors. However, prices in the primary goods sector, which is subject to large trade diversion from the rest of the world to the EU, rise. All factor prices increase as a result of trade liberalization, ranging from 1.12% for the rental rate to 1.60% for the wages of unskilled and skilled labor. In terms of welfare, the aggregate consumer welfare increases by 1.42% while the government welfare increases by 2.88%. The larger gain in the government side is partly attributable to the fact that adopting the EU's protectionist tariff schedule actually increases the government tariff revenue. Coupled with increases in both the consumer and the government welfare, the social welfare also increases by 1.72%. Looking at disaggregated household groups, while the welfare gains are proportional to the income level, the younger households benefit more than the older households, and the labor earners benefit more than the nonlabor earners. For example, the rich old households, who have the highest average income, experience welfare gains of 1.21%, whereas the middle-income young households record higher gains at 1.46%.

To complement the analysis, we perform several additional numerical experiments. In the benchmark numerical experiment, all the elasticities of substitution (for both imports and exports) were assumed to be the same across sectors. We perform a sensitivity analysis with differentiated values for the import elasticities of substitution for each sector, and explore the implications on prices and welfare. We take two sets of values from the literature, one from Hummels (2001) and the other from Rolleigh (2003). The quantitative implications are further amplified for sectors with higher elasticities of substitution. For example, Rolleigh (2003) reports import elasticities of substitution parameter ρ_m to be 0.95 in the food and beverages sector. Compared to the benchmark case where $\rho_m = 0.8$ for all sectors, the prices in the food and beverage sector fall by more than 1.87%, which is 85% larger than the magnitude under the benchmark case (−1.01%). The effects on factor prices differ, with the rental rate

experiencing a 0.47% increase under the elasticities taken from Rolleigh (2003), compared to a 1.11% increase under the elasticities taken from Hummels (2001). As for the welfare impact, for the elasticities taken from Rolleigh (2003), the effects are smaller, especially for older households relying more on nonlabor earnings as a source of their income.

Another experiment looks at an alternative type of trade liberalization for Slovenia. We discover that, by joining the EU, Slovenia must adopt a tariff schedule that is more protectionist than the one it previously had. This is especially important for the case of primary goods, which Slovenia mainly imports from countries outside the EU. The numerical experiment that we perform allows Slovenia to mutually eliminate its tariff barriers with the EU while retaining its tariff schedule with the rest of the world. Under this "free trade agreement (FTA)" experiment, the price of primary goods decreases, which is contrary to the case under the benchmark simulation. In addition, the magnitude of the price decrease in the main import sectors is larger, while the increases in factor prices are larger than in the benchmark simulation. Aggregate consumers' welfare is approximately 27% larger under the FTA than under the customs union case. However, as a result of tariff revenue loss, government's welfare gain is significantly lower. For disaggregated household groups, the patterns are similar to the benchmark case, but the margins differ by age groups. While older households gain between 21% and 24% more under the FTA than under the customs union, for younger households, the additional gains range from 27% to 30%.

Our final experiment involves a sensitivity analysis on the fiscal arrangements under the trade liberalization. In the benchmark scenario, the government's welfare gain is more than twice the level of aggregate consumer gain. We conduct a numerical experiment where all the additional tariff revenues from the rest of the world are redistributed to the households directly as lump-sum transfers, instead of being added as government revenue. While prices remain unchanged compared with the benchmark scenario, the welfare changes are significant. Aggregate consumers' welfare gains of 2.05% are 44% higher than the gains recorded under the benchmark scenario and 13% higher than the FTA scenario. The distributional impacts are even more striking as the largest gain is attributed to the poor households, regardless of age. Welfare gains for the poor unskilled young households and the poor old households are 2.66% and 2.38%, respectively, which is 40% and 57% higher than their rich counterparts, making this redistributive fiscal policy more beneficial toward the poorer households.

The remainder of this paper is organized as follows: Section II discusses the sectoral disaggregation that is used, and details the sources and features of the data that are employed; Section III presents the model, and Section IV describes the calibration results; Section V discusses the results of the benchmark numerical experiment, as well as the results of the additional sensitivity experiments mentioned above; Section VI presents some concluding remarks, and lays out possible extensions for future research.

II. DATA

A. *Sectoral Disaggregation*

As mentioned earlier, the main objective of this paper is to quantify the impact of trade liberalization reforms on the different productive sectors and on different household groups. Thus, an important factor in this analysis is to find the correct level of sectoral disaggregation. We use a variety of criteria to determine the specific sectors. In particular, we consider the relative importance of a sector in the total economy, the level of tariff protection that the sector enjoys, the differential between the EU's tariff rate, and the Slovenian tariff rate, the relative importance of the sector in the total imports or exports, and the historical importance of some particular sectors, detailed, for example in World Trade Organization (2002), which is the Trade Policy Review for Slovenia. The sectoral disaggregation we choose for Slovenia is shown in Table 1.

B. *Social Accounting Matrices*

The construction of an AGEM requires that all the parameters that govern the preferences of the agents and the technologies of the firms, as well as the different tax rates and tariff rates must be numerically specified. In order to calibrate the parameters, we use a SAM for Slovenia.

A SAM is a record of all the transactions that take place in an economy, usually during a 1-yr period. It provides a snapshot of the structure of

TABLE 1
Sectoral Disaggregation

Primary goods
Food and beverages
Leather
Wood and furniture
Textiles
Transportation equipment
Other manufactures[a]
Services

[a]The "Other manufactures" sector is composed of all manufacturing industries not explicitly chosen in our sectoral disaggregation.

production, where the rows record the receipts of a particular agent and the columns represent the payments made by the agents. Depending on the data availability, it can provide a finely disaggregated level of institutional detail, with different types of firms, levels of government, households that differ in basic demographic characteristics, and several trade partners. The use of SAMs can be traced back to Quesnay's (1759) *Tableau Economique* and more recently to Stone (1947), the architect of the United Nations System of National Accounts. Given the richness of information contained in them, SAMs have been commonly and extensively used in AGEMs designed to analyze policy reforms (see e.g., Kehoe et al. 1989 or Kehoe 1996).

As a SAM for Slovenia is not readily available (to the best of our knowledge), we construct one ourselves. We start with the input-output table for the year 2001 and combine it with additional data from a variety of sources. This leaves us with a SAM that disaggregates the Slovenian economy into eight different production sectors as shown in Appendix A. Next, we disaggregate the household sector by income, skills, and age, using the Household Budget Survey (HBS) produced by the Statistical Office of Slovenia. Similarly, the factors of production account are broken down into three factors: skilled labor, unskilled labor, and capital.

C. Slovenia Household Budget Survey (HBS)

The Slovenia HBS for the year 2004 contains data on household-level income and consumption expenditures for 3725 households. From the survey, we categorize households into nine groups according to the socio-demographic characteristics: age, income, and skill level. For age, we divide working households aged 65 and below against retired households aged 65 and above. For income, we divide into three groups: the first and the fourth quartile correspond to the poorest and the richest households, respectively, and households in the interquartile range correspond to the middle class.[2] Finally, for skill levels, we distinguish skilled versus unskilled working households, where the skilled working households have postsecondary education or higher, while unskilled households have secondary general education or lower. For the share of labor earning, we extract income from work under employment, work under contract, student payments, as well as half of the income from self-employment. The average share of labor earning is 58.6%. The descriptive statistics for the different household groups are shown in Table 2, which reports the number of households, average income as well as the share of labor income in each household group.

D. Combining Household Budget Survey and Social Accounting Matrix

Regarding household consumption expenditures, the household survey contains information on more than 70 goods and services. To comply with the sectoral dissagregation made in the SAM, we construct eight consumption groups consistent with the sectoral disaggregation made under the SAM. Because this matrix deals with productive sectors while the household survey concentrates on consumption expenditures, there are some sectors that required adjustment. For example, the "food" category in the household survey does not have a single corresponding category in the SAM, and had to be imputed between the "primary" and "food and beverages" sectors. The sectoral matching is shown in Table B1 of Appendix B. Next, we calculate the shares of consumption expenditure in each sector from the aggregate of the household survey and check whether these match with the share of consumption expenditure shown in the SAM. Given the sectoral matching, the share of expenditures for disaggregated sectors from the Household Survey aggregates and the SAM turned out to be similar in its pattern as shown in Table 3 below.

Given that the HBS enables us to disaggregate household groups by age, income, and skill

2. A similar classification of middle class was used by Easterly (2001).

TABLE 2
Descriptive Statistics: Household Budget Survey

	No. of Households	Average Income[a]	Labor Share (%)
Old poor	314	0.419	4.0
Old middle-income	375	0.817	13.2
Old rich	95	2.129	19.6
Young poor unskilled	594	0.411	39.3
Young poor skilled	24	0.404	34.4
Young middle-income unskilled	1265	0.840	63.3
Young middle-income skilled	222	0.919	71.1
Young rich unskilled	498	1.779	72.2
Young rich skilled	338	2.006	79.9

[a]The average income is normalized to 1.

TABLE 3
Aggregate Consumption: Household Budget Survey versus SAM

	Expenditure Survey (%)	Social Accounting Matrix (%)
Primary	8.0	5.4
Food and beverages	16.0	19.4
Textiles	7.0	5.6
Leather	1.7	1.8
Wood	2.3	0.1
Transport	8.9	6.8
Other manufactures	22.5	20.6
Services	33.7	40.4

level, we are also interested in the share of expenditure for different household groups. This is shown in Table 4. For example, we find that poor households and old retired households in general spend more on primary and food and beverages than the rich. On the other hand, rich households spend more on transport equipment. Similar differences are observed across different skill levels. For example, in the young and poor category, skilled households spend negligible amounts on transport while unskilled households spend around 3% of the total expenditure on transport equipment. Given that household groups have different compositions of their consumption baskets, price changes resulting from trade liberalization are expected to have different impact on the household groups.

Appendices C and D show how sectoral factor payments (labor and capital) are distributed across different household groups and how they make consumption expenditures of disaggregated sectors in the SAM.

III. THE MODEL

A. Overview

The model we use is a standard static AGEM that follows the tradition of Shoven and Whalley (1984). There are several agents in the Slovenian economy: nine representative consumers (differentiated by their levels of income,

TABLE 4
Expenditure Shares—Disaggregated Households

	Primary	Food and Bev.	Textiles	Leather	Wood	Transport	Other Man.	Services
Old poor	0.123	0.199	0.047	0.011	0.013	0.022	0.203	0.383
Old middle-income	0.105	0.170	0.056	0.013	0.016	0.043	0.204	0.393
Old rich	0.080	0.160	0.066	0.016	0.018	0.060	0.244	0.356
Young poor unskilled	0.099	0.187	0.054	0.014	0.016	0.033	0.217	0.379
Young poor skilled	0.087	0.188	0.103	0.012	0.028	0.002	0.217	0.363
Young middle unskilled	0.081	0.164	0.072	0.018	0.020	0.088	0.222	0.335
Young middle skilled	0.073	0.149	0.074	0.020	0.021	0.074	0.244	0.347
Young rich unskilled	0.067	0.146	0.075	0.019	0.029	0.135	0.226	0.303
Young rich skilled	0.059	0.138	0.088	0.022	0.031	0.109	0.241	0.311

skills, and age), producers, a domestic government, and foreign trade partners. We provide a more detailed explanation of their features below.

B. Domestic Production Firms

We assume that the final goods are produced combining a locally produced component and imported components. The domestic production firms produce the local component of the final goods. They use intermediate inputs from all sectors in fixed proportions, and also combine capital and skilled and unskilled labor using a Cobb-Douglas technology for output. The production function of the domestic firm producing good i is:

$$(1) \qquad y_{i,d} = \min\left\{\frac{x^d_{1,i}}{a^d_{1,i}}, \ldots, \frac{x^d_{i,i}}{a^d_{i,i}}, \ldots, \frac{x^d_{n,i}}{a^d_{n,i}}, \beta_i k_i^{\alpha_{k,i}} \ell_{s,i}^{\alpha_{s,i}} \ell_{u,i}^{\alpha_{u,i}}\right\}$$

with $\alpha_{k,i} + \alpha_{s,i} + \alpha_{u,i} = 1, \forall i = 1, \ldots, n \in \mathsf{G_P}$, the set of production goods; $y_{i,d}$ is the output of the domestic firm i, $x^d_{m,i}$ is the amount of intermediate inputs of good m used in the production of good i, $a^d_{m,i}$ is the unit-input requirement of intermediate good m in the production of good i, and k_i, $\ell_{s,i}$ and $\ell_{u,i}$ are, respectively, the capital, skilled labor, and unskilled labor inputs used to produce good i.

C. Final Production Goods Firms

The firm that produces the final production good i combines the domestic component with the imported goods using an Armington aggregator of the form:

$$(2) \qquad y_i = \gamma_i \left[\delta_{i,d} y_{i,d}^{\rho_{m,i}} + \sum_{f \in \mathsf{T}} \delta_{i,f} y_{i,f}^{\rho_{m,i}}\right]^{\frac{1}{\rho_{m,i}}}$$

where $\sigma_{m,i} = 1/(1 - \rho_{m,i})$ is the elasticity of substitution between domestic and imported goods (note that we allow for possibly different elasticities of substitution for different production goods), y_i is the output of the final good i, $y_{i,d}$ is the domestic component in final good i, and $y_{i,f}$ is the imported component from each of the trade partners. Note that when $\rho_{m,i} \to 0$, the production function takes the usual Cobb-Douglas form, that is, $y_i = \gamma_i \left[y_{i,d}^{\delta_{i,d}} \times \prod_{f \in \mathsf{T}} y_{i,f}^{\delta_{i,f}}\right]$. Finally, imports of good i from country f are subject to an ad valorem tariff rate $\tau_{i,f}$.

D. Consumption Goods Firms

We assume that the goods that the households purchase are different from the goods that production firms purchase in their intra-industries transactions. In particular, the goods that consumers purchase have a very high service component embedded in them. Therefore, we assume that consumers purchase goods that we label as "consumption goods." The consumption goods firms combine the final production goods using a fixed proportion technology:

$$(3) \qquad y_{i,c} = \min\left\{\frac{x^c_{1,i}}{a^c_{1,i}}, \ldots, \frac{x^c_{i,i}}{a^c_{i,i}}, \ldots, \frac{x^c_{n,i}}{a^c_{n,i}}\right\}$$

where $\{1, 2, \ldots, n\}$ are the goods in $\mathsf{G_c}$, the set of consumption goods. We make an additional assumption: $x^c_{i,j} = 0$ for $i \neq j$, *ser*. This implies that the consumption good i firm only uses as inputs final goods of the same sector and services.

E. Investment Good Firm

This model includes an investment good in order to account for the savings observed in the data. In a dynamic model, agents save in order to enjoy future consumption. In our static model, agents derive utility from consuming the investment good, just as they derive utility from the consumption goods. The investment good y_{inv} is produced by a firm that combines the final goods as intermediate inputs using a fixed proportions technology, as shown by:

$$(4) \quad y_{\text{inv}} = \min\left\{\frac{x_{1,\text{inv}}}{a_{1,\text{inv}}}, \ldots, \frac{x_{\text{i,inv}}}{a_{i,\text{inv}}}, \ldots, \frac{x_{n,\text{inv}}}{a_{n,\text{inv}}}\right\}$$

F. Consumers

As we previously specified, we disaggregate Slovenian households into nine different representative consumers, characterized by their income, age, and skills (see Table 2). We denote the set of households by H. The motivation of this disaggregation is to explicitly trace the effects of liberalized trade on the different types of consumers. Household preferences are represented by Cobb-Douglas utility functions defined over the consumption goods and

savings. The problem of representative household j is:

$$\max \sum_{i\in \mathsf{G_C}} \theta_i^j \log c_i^j + \theta_{inv}^j \log c_{\text{inv}}^j + \sum_{f\in \mathsf{T}} \theta_{\text{inv},f}^j \log c_{\text{inv},f}^j \tag{5}$$

$$\text{s.t.} \sum_{i\in \mathsf{G_C}} p_{c,i} c_i^j + p_{\text{inv}} c_{\text{inv}}^j + \sum_{f\in \mathsf{T}} e_f \overline{p}_{\text{inv},f} c_{\text{inv},f}^j = (1-\tau_d^j)(w_s \overline{\ell}_s^j + w_u \overline{\ell}_u^j + r\overline{k}^j)$$

where c_i^j is the consumption of good i by household j, $p_{c,i}$ is the price of consumption good i; τ_d^j is the direct tax rate imposed on household j, w_s and w_u are, respectively, the wage rate for skilled and unskilled labor, and r is the rental rate of capital; $\overline{\ell}_s^j$, $\overline{\ell}_u^j$, $\overline{k}^j$ are, respectively, the endowments of skilled, unskilled and capital. Note that given our disaggregation of households, we must have that either $\overline{\ell}_s^j > 0$ and $\overline{\ell}_u^j = 0$, or $\overline{\ell}_s^j = 0$ and $\overline{\ell}_u^j > 0$, but no household can have positive endowments of both skilled and unskilled labor.

Because this is a static setup, we model household savings as purchases of the investment good. Then, c_{inv}^j represents the purchases of the investment good by household j, and p_{inv} is the price of the investment good. Additionally, if Slovenia is running a trade surplus with a trade partner, we model this as household purchases of a foreign investment good (i.e., Slovenian households are saving abroad). Then, $c_{\text{inv},f}^j$ represents the purchases of the investment good from country f by household j, $\overline{p}_{\text{inv},f}$, its price (which is assumed to be exogenous), and e_f is the bilateral real exchange rate.

G. The Government

A look at the SAM shows that the Slovenian government makes purchases of goods and also that it runs a fiscal surplus. To account for these observations, we follow the standard practice in the literature[3] and assume that, in the model, the government is an agent that enjoys utility from consuming the production goods and the investment good. Purchases of these goods must be financed by the revenues collected from direct and indirect taxes and tariffs imposed on imports.

3. See for example, Whalley (1982) or Kehoe (1996).

The problem of the government is then:

$$\max \sum_{i\in \mathsf{G_P}} \theta_i^g \log c_i^g + \theta_{\text{inv}}^g \log c_{inv}^g \tag{6}$$

$$\text{s.t.} \sum_{i\in \mathsf{G_P}} p_i c_i^g + p_{\text{inv}} c_{\text{inv}} = \sum_{j\in \mathsf{H}} \tau_d^j (w_s \overline{\ell}_s^j + w_u \overline{\ell}_u^j + r\overline{k}^j) + \sum_{i\in \mathsf{G_P}} t_{p,i}\, p_{d,i}\, y_{i,d} + \sum_{i\in \mathsf{G_C}} t_{c,i}\, p_{c,i}\, y_{i,c} + \sum_{f\in \mathsf{T}} \sum_{i\in \mathsf{G_P}} \tau_{i,f} e_f \overline{p}_{i,f} y_{i,f}$$

The left-hand side of the budget constraint of the government includes the purchases of goods and the investment good. The right-hand side of the equation includes the tax and tariff revenues: the first term is the direct taxes collected from the income of the nine different households; the second and third terms are the revenues collected from taxing the domestic and consumption goods firms, respectively; the last term represents the tariff revenues collected.

H. Foreign Trade Partners

In our model, Slovenia trades with two trade partners: the EU and the rest of the world (ROW), which is composed of all countries not in the EU. We denote a set of trade partners by $\mathsf{T} = \{\text{EU, ROW}\}$. In each one of these trade partners $f \in \mathsf{T}$ there is a representative household that purchases imported goods $x_{j,f}$ from Slovenia, and consumes the local good $x_{f,f}$. If this particular trade partner is running a trade surplus with Slovenia, we model these savings as foreign purchases of the Slovenian investment good $x_{\text{inv},f}$. The problem of the representative household in the foreign country f is

$$\max \left[\sum_{j\in \mathsf{G_P}} \theta_{j,f} x_{j,f}^{\rho_x} + \theta_{\text{inv},f} x_{\text{inv},f}^{\rho_x} + \theta_{f,f} x_{f,f}^{\rho_x} - 1 \right] / \rho_x \tag{7}$$

$$\text{s.t.} \sum_{j\in \mathsf{G_P}} (1+\tau_j^f) p_j x_{j,f} + p_{\text{inv}} x_{\text{inv},f} + e_f x_{f,f} = e_f I_f$$

where τ_j^f is the ad valorem tariff rate that country f levies on the imports of good j, ρ_x is the parameter that determines the exports elasticity of substitution σ_x (i.e., $\sigma_x = 1/(1-\rho_x)$), e_f is the bilateral real exchange between Slovenia and country f, and I_f is the (exogenous) income of the household in country f.

I. Definition of Equilibrium

An equilibrium for this economy is a set of prices for the domestic goods $\{p_{i,d}\}_{i\in \mathsf{G_p}}$; prices for the final goods $\{p_i\}_{i\in \mathsf{G_p}}$; a price for the investment good p_{inv}; prices for the consumption goods $\{p_{c,i}\}_{i\in \mathsf{G_c}}$; factor prices w_s, w_u, r; bilateral exchange rates $\{e_f\}_{f\in \mathsf{T}}$; foreign prices $\{\overline{p}_{i,f}\}_{i\in \mathsf{G_p},\ f\in \mathsf{T}}$; a consumption plan for each type of household $\{c_i^j, c_{\text{inv}}^j\}_{i\in \mathsf{G_c},\ j\in \mathsf{H}}$; a consumption plan for the government $\{c_i^g, c_{\text{inv}}^g\}_{i\in \mathsf{G_p}}$; a consumption plan for the household in country f $\{x_{i,f}, x_{\text{inv},f}, x_{f,f}\}_{i\in \mathsf{G_p},\ f\in \mathsf{T}}$; a production plan for the domestic good i firm $(y_{i,d}, x_{1,i}^d, \ldots x_{n,i}^d, k_i, \ell_{u,i}, \ell_{s,i})$; a production plan for the final good i firm $(y_i, y_{i,d}, \{y_{i,f}\}_{f\in \mathsf{T}})$; a production plan for the investment good firm $(y_{\text{inv}}, x_{1,\text{inv}}, \ldots, x_{n,\text{inv}})$; a production plan for the consumption good i firm $(y_{i,c}, x_{1,i}^c, \ldots, x_{n,i}^c)$; such that, given the tax rates and the tariff rates:

(i) The consumption plan $\{c_i^j, c_{\text{inv}}^j, c_{\text{inv},f}^j\}_{i\in \mathsf{G_c},\ f\in \mathsf{T}}$ solves the problem of household j.

(ii) The consumption plan $\{c_i^g, c_{\text{inv}}^g\}_{i\in \mathsf{G_p}}$ solves the problem of the government.

(iii) The consumption plan $\{x_{i,f}, x_{\text{inv},f}\}_{i\in \mathsf{G_c}}$, $x_{f,f}$ solves the problem of the representative household in country f.

(iv) The production plan $(y_{i,d}, x_{1,i}^d, \ldots, x_{n,i}^d, k_i, \ell_{u,i}, \ell_{s,i})$ satisfies

$$y_{i,d} = \min\left\{\frac{x_{1,i}^d}{a_{1,i}^d}, \ldots, \frac{x_{i,i}^d}{a_{i,i}^d}, \ldots, \frac{x_{n,i}^d}{a_{n,i}^d}, \beta_i k_i^{\alpha_{k,i}} \ell_{s,i}^{\alpha_{s,i}} \ell_{u,i}^{\alpha_{u,i}}\right\} \quad \text{and}$$

$$(1+t_{p,i})p_{i,d}y_{i,d} - \sum_{j\in \mathsf{G_p}} p_j x_{j,i}^d - w_u\ell_{u,i} - w_s\ell_{s,i} - rk_i \le 0,\ = 0 \ \text{ if } \ y_{i,d} > 0$$

(v) The production plan $(y_i, y_{i,d}, \{y_i, f\}_{f\in \mathsf{T}})$ satisfies

$$p_i y_i - p_{i,d}y_{i,d} - \sum_{f\in \mathsf{T}}(1+\tau_{i,f})e_f\overline{p}_{i,f}y_{i,f} \le 0, \quad = 0 \ \text{ if } \ y_i > 0$$

where $y_{i,d}$ and $\{y_i, f\}_{f\in \mathsf{T}}$ solve

$$\min\ (1+t_{p,i})p_{i,d}y_{i,d} + \sum_{f\in \mathsf{T}}(1+\tau_{i,f})e_f\overline{p}_{i,f}y_{i,f}$$

$$\text{s.t. } \gamma_i\left[\delta_{i,d}y_{i,d}^{\rho_{m,i}} + \sum_{f\in \mathsf{T}}\delta_{i,f}y_{i,f}^{\rho_{m,i}}\right]^{\frac{1}{\rho_{m,i}}} = y_i$$

(vi) The production plan $(y_{\text{inv}}, x_{1,\text{inv}}, \ldots, x_{n,\text{inv}})$ satisfies

$$y_{\text{inv}} = \min\left\{\frac{x_{1,\text{inv}}}{a_{1,\text{inv}}}, \ldots, \frac{x_{i,\text{inv}}}{a_{i,\text{inv}}}, \ldots, \frac{x_{n,\text{inv}}}{a_{n,\text{inv}}}\right\} \quad \text{and}$$

$$p_{\text{inv}}y_{\text{inv}} - \sum_{j\in \mathsf{G_p}} p_j x_{j,\text{inv}} \le 0, = 0 \ \text{ if } \ y_{\text{inv}} > 0$$

(vii) The production plan $(y_{i,c}, x_{1,i}^c, \ldots, x_{n,i}^c)$ satisfies

$$y_{i,c} = \min\left\{\frac{x_{1,i}^c}{a_{1,i}^c}, \ldots, \frac{x_{i,i}^c}{a_{i,i}^c}, \ldots, \frac{x_{n,i}^c}{a_{n,i}^c}\right\} \quad \text{and}$$

$$(1+t_{c,i})p_{i,c}y_{i,c} - \sum_{j\in \mathsf{G_p}} p_j x_{j,i}^c \le 0, \quad = 0 \ \text{ if } \ y_{i,c} > 0$$

(viii) The factor markets clear:

$$\sum_{i\in \mathsf{G_p}} \ell_{u,i} = \sum_{j\in \mathsf{H}} \overline{\ell}_u^j, \quad \sum_{i\in \mathsf{G_p}} \ell_{s,i} = \sum_{j\in \mathsf{H}} \overline{\ell}_s^j,$$

$$\sum_{i\in \mathsf{G_p}} k_i = \sum_{j\in \mathsf{H}} \overline{k}^j$$

(ix) The goods markets clear:

$$y_i = \sum_{j\in \mathsf{G_p}} x_{j,i}^d + \sum_{j\in \mathsf{G_c}} x_{j,i}^c + x_{i,\text{inv}} + c_i^g + \sum_{f\in \mathsf{T}} x_{i,f}$$

$$y_{i,c} = \sum_{j\in \mathsf{H}} c_i^j$$

$$y_{\text{inv}} = \sum_{j\in \mathsf{H}} c_{\text{inv}}^j + c_{\text{inv}}^g + \sum_{f\in \mathsf{T}} x_{\text{inv},f}$$

(x) The balance of payments condition for each trade partner country f is satisfied:

$$\sum_{i \in \mathsf{G_p}} e_f \overline{p}_{f,i} y_{i,f} + \sum_{j \in \mathsf{H}} e_f \overline{p}_{\text{inv},f} c^j_{\text{inv},f} = \sum_{i \in \mathsf{G_p}} p_i x_{i,f} + p_{\text{inv}} x_{\text{inv},f}$$

IV. CALIBRATION

We calibrate the parameters of the model so that, in equilibrium, the agents of the model replicate the same transactions that their counterparts in the real world perform according to the SAM. Appendix E contains the values of the calibrated parameters in the model economies. Most of the parameters, such as the input shares and total factor productivity scale parameters in the production functions and the parameters in the agents' utility functions, can be directly calibrated from the SAM using the optimality and market clearing conditions. For those parameters that cannot be calibrated from the data, we explain below how we choose those values.

A. Trade Partners' Income

The incomes of the trade partners are extracted from the *International Financial Statistics* published by the International Monetary Fund.

B. Tariff Rates

The tariff rates that Slovenia levies on the imports from its trade partners are extracted implicitly from the SAM. To determine the tariff rates that the trading partners impose on imports from Slovenia, the most recent editions of the *Trade Policy Reviews* by the World Trade Organization are used. The tariff rates imposed by Slovenia and the EU are shown in Tables 5 and 6, respectively. To determine the tariff rates imposed by the "rest of the world," we assume that the tariffs from the rest of the world are a simple average of the tariffs imposed by Japan and the United States.

C. Direct Tax Rates

From the HBS we observe that the different types of households pay different amounts of direct taxes to the government. We compute a specific direct tax rate for each type of household as the proportion of disposable income that is destined to direct tax payments. In that sense, the tax rates that we calibrate are *effective* rates, rather than *nominal* rates.

TABLE 5
Tariff Rates—Slovenia

Sectors	Tariff Rates (%)
Primary	3.0
Food and beverages	9.2
Textiles	1.5
Leather	2.3
Wood products	0.4
Transport	0.6
Other manufactures	0.6
Services	0.0

TABLE 6
Tariff Rates—European Union

Sectors	Tariff Rates (%)
Primary	17.2
Food and beverages	12.6
Textiles	9.5
Leather	2.6
Wood products	2.3
Transport	6.4
Other manufactures	5.1
Services	0.0

D. Elasticities of Substitution

Given the static nature of our model, the elasticities of substitution for exports and imports cannot be calibrated directly from the SAM. Instead, we use different sets of values for these parameters. For our "benchmark" case, we set $\rho_{m,j} = 0.8 \, \forall j \in \mathsf{G_p}$, and $\rho_x = 0.9$, implying elasticities of import and export substitution of 5 and 10, respectively. Additionally, we take two sets of values from the literature, one from Hummels (2001) and the other from Rolleigh (2003). In his article, Rolleigh (2003) calibrates these parameters by choosing the value of the elasticities to match the sectoral gross output markups in the United States. Hummels (2001) constructs a multisectoral trade model and empirically estimates the relationship between freight rates and distance between trade partners and uses this relation to infer the elasticities of substitution for different production sectors. We use these two sets of parameters in our sensitivity experiments. The values used are shown in Table 7.

Note that, in his paper, Rolleigh only provides estimates for the elasticities of substitution

TABLE 7
Import Elasticities of Substitution ($\rho_{m,j}$)

Sector	Hummels (2001)	Rolleigh (2003)
Primary	0.77	0.80
Food and beverages	0.79	0.95
Textiles	0.84	0.93
Leather	0.89	0.93
Wood products	0.74	0.91
Transport	0.86	0.91
Other manufactures	0.82	0.90
Services	0.80	0.80

of manufacturing industries. As a result, we use the same value of $\rho_{m,j}$ for the primary goods and services as the one we use in the benchmark experiment. Moreover, when any sector in our disaggregation does not exactly correspond to a sector in either Rolleigh or Hummels (for example, in the case of "Other manufactures"), we arrange their disaggregation to fit ours by taking simple averages of the corresponding elasticities of substitution. Finally, for all cases, the export elasticity of substitution ρ_x is fixed to be 0.9.

V. RESULTS AND NUMERICAL EXPERIMENTS

This section presents the results from the benchmark simulation, which examines the impact of trade liberalization on prices and welfare of different household groups. For Slovenia, this implies joining the EU as a full-fledged member. For our welfare analysis, we construct a social real income index that uses both the consumer real income index and the government real income index to look at the aggregate welfare index. The consumer real income index is given by $\prod_j c_j^{\theta_j}$, where j ranges over the consumption goods and the investment good. The government real income index is given by $\prod_j c_{g,j}^{\theta_{g,j}}$, where j ranges over the production goods and the investment goods consumed by the government. The social real income index is defined as $\prod_j \mathbb{C}_j^{\Theta_j}$, where $\mathbb{C}_j = c_j + c_{g,j}$ and $\Theta_j = \frac{c_j + c_{g,j}}{\sum_j c_j + \sum_j c_{g,j}}$. For the welfare analysis of disaggregated households, we only look at the consumer real income index for the specific household group. For the benchmark simulation, we also trace out the overall macroeconomic impact of joining the EU.

Next, with the benchmark simulation as a reference, we conduct numerical experiments, each of which explores the implications on prices and welfare.

First, we analyze how the benchmark results change when we allow for import elasticities of substitution that are different across sectors (as opposed to a uniform Armington elasticity for all sectors as in the benchmark case). For sectoral import elasticities, we take the estimated numbers from Rolleigh (2003) and Hummels (2001), respectively.

Second, we look at the hypothetical case of Slovenia signing a FTA with the EU instead of joining the EU. This experiment could provide a useful comparison on different types of trade liberalization.

In the benchmark scenario, owing to the government budget balance condition, the increase in the tariff revenue from the rest of the world would increase government expenditure as well as government welfare. In the third experiment, we look at the case where the additional tariff revenues from the rest of the world are redistributed directly to the households in a lump-sum fashion.

A. Benchmark Results

Tables 8 and 9 show the percentage change in the price of consumption goods and factor prices after Slovenia joins the EU, respectively. The largest decline in prices takes place in the leather and food and beverages sectors, falling

TABLE 8
Effect of Customs Union on Consumption Good Prices

	Consumption Good Price (%)
Primary	0.62
Food and beverages	−1.01
Textiles	−0.28
Leather	−1.23
Wood products	0.29
Transport	−0.87
Other manufactures	0.07
Services	0.71

TABLE 9
Effect of Customs Union on Factor Prices

	Factor Price (%)
Rental rate	1.12
Wage (unskilled)	1.60
Wage (skilled)	1.60

by more than 1%. The main import sector, which is the transport sector, also shows a price decline of 0.87%. On the other hand, another important import sector, which is the primary goods sector, recorded an increase of 0.62%. As for factor prices, wages increase more than the rental rate. Wages of unskilled and skilled labor increase by 1.60% while the rental rate increases by 1.12%. This has different implications for labor earners vis-à-vis rental earners.

Looking at production patterns, domestic production increases in the primary, textiles, transport, and other manufactures sectors. The largest gains are recorded in the textiles and transport sectors, increasing by 31.71% and 21.57%, respectively. The effects on exports and imports are large for Slovenia, with exports to and imports from the EU increasing by 46.66% and 31.47%, respectively. However, adopting EU's tariff policy causes trade to be diverted from the rest of the world as exports decline by 11.73% and imports decrease by 4.87%. On the other hand, government tariff revenues from the rest of the world explodes by more than 290%. While the aggregate consumers' welfare increases by 1.42%, the government's welfare increases even more by 2.88%. The overall social welfare also shows an increase of 1.72%. For the disaggregated household groups, we report the gains in consumers' welfare for each group. Young households benefit more than old households, as younger households rely more on labor earnings with increases in wage rates outweighing the increase in rental rate. As a result, the old rich group, which has the highest average income, has a smaller gain than any of the younger household groups, even young and poor households. In addition, the increase in consumers' welfare is proportional to income levels, while the relation to skill intensity depends on the factor endowments. For middle- and high-income households, there is not much difference in welfare gains between skilled and unskilled households. However, it is interesting to note that young, poor, and skilled households gain less than their unskilled counterpart. This could be potentially explained by the fact that wages (both for skilled and unskilled workers) increase more than the rental rate and factor endowments are different across household groups. For the poor households, unskilled workers have a higher share of labor than skilled workers, thus enjoying larger welfare gains, while the opposite is true for middle-income and rich households.

Finally, we look at the welfare impact of joining the EU. Table 10 shows the percentage change in the aggregate welfare as well as disaggregated household groups' welfare. For the aggregate welfare, we report the overall consumers' welfare gain and the government's welfare gain, as well as the social gain which is a weighted sum of consumers' and government's welfare. Note that in Slovenia, the total tariff revenue increases by around 4% as the country adopts a more protectionist tariff policy of the EU. This is because of the fact that despite elimination of tariff revenues from the EU, the tariff revenue from the rest of the world

TABLE 10
Effect of Customs Union on Welfare

Welfare	Change (%)
Aggregate consumer welfare	1.42
Government welfare	2.88
Social welfare	1.72
Old poor	1.07
Old middle-income	1.11
Old rich	1.21
Young poor unskilled	1.28
Young poor skilled	1.21
Young middle-income unskilled	1.46
Young middle-income skilled	1.46
Young rich unskilled	1.54
Young rich skilled	1.55

B. Sector-by-Sector Elasticity of Import Substitution

Tables 11 and 12 show the percentage change in the price of consumption goods and factor prices after Slovenia joins the EU, respectively, when the Armington elasticities of import

TABLE 11
Effect of Customs Union on Consumption Good Prices ($\sigma_{mi} \neq \sigma_{mj}$)

	Consumption Good Price	
	"Rolleigh" elasticities (%)	"Hummels" elasticities (%)
Primary	0.78	0.68
Food and beverages	−1.87	−0.97
Textiles	0.07	−0.30
Leather	−0.77	−1.29
Wood products	0.45	0.31
Transport	−0.13	−0.84
Other manufactures	0.35	0.08
Services	0.62	0.69

TABLE 12
Effect of Customs Union on Factor Prices
($\sigma_{mi} \neq \sigma_{mj}$)

	Factor Price	
	"Rolleigh" elasticities (%)	"Hummels" elasticities (%)
Rental rate	0.47	1.11
Wage (unskilled)	1.42	1.53
Wage (skilled)	1.42	1.52

substitution are differentiated by sector, rather than set uniformly for all sectors, as in the benchmark simulation. Owing to differentiated elasticities, the results on consumption good prices are mixed. For example, in the textiles sector, one of the main trade sectors, the signs of price changes are sensitive to the elasticities chosen. As for the factor prices, the rental rate changes are more sensitive to the choices of elasticities than the wages of skilled and unskilled labor.

Table 13 shows the percentage change in the aggregate welfare as well as disaggregated household groups' welfare. For the different household groups, we find larger differences in welfare gains among old households than for younger households. This could be explained by the fact that the changes in the rental rate under "Rolleigh" elasticities are less than half the magnitude under "Hummels" elasticities.

C. Free Trade Agreement (FTA) versus Customs Union

In this section, we look at the hypothetical case of Slovenia signing a FTA with the EU, instead of joining the EU as a full member. This implies that Slovenia and the EU eliminate their tariffs on each other, while Slovenia retains its own tariff policy with the rest of the world, instead of adopting the tariff policy of the EU. All other calibrated parameters remain unchanged from the benchmark case, including the elasticities of substitution for imports and exports. This comparison could provide a useful insight on the welfare effects of different trade liberalization arrangements.

Tables 14 and 15 show the percentage change in the prices of consumption goods and the factor prices after Slovenia and the EU sign a FTA, respectively. The largest decline in prices takes place in the leather and the food and beverages sectors, falling by more than 1%. The main import sector, which is the transport sector, also shows a price decline of 1.09%, which is larger than in the benchmark case of joining the customs union. In addition, the other main imports (primary goods) now records a small decline in its price, as compared with an increase shown under the benchmark simulation. As for the factor prices, wages increase more than the rental rate. Compared with the benchmark case, all factor prices increase by a larger margin.

TABLE 13
Effect of Customs Union on Welfare
($\sigma_{mi} \neq \sigma_{mj}$)

	Welfare Change	
	"Rolleigh" elasticities (%)	"Hummels" elasticities (%)
Aggregate consumer welfare	1.06	1.37
Government welfare	0.67	2.70
Social welfare	0.98	1.65
Old poor	0.55	1.06
Old middle-income	0.60	1.10
Old rich	0.67	1.20
Young poor unskilled	0.93	1.24
Young poor skilled	0.88	1.18
Young middle-income unskilled	1.14	1.41
Young middle-income skilled	1.16	1.40
Young rich unskilled	1.20	1.48
Young rich skilled	1.25	1.49

TABLE 14
Effect of FTA on Consumption Good Prices

	Consumption Good Price (%)
Primary	−0.17
Food and beverages	−1.17
Textiles	−0.68
Leather	−1.14
Wood products	0.32
Transport	−1.09
Other manufactures	−0.03
Services	0.90

TABLE 15
Effect of FTA on Factor Prices

	Factor Price (%)
Rental rate	1.34
Wage (unskilled)	2.09
Wage (skilled)	2.08

Wages of unskilled and skilled labor increase by 2.09% and 2.08%, respectively, while the rental rate increases by 1.34%. On average, consumers would enjoy higher income and face lower prices in their consumption goods under the FTA than under the customs union scenario.

Table 16 shows the percentage change in the aggregate welfare as well as disaggregated household groups' welfare. Compared with the benchmark case, the consumers' welfare increases more under FTA. Quantitatively, the consumers' welfare increase under the FTA is approximately 27% larger than under the customs union. However, the increase in the government's welfare is significantly smaller than under the customs union case, reflected in the government tariff revenue loss. The overall social welfare also shows an increase of 1.62%, slightly lower than in the customs union scenario. For the disaggregated household groups, the patterns are similar to the benchmark case with higher gains for all household groups. However, the margins differ by age groups. For older households, the gains under the FTA range between 21% and 24% larger than in the benchmark case. For younger households, the gains are even larger, ranging from 27% to 30%. In addition, among older households, the additional gains are inversely related to income. For poor and old households, the additional gain in welfare (24% more gain than the benchmark case) under the FTA is larger than their rich counterparts (21%).

One important issue that our experiment does not address explicitly regarding the FTA deals the rules of origin requirements, which might lower the quantitative impact of our FTA simulation. In fact, according to Brenton and Manchin (2003), the EU stipulates highly technical rules of origin to prevent trade deflection, where goods from nonparticipating countries first enter through the low-tariff free trade partners of the EU and are then redirected to the EU market to circumvent the payment of EU customs duties. The textiles sector is a fine example which entails strict requirements for such rules of origin. In our experiment, the tariff differential in the textiles sector is around 8 percentage points (9.5% under the customs union vs. 1.5% under the FTA). Given the magnitude of this tariff differential, imports from the rest of the world in the textiles sector increase by 32.3% under the FTA scenario. However, textiles exports to the EU increase by 14.8%, which indicates that the increase in the textiles imports from the rest of the world is mainly absorbed into the domestic production rather than being re-exported to the EU.[4]

TABLE 16
Effect of FTA on Welfare

Welfare	Change (%)
Aggregate consumer welfare	1.80
Government welfare	0.92
Social welfare	1.62
Old poor	1.33
Old middle-income	1.37
Old rich	1.47
Young poor unskilled	1.63
Young poor skilled	1.58
Young middle-income unskilled	1.86
Young middle-income skilled	1.87
Young rich unskilled	1.96
Young rich skilled	1.99

D. Tariff Revenue Rebate under Customs Union

In the benchmark simulation, we notice that by joining the EU and adopting EU's tariff rates, the tariff revenues from the rest of the world increase significantly by around 290%. As a result, total tariff revenues increase as well. In this section, we consider a hypothetical case where these additional tariff revenues from the rest of the world are instead directly redistributed to the consumers in a lump-sum fashion. By passing on the revenues to the consumers directly, this experiment could provide alternative policy insights on the welfare effects of different fiscal arrangements under trade liberalization reforms. Tables 17 and 18 show the percentage change in the prices of consumption goods and factor prices, respectively. Compared with the benchmark simulation, we note that rebating the tariff revenues to households generates no significant changes in the prices of consumption goods or factor prices.

Table 19 shows the percentage change in aggregate welfare as well as disaggregated household groups' welfare. We note that the lump-sum rebate policy has a more significant impact on the aggregate consumers' welfare gain. The increase of 2.05% under the rebate policy is 44% higher than the gain under the

4. For reference, under the benchmark scenario, textiles imports from the rest of the world fall by 4.4% while exports to the EU increase by 6.0%, which reflects trade diversion and creation.

TABLE 17
Effect of Customs Union with Rebate on Consumption Good Prices

	Consumption Good Price (%)
Primary	0.62
Food and beverages	−1.01
Textiles	−0.28
Leather	−1.22
Wood products	0.29
Transport	−0.86
Other manufactures	0.07
Services	0.70

TABLE 18
Effect of Customs Union with Rebate on Factor Prices

	Factor Price (%)
Rental rate	1.11
Wage (unskilled)	1.58
Wage (skilled)	1.59

TABLE 19
Effect of Customs Union with Rebate on Welfare

Welfare	Change (%)
Aggregate consumer welfare	2.05
Government welfare	0.80
Social welfare	1.79
Old poor	2.38
Old middle-income	1.82
Old rich	1.52
Young poor unskilled	2.66
Young poor skilled	2.20
Young middle-income unskilled	2.21
Young middle-income skilled	2.14
Young rich unskilled	1.90
Young rich skilled	1.87

benchmark scenario, and 13% higher than under the FTA scenario. Government's welfare gain, on the other hand, is lower than both the benchmark and the FTA scenario. However, the overall gains are the highest under this alternative fiscal policy scenario, with gains of 1.79%. This is 4% higher than in the benchmark case and 10.5% higher than in the FTA case. The effects on disaggregated households are more interesting under the rebate scenario. The groups that experience the largest gains in welfare are the poor households, namely, the old poor, young poor unskilled, and young poor skilled households, implying that this fiscal arrangement is beneficial for poorer households. For the old poor households, the welfare gain of 2.38% is more than 2.2 times the gain recorded under the benchmark scenario. In addition, benefits are accrued more on unskilled households than on their skilled counterparts with the gap declining as income grows.

VI. CONCLUSIONS

This paper analyzes the potential distributional effects of trade liberalization on heterogeneous households. We use a calibrated AGEM as our tool of analysis and apply it to the particular case of Slovenia joining the EU as a full member as it provides a natural case of a small open economy being integrated into a larger economic area. Our structural model also enables us to simulate alternative policy reforms such as an FTA which enables us to evaluate different policy reforms and compare the quantitative effects of these trade liberalization policies on prices and welfare of the domestic disaggregated consumer groups.

As any model, ours abstracts from several issues. Among others, because of the static nature of the model, this paper is not designed to capture the dynamic aspects of trade liberalization policies such as capital flows, foreign direct investment, and changes in productivity across sectors. Adding dynamic features to the model would help shed light on these issues and capture the long-term effects that these types of trade liberalization reforms encompass. These issues are of significant importance especially for small open economies that have opted to integrate into a larger economic area. Incorporating these issues in a general equilibrium setup raises several challenging questions for future research.

APPENDIX A

Social Accounting Matrix (SAM) Slovenia 2001, current prices, Million USD

		Production								Consumption								L	K	C	G	I	X			TOTAL
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8						Total	EU	ROW	
Production	1	335.3	387.9	15.2	19.2	57.1	0.4	166.6	430.5	375.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	46.1	21.7	24.4	1,833.4
	2	0.0	611.6	6.0	0.0	3.3	0.4	10.9	593.6	0.0	1,607.7	0.0	0.0	0.0	0.0	0.0	0.0				0.0	29.6	346.2	62.3	283.9	3,209.4
	3	6.9	0.0	740.6	0.0	1.4	19.3	103.0	157.2	0.0	0.0	436.1	0.0	0.0	0.0	0.0	0.0				2.1	0.0	638.9	498.0	140.8	2,105.6
	4	1.8	10.6	18.4	81.1	5.2	1.3	46.5	31.3	0.0	0.0	0.0	148.1	0.0	0.0	0.0	0.0				0.0	0.0	161.4	117.3	44.1	505.8
	5	3.7	1.3	0.8	0.0	188.3	4.8	97.3	73.7	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0				0.0	0.0	282.7	216.4	66.3	656.3
	6	2.4	0.4	0.0	0.0	0.5	589.5	0.0	223.8	0.0	0.0	0.0	0.0	0.0	570.2	0.0	0.0				0.0	491.8	1,199.9	1,092.2	107.7	3,078.6
	7	173.2	198.0	35.6	26.7	37.6	537.3	5,237.6	2,636.9	0.0	0.0	0.0	0.0	0.0	0.0	1,054.5	0.0				233.0	1,632.3	6,599.7	4,353.7	2,246.0	18,402.4
	8	222.2	624.9	170.6	34.7	59.7	199.4	1,684.1	7,572.3	156.7	488.5	143.3	38.6	2.5	157.2	876.4	3,288.4				3,780.1	2,556.9	2,030.7	1,428.1	602.6	24,087.2
Consumption	1																			**592.0**						592.0
	2																			**2,144.4**						2,144.4
	3																			**613.5**						613.5
	4																			**196.4**						196.4
	5																			**7.7**						7.7
	6																			**747.7**						747.7
	7																			**2,273.0**						2,273.0
	8																			**4,463.0**						4,463.0
L		**188.2**	**300.0**	**286.7**	**78.4**	**123.6**	**134.5**	**2,194.6**	**7,601.0**																	**10,907.1**
K		**413.9**	**181.8**	**54.2**	**18.5**	**42.2**	**68.2**	**1,227.0**	**4,145.4**																	**6,151.1**
Households																		10,907.1	6,151.1							17,058.2
Government		-23.7	351.4	84.3	27.8	3.1	177.5	766.9	-504.9	60.2	48.2	34.1	9.7	1.7	20.3	342.2	1,174.6									2,573.3
Direct Tax																				1,497.2						1,497.2
Indirect tax		-39.1	301.7	74.1	22.7	2.6	168.8	726.4	-505.0	60.2	48.2	34.1	9.7	1.7	20.3	342.2	1,174.6									2,443.1
Tariff	**TOTAL**	15.4	49.7	10.2	5.1	0.5	8.6	40.6	0.1																	130.2
	EU	8.8	34.5	8.0	3.9	0.4	7.8	32.2	0.1																	
	ROW	6.6	15.2	2.2	1.2	0.1	0.8	8.4	0.0																	
Capital																				4,523.4	55.3		132.0	845.6	-713.6	4,710.6
IM	**TOTAL**	509.5	541.4	693.2	219.3	134.2	1,345.8	6,867.8	1,126.5																	11,437.7
	`	291.2	375.8	541.9	167.7	103.3	1,214.2	5,288.4	652.8																	8,635.3
	ROW	218.3	165.5	151.3	51.6	30.9	131.6	1,579.4	473.7																	2,802.4
TOTAL		1,833.4	3,209.4	2,105.6	505.8	656.3	3,078.6	18,402.4	24,087.2	592.0	2,144.4	613.5	196.4	7.7	747.7	2,273.0	4,463.0	10,907.1	6,151.1	**17,058.2**	4,070.5	4,710.6	11,437.7	8,635.3	2,802.4	

1	Primary	**L**	Payment to labor
2	Food & beverages	**K**	Payment to capital
3	Textile	**C**	Final consumption
4	Leather	**G**	Government expenditure
5	Wood products	**I**	Final investment
6	Transport equipments	**X**	Exports
7	Other manufacturing	**IM**	Imports
8	Service	**EU**	European Union
		ROW	Rest of the world

APPENDIX B SECTORAL MATCHING OF CONSUMPTION

TABLE B1

Sectoral Matching: SAM versus Household Budget Survey

8-Sector SAM	**Households Budget Survey**
(1) Primaries	0.0110 Food (only one-half imputed)
(2) Food and beverages	0.0110 Food (only one-half imputed)
	0.0120 Nonalcoholic beverages
	0.0200 Alcoholic, tobacco
	0.1110 Restaurant meals
(3) Textiles	0.0310 Clothing
	0.0520 Households textiles
(4) Leather	0.0320 Footwear
(5) Wood products	0.0510 Furniture and furnishings, carpets and other floor coverings
(6) Transportation equipments	0.0710 Purchases of vehicles
(7) Other manufactures	0.0431 Materials for the maintenance and repair of the dwelling
	0.0530 Household appliances
	0.0540 Glassware, tableware and household utensils
	0.0550 Tools and equipment for house and garden
	0.0560 Goods and services for routine household maintenance
	0.0610 Medical products, appliances and equipment
	0.0720 Operation of personal transport equipment
	0.0812 Telephone and telefax equipment
	0.0910 Audio-visual, photographic and information processing equipment
	0.0920 Other major durables for recreation and culture
	0.0930 Other recreational items and equipment, gardens and pets
	0.0950 Newspapers, books and stationery
	0.1210 Personal care
	0.1220 Personal effects
(8) Services	0.0410 Rentals for housing
	0.0432 Services for maintenance and repair of the dwelling
	0.0440 Water supply services
	0.0450 Electricity, gas and other fuels
	0.0620 Outpatient services
	0.0630 Hospital services
	0.0730 Transport services
	0.0811 Postal services
	0.0813 Telephone and telefax services
	0.0940 Recreational and sporting services
	0.0960 Package holidays
	0.1000 Education
	0.1120 Accommodation services
	0.1230 Social protection
	0.1240 Insurance
	0.1250 Financial services
	0.1260 Other services

APPENDIX C SAM — FACTOR INCOME (MILLION USD)

		PRODUCTION							
		Primary	**Food &Bev**	**Textile**	**Leather**	**Wood Prod.**	**Transport**	**Other Man.**	**Service**
Labor Input		**188.2**	**300.0**	**286.7**	**78.4**	**123.6**	**134.5**	**2,194.6**	**7,601.0**
Old	Poor	0.4	0.7	0.7	0.2	0.3	0.3	5.2	18.2
	Middle-income	3.5	5.6	5.3	1.5	2.3	2.5	40.8	141.2
	Rich	3.4	5.4	5.2	1.4	2.2	2.4	39.8	138.0
Young	Poor unskilled	8.3	13.2	12.6	3.4	5.4	5.9	96.3	333.7
	Poor skilled	0.3	0.5	0.4	0.1	0.2	0.2	3.4	11.6
	Middle-income unskilled	58.0	92.4	88.4	24.2	38.1	41.4	676.2	2,342.1
	Middle-income skilled	12.5	19.9	19.0	5.2	8.2	8.9	145.8	504.9
	Rich unskilled	55.1	87.8	84.0	23.0	36.2	39.4	642.6	2,225.7
	Rich skilled	46.7	74.4	71.1	19.5	30.7	33.4	544.4	1,885.7
Capital Input		**413.9**	**181.8**	**54.2**	**18.5**	**42.2**	**68.2**	**1,227.0**	**4,145.4**
Old	Poor	34.0	14.9	4.4	1.5	3.5	5.6	100.7	340.1
	Middle-income	71.4	31.4	9.3	3.2	7.3	11.8	211.7	715.2
	Rich	43.6	19.2	5.7	2.0	4.5	7.2	129.4	437.1
Young	Poor unskilled	39.8	17.5	5.2	1.8	4.1	6.6	118.0	398.5
	Poor skilled	1.7	0.8	0.2	0.1	0.2	0.3	5.1	17.1
	Middle-income unskilled	104.8	46.0	13.7	4.7	10.7	17.3	310.6	1,049.4
	Middle-income skilled	15.9	7.0	2.1	0.7	1.6	2.6	47.0	158.8
	Rich unskilled	66.2	29.1	8.7	3.0	6.7	10.9	196.2	662.9
	Rich skilled	36.6	16.1	4.8	1.6	3.7	6.0	108.4	366.3

APPENDIX D SAM — HOUSEHOLD CONSUMPTION (MILLION USD)

		C	**Consumption**								
			Old			**Young**					
						Poor		**Middle-Income**		**Rich**	
			Poor	**Middle-Income**	**Rich**	**Unskilled**	**Skilled**	**Unskilled**	**Skilled**	**Unskilled**	**Skilled**
CONSUMPTION	**Primary**	**592.0**	44.6	76.2	26.6	62.3	3.8	169.8	30.6	102.9	75.2
	Food &Bev	**2,144.4**	128.8	219.4	93.8	213.2	14.4	626.8	114.2	414.2	319.6
	Textile	**613.5**	19.4	46.3	24.6	38.6	5.1	177.3	36.3	135.8	130.1
	Leather	**196.4**	6.0	13.9	7.6	13.3	0.7	56.2	12.6	44.7	41.4
	Wood prod.	**7.7**	0.2	0.5	0.3	0.5	0.0	1.9	0.4	2.1	1.8
	Transport	**747.7**	8.6	31.7	18.2	21.8	0.1	210.8	33.9	254.2	168.3
	Other man.	**2,273.0**	95.4	195.5	109.4	183.3	12.4	630.4	138.7	482.2	425.9
	Service	**4,463.0**	243.7	518.2	209.3	416.9	28.1	1243.6	262.3	842.7	698.0

APPENDIX E CALIBRATED PARAMETERS

TABLE E1

Preference Parameters (θ)—Aggregate Consumer and Government

	Consumer	Government
Primary	0.0380	0.0000
Food and beverages	0.1378	0.0000
Textiles	0.0394	0.0005
Leather	0.0126	0.0000
Wood products	0.0005	0.0000
Transport	0.0480	0.0000
Other manufactures	0.1461	0.0572
Services	0.2868	0.9287
Investment good	0.2907	0.0136

TABLE E2

Preference Parameters (θ)—Old Households

	Old Poor	Old Middle-Income	Old Rich
Primary	0.0700	0.0547	0.0335
Food and beverages	0.2023	0.1576	0.1179
Textiles	0.0305	0.0333	0.0310
Leather	0.0094	0.0100	0.0096
Wood products	0.0003	0.0004	0.0003
Transport	0.0136	0.0228	0.0229
Other manufactures	0.1498	0.1404	0.1376
Services	0.3827	0.3723	0.2633
Investment good	0.1414	0.2085	0.3840

TABLE E3

Preference Parameters (θ)—Young Households

	Poor		Middle-Income		Rich	
	Unskilled	Skilled	Unskilled	Skilled	Unskilled and Skilled	
Primary	0.0544	0.0589	0.0384	0.0354	0.0294	0.0275
Food and beverages	0.1862	0.2223	0.1416	0.1319	0.1184	0.1168
Textiles	0.0337	0.0785	0.0400	0.0419	0.0388	0.0476
Leather	0.0116	0.0111	0.0127	0.0145	0.0128	0.0151
Wood products	0.0004	0.0008	0.0004	0.0005	0.0006	0.0007
Transport	0.0191	0.0011	0.0476	0.0391	0.0727	0.0615
Other manufactures	0.1600	0.1919	0.1424	0.1601	0.1378	0.1557
Services	0.3640	0.4355	0.2809	0.3030	0.2408	0.2552
Investment good	0.1706	0.0000	0.2959	0.2736	0.3487	0.3200

TABLE E4

Domestic Goods Firm Parameters (α, α_s, α_u, β)

	α	α_s	α_u	β
Primary	0.6875	0.0988	0.2138	4.9155
Food and beverages	0.3774	0.1968	0.4258	15.5485
Textiles	0.1589	0.2658	0.5753	10.7697
Leather	0.1911	0.2556	0.5533	7.8275
Wood products	0.2546	0.2356	0.5099	8.8326
Transport	0.3364	0.2097	0.4539	24.3702
Other manufactures	0.3586	0.2027	0.4387	9.6259
Services	0.3529	0.2045	0.4426	5.6021

TABLE E5

Armington Aggregators (γ, δ)

	γ	δ_{dom}	δ_{EU}	δ_{ROW}
Primary	2.8647	0.4028	0.3072	0.2900
Food and beverages	2.7933	0.4221	0.3126	0.2653
Textiles	2.8242	0.4018	0.3371	0.2612
Leather	2.9223	0.3771	0.3480	0.2749
Wood products	2.6693	0.4354	0.3162	0.2484
Transport	2.7735	0.3937	0.3694	0.2368
Other manufactures	2.8469	0.3941	0.3395	0.2664
Services	2.2782	0.5126	0.2515	0.2359

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