Trade Preferences and Bilateral Trade in Goods and Services: A Structural Approach*

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Abstract

The large reduction in tariff rates worldwide under several rounds of the GATT is commonly credited with being one of the most notable economic policy accomplishments since World War II. However, the remarkable progress towards free trade of goods is unparalleled in trade with services where liberalization agreements are much harder to achieve and cross-border transactions are impeded by far tighter barriers than for the exchange of goods. In any case, the question as to how trade policy affects services trade is complex for various reasons. First, services transactions are much harder to measure than goods transactions and acceptable data on service trade have only recently become available, mostly for trade of OECD countries. Second, neither production nor trade of goods and services are independent; often they are even unseparable. Thus, achievements towards liberalizing cross-border trade of goods should have an impact on services and, by the same token, the lack of liberalization of services trade should be responsible for there being less goods trade than possible. We provide a general equilibrium comparative static estimate of the trade and welfare effects of trade policy measures towards goods and services trade.

Key words: Goods trade; Services trade; Gravity equation; Structural estimation

JEL classification: F10; F12; F13

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1 Introduction

An economy's service sector is known to grow in importance – and eventually dominate manufacturing – during its transition from a developing towards a developed country (see Schettkat and Yocarini, 2006; Francois and Hoekman, 2010). Along that path of development, the significance of cross-border service transactions increases (see Francois and Reinert, 1996; Mattoo and Sauvé, 2003; Francois and Woerz, 2008).

The rising importance of services relative to goods production and trade is reflected in the growth of attention in the policy arena. Not only has services trade become a key *outcome* of interest in multilateral policy making – e.g., with the General Agreement on Trade in Services (GATS) under the auspices of the World Trade Organization (WTO; see Mattoo and Sauvé, 2003) – but it became important with regard to *specific policy instruments* both in terms of means of multilateral liberalization as well as of preferential market access. The latter is obvious from the increasing number of recently-concluded or -extended preferential trade agreements that are notified to the WTO and liberalize not only trade in goods but also trade in services preferentially in accordance with WTO rules (see Mattoo and Fink, 2002).

In general, cross-border service transactions are difficult to measure in comparison to goods trade. This has to do with the fact that, unlike goods trade, not all cross-border service transactions correspond to direct trade in services (e.g., the delivery of a computer program via email from the programmer's residence country to the customer's residence country, corresponding to Mode 1 in GATS jargon). Some services trade happens by way of cross-border consumption at the site of the services provider (e.g., tourism which is referred to as Mode 2). Yet other services are provided in connection with foreign direct investment and the offshore provision through affiliates (Mode 3 in GATS jargon). Finally, as a counterpart to Mode 2, some services are provided locally by the temporary foreign labor service of natural persons at the consumer's site (e.g., installation or repairs; Mode 4). The multi-faceted appearance of cross-border services transactions has deterred both data collection and provision as well as associated quantitative academic research for long. Only fairly recently, notable attempts to collect and provide data on services trade have been undertaken (e.g., by the OECD and the World Bank; or Francois, Pindyuk, and Woerz, 2009) and systematic structural quantitative work is still scarce (see Anderson, Milot, and Yotov, 2011; Francois, Pindyuk, and Woerz, 2008; or Nordås, 2010; for a

few exceptions).

Unlike for goods trade, most of the existing quantitative work on services trade is of a reduced-form type (Anderson, Milot, and Yotov, 2011, are a notable exception but focus on Canada and the services sector only) or based on calibration and simulation methods in a broad sense. Three potential shortcomings flow from this treatment. First, as in models of goods trade only, reduced-form econometric work tends to ignore market-clearing conditions at the multilateral level, rendering the analysis of consequences of big economic shocks inconsistent with general equilibrium. Second, with reduced-form econometric work market-clearing conditions at the multisectoral level within countries are ignored with qualitatively similar consequences: an analysis of big economic shocks leads to estimated effects which are likely inconsistent with limited factor supply and cross-sectoral effects through intranational factor movements (see, e.g., Eaton and Kortum, 2002, for an exception). Third, a problem with the analysis based on computable general equilibrium may be that the calibration is based on external information beyond the data which are employed. These three issues are overcome in structurally estimated general equilibrium models. Moreover, we will illustrate that collapsing a world with goods and services production into a one-sector economy may lead to severe (aggregation) biases in quantitative work on the effects of trade liberalization.

The goal of this paper is to provide a structural quantitative analysis of the consequences of the preferential liberalization of services and goods trade by way of agreements as notified to the WTO in multi-country general equilibrium. The paper unifies four literatures in international economics: the one on structural estimation of gravity models,[1] the one on policy analysis (so far mostly with goods trade only),[2] and the ones on goods trade[3] and services trade.[4] We outline a model of goods and services production and propose a systems estimation strategy which identifies all model parameters of interest and takes the bivariate stochastic nature of

[1]See Eaton and Kortum (2002), Trefler and Lai (2002), Anderson and van Wincoop (2003), Carrère (2006), Martin, Mayer, and Thoenig (2008), Egger and Larch (2010), Head, Mayer, and Ries (2010), Arcand, Olarreaga, and Zoratto (2011), Balistreri, Hillberry, and Rutherford (2011), Egger, Larch, Staub, and Winkelmann (2011).

[2]See Baier and Bergstrand (2001, 2007, 2009), Carrère (2006), Egger, Egger, and Greenaway (2008), Egger and Larch (2010), Arcand, Olarreaga, and Zoratto (2011), Egger, Larch, Staub, and Winkelmann (2011), and Vicard (2011). Anirudh (2009) and Guillin (2011) provide two of the few policy analyses on preferential trade agreements on services trade.

[3]See Eaton and Kortum (2002), Trefler and Lai (2002), Anderson and van Wincoop (2003), or Egger, Larch, Staub, and Winkelmann (2011).

[4]Ceglowski (2006), Kimura and Lee (2006), Walsh (2006), Francois, Hoekman, and Woerz (2007), Nordås (2010), Anderson, Milot, and Yotov (2011), and Guillin (2011).

data on bilateral trade in goods and services into account. The model together with parameters estimated using panel data on 16 European countries for the period 1999 to 2006 is then used to assess quantitatively the comparative static effects of preferential liberalization of goods and/or services trade in general equilibrium.[5]

Key findings of the analysis can be summarized as follows. First, services trade reacts more elastically than goods trade to preferential trade liberalization of any kind. On average, services liberalization boosts labor demand in the services sector at the cost of labor demand in the goods sector and vice versa. However, preferential liberalization of many country-pairs at the same time induces a complex mix of direct (*trade creation*) and indirect (*trade diversion*) effects on bilateral trade. Preferential goods and services trade liberalization together in 2006 lead to welfare effects of about 0.74% of GDP in the average economy covered compared to an equilibrium without such liberalization. In comparison, goods trade versus services trade liberalization alone account for welfare gains of about 0.41% and 0.27%, respectively.

The remainder of the paper is structured as follows. Section 2 presents the theoretical model and outlines how the model can be solved in counterfactual equilibrium with known data on independent variables and parameters. Section 3 introduces a stochastic version of the model and discusses how these model parameters can be estimated from the data. Section 4 summarizes features of the data, estimation results, and comparative static effects of adopting preferential trade agreements on goods versus services trade, and the last section concludes.

2 A gravity model of goods and services

2.1 Utility

Let us assume that there are two industries, services (S) and goods (G), respectively. Consumers receive utility from the consumption of goods from either industry through a constant-elasticity-of-substitution (CES) function with industry-specific elasticity of substitution, following Dixit and Stiglitz (1977), and their respective subutility functions are aggregated by the following Cobb-Douglas upper-tier utility function that translates sectoral subutility into an overall wel-

[5]The proposed stochastic model is amenable to structural estimation of multi-sector multi-country gravity models in general and may potentially be used in other contexts beyond goods and services trade.

fare level:

$$U_j = \prod_{\ell} C_{\ell,j}^{\alpha_\ell}, \qquad C_{\ell,j} = \left\{ \int_{v=V_\ell} [c_{\ell,j}(v)]^{\frac{\sigma_\ell - 1}{\sigma_\ell}} dv \right\}^{\frac{\sigma_\ell}{\sigma_\ell - 1}}, \qquad \ell = \{G, S\} \tag{1}$$

where α_ℓ with $\sum_\ell \alpha_\ell = 1$ is the weight of the ℓ-th industry in total expenditure, $c_{\ell,j}(v)$ is the consumption of consumers in country j of variety v from sector ℓ with V_ℓ denoting the set of available varieties in sector ℓ, and σ_ℓ is the elasticity of substitution in consumption of varieties v in sector ℓ. A key property of $C_{\ell,j}$ is that it captures a love of variety: consumers value a given amount of consumption of either S or G higher if it consists of a larger number of varieties.

Utility in (1) is maximized subject to total income. The latter is defined as total consumption expenditures for varieties in either sector, $\mathfrak{X}_j \equiv \sum_\ell \mathfrak{X}_{\ell,j} = \sum_\ell \alpha_\ell \mathfrak{X}_j$. Household expenditures in country j for varieties in sector ℓ and total expenditures, respectively, are defined as:

$$\mathfrak{X}_{\ell,j} = \alpha_\ell \mathfrak{X}_j = \int_{v=V_\ell} \tilde{p}_{\ell,j}(v) c_{\ell,j}(v) dv, \qquad \mathfrak{X}_j = \sum_\ell \int_{v=V_\ell} \tilde{p}_{\ell,j}(v) c_{\ell,j}(v) dv, \tag{2}$$

where $\tilde{p}_{\ell,j}(v)$ is the consumer price of variety v of sector ℓ in country j.

Maximization of (1) subject to (2) obtains consumption expenditures for variety v in sector ℓ and country j:

$$c_{\ell,j}(v) = \left(\frac{\tilde{p}_{\ell,j}(v)}{P_{\ell,j}} \right)^{-\sigma_\ell} \frac{\mathfrak{X}_{\ell,j}}{P_{\ell,j}}, \qquad P_{\ell,j} = \left\{ \int_{v=V_\ell} [\tilde{p}_{\ell,j}(v)]^{1-\sigma_\ell} \right\}^{\frac{1}{1-\sigma_\ell}}, \tag{3}$$

where $P_{\ell,j}$ denotes the consumer price index in country j and sector ℓ.

In the sequel, we use the following simplifying assumptions. First, trade costs are of the iceberg form so that we may write $\tilde{p}_{\ell,j}(v) = p_\ell(v) t_j(v)$, where $p_\ell(v)$ is the producer price of v and $t_j(v) \geq 1$ is the iceberg trade cost term for shipping variety v from wherever it is produced to consumers in j. Second, each variety is produced by a single firm which acts under monopolistic competition. Third, all producers located in a country, say, i, have access to and, in equilibrium, use the same production technology. Hence, we may replace the integral over the varieties by the weighted sum over prices to the power of $1 - \sigma$ over all countries $j = 1, ..., J$, where the weights are given by the number of firms in sector ℓ in country j, denoted by $n_{\ell,j}$.

2.2 Production

The representative firm in country i and sector ℓ is assumed to maximize profits subject to the linear cost function:

$$l_{\ell,i} = \delta_\ell + \psi_\ell x_{\ell,i}, \tag{4}$$

where $l_{\ell,i}$ denotes labor used by the representative firm in sector ℓ and country i and $x_{\ell,i}$ denotes the output of the firm.

Hence, we assume that labor is the only factor of production. Moreover, we assume that labor is mobile across sectors but not internationally. The latter implies equalization of the reward to labor services within but not across countries and the variety index (v) with producer prices and trade costs, respectively, in sector ℓ may be replaced by a subscript denoting the residence country of producers, say, i. For consumption of a variety from country i, we may then replace $\tilde{p}_{\ell,j}(v)$ in equation (3) by $p_{\ell,i}t_{\ell,ij}$.

Let us denote the wage rate paid to workers in country i by w_i. Then, profit maximization ensures fixed-markup pricing:

$$p_{\ell,i} = \frac{\sigma_\ell}{\sigma_\ell - 1}\psi_\ell w_i. \tag{5}$$

Under monopolistic competition, zero economic profits in equilibrium ensures:

$$x_{\ell,i} = \frac{\delta_\ell}{\psi_\ell}\left(\sigma_\ell - 1\right). \tag{6}$$

Clearing of the market for labor with full employment is ensured by the factor constraint

$$L_i = \sum_\ell L_{\ell,i}, \qquad L_{\ell,i} \equiv n_{\ell,i}l_{\ell,i} = n_{\ell,i}\left(\delta_\ell + \psi_\ell x_{\ell,i}\right), \tag{7}$$

which yields:

$$n_{\ell,i} = \frac{L_{\ell,i}}{\delta_\ell + \psi_\ell x_{\ell,i}} = \frac{L_{\ell,i}}{\delta_\ell \sigma_\ell}, \tag{8}$$

where $L_{\ell,i}$ is the (endogenous) amount of labor employed in sector ℓ and country i and $\sum_\ell L_{\ell,i} = L_i$ is country i's total endowment with labor. Hence, while L_i is fixed in this model, the allocation of labor across sectors is determined endogenously in general equilibrium.

2.3 Bilateral trade flows at the sector level

Let us denote bilateral consumption of a representative variety in sector ℓ originating from country i by consumers in j by $c_{\ell,ij}$. Furthermore, denote the corresponding shipments from the perspective of a firm in i by $x_{\ell,ij} \equiv t_{\ell,ij}c_{\ell,ij}$. The value of bilateral shipments per firm, $p_{\ell,i}x_{\ell,ij}$, equals the corresponding value of consumption, $p_{\ell,i}t_{\ell,ij}c_{\ell,ij}$. With labor being perfectly mobile between sectors, GDP is defined as $Y_i \equiv w_i \sum_\ell L_{\ell,i}$ so that $w_i = Y_i/L_i$. Using this and equations (5) and (8), we can substitute Y_i/L_i for w_i, $\sigma_\ell \psi_\ell w_i/(\sigma_\ell - 1)$ for $p_{\ell,i}$, and $L_{\ell,i}/(\delta_\ell \sigma_\ell)$ for $n_{\ell,i} \;\; \forall \;\; \ell \in \{S, G\}$. Using equation (3) and $x_{\ell,ij} \equiv t_{\ell,ij}c_{\ell,ij}$ yields the following expression for aggregate nominal bilateral export flows from country i to j in sector ℓ:

$$X_{\ell,ij} \equiv n_{\ell,i}p_{\ell,i}x_{\ell,ij} = \frac{L_{\ell,i}\left(Y_i/L_i\right)^{1-\sigma_\ell} t_{\ell,ij}^{1-\sigma_\ell}\alpha_{\ell,j}\mathfrak{X}_j}{\sum_{k=1}^{J} L_{\ell,k}\left(Y_k/L_k\right)^{1-\sigma_\ell} t_{\ell,kj}^{1-\sigma_\ell}} = \frac{\mathfrak{Y}_{\ell,i}\left(Y_i/L_i\right)^{-\sigma_\ell} t_{\ell,ij}^{1-\sigma_\ell}\alpha_{\ell,j}\mathfrak{X}_j}{\sum_{k=1}^{J} \mathfrak{Y}_{\ell,k}\left(Y_k/L_k\right)^{-\sigma_\ell} t_{\ell,kj}^{1-\sigma_\ell}}, \tag{9}$$

where J denotes the number of countries, $\sum_{k=1}^{J} \mathfrak{Y}_{\ell,k}\left(Y_k/L_k\right)^{-\sigma_\ell} t_{\ell,kj}^{1-\sigma_\ell} = P_{\ell,j}^{1-\sigma_\ell}$, $\mathfrak{Y}_{\ell,i} \equiv \sum_{j=1}^{J} X_{\ell,ij} = n_{\ell,i}p_{\ell,i}x_{\ell,i} = w_i L_{\ell,i}$ are total sales by country i in sector ℓ, so that $L_{\ell,i} = \mathfrak{Y}_{\ell,i}/w_i$ and

$$\mathfrak{Y}_{\ell,i} = \sum_{j=1}^{J} \frac{\mathfrak{Y}_{\ell,i}\left(Y_i/L_i\right)^{-\sigma_\ell} t_{\ell,ij}^{1-\sigma_\ell}\alpha_{\ell,j}\mathfrak{X}_j}{\sum_{k=1}^{N} \mathfrak{Y}_{\ell,k}\left(Y_k/L_k\right)^{-\sigma_\ell} t_{\ell,kj}^{1-\sigma_\ell}}, \qquad Y_i = \sum_{\ell}\sum_{j=1}^{J} \frac{\mathfrak{Y}_{\ell,i}\left(Y_i/L_i\right)^{-\sigma_\ell} t_{\ell,ij}^{1-\sigma_\ell}\alpha_{\ell,j}\mathfrak{X}_j}{\sum_{k=1}^{J} \mathfrak{Y}_{\ell,k}\left(Y_k/L_k\right)^{-\sigma_\ell} t_{\ell,kj}^{1-\sigma_\ell}}, \tag{10}$$

where $Y_i = \sum_\ell \mathfrak{Y}_{\ell,i}$ is the multilateral balance of payments constraint. Note that with trade imbalances, D_i total spending is given by the sum of GDP and trade imbalances, i.e. $\mathfrak{X}_i = Y_i + D_i$ (see Dekle, Eaton and Kortum, 2007).

Hence, given the fundamental parameters σ_ℓ and α_ℓ and the fundamental variables $t_{\ell,ij}$ and $L_{\ell,i}$ for all $\{\ell, i, j\}$, the endogenous variables of the model, namely $X_{\ell,ij}$, $\mathfrak{Y}_{\ell,i}$, $\mathfrak{X}_{\ell,i}$ and Y_i are determined. Note that under the given assumptions knowledge or estimation of δ_ℓ and ψ_ℓ is not necessary to determine counterfactual equilibria of $X_{\ell,ij}$, $\mathfrak{Y}_{\ell,i}$ and Y_i.

2.4 Equilibrium and equivalent variation

Market clearing implies $Y_i = \sum_\ell \mathfrak{Y}_{\ell,i}$. Dividing the left-hand side and right-hand side of the equation for $\mathfrak{Y}_{\ell,i}$ in (10) by $\mathfrak{Y}_{\ell,i}$ and by $[(\sum_\ell \mathfrak{Y}_{\ell,i})/L_i]^{-\sigma_\ell}$ and substituting Y_i by $\sum_\ell \mathfrak{Y}_{\ell,i}$ yields

$$\left[\left(\sum_\ell \mathfrak{Y}_{\ell,i}\right)/L_i\right]^{\sigma_\ell} = \sum_{j=1}^{J}\left(\frac{t_{\ell,ij}^{1-\sigma_\ell}\alpha_{\ell,j}\left[\sum_\ell\left(\mathfrak{Y}_{\ell,j}\right)+D_j\right]}{\sum_{k=1}^{J}\mathfrak{Y}_{\ell,k}\left[\left(\sum_\ell \mathfrak{Y}_{\ell,k}\right)/L_k\right]^{-\sigma_\ell}t_{\ell,kj}^{1-\sigma_\ell}}\right). \tag{11}$$

Hence, with two sectors $\ell \in \{G, S\}$, (11) obtains a system of $2J$ equations that can be solved for J values of $\mathfrak{Y}_{G,i}$ and $\mathfrak{Y}_{S,i}$ each.

In order to do so, one needs data on L_i and one needs estimates of $\alpha_{\ell,i}$ and σ_ℓ. Further, one needs predictions of $t_{\ell,ij}$ which can be obtained by specifying an estimable functional relationship relating $t_{\ell,ij}$ to variables such as bilateral distance or regional trade agreement membership. Solving (11) based on benchmark and counterfactual estimates of $t_{\ell,ij}^{1-\sigma_\ell}$ yields the corresponding equilibria.

With the solutions at hand, we can also compute the equivalent variation corresponding to the change in $t_{\ell,ij}^{1-\sigma_\ell}$ as a measure of welfare. In general,

$$P_{\ell,j} = \left\{\sum_{k=1}^{J}\mathfrak{Y}_{\ell,k}\left[\left(\sum_\ell \mathfrak{Y}_{\ell,k}\right)/L_k\right]^{-\sigma_\ell}t_{\ell,kj}^{1-\sigma_\ell}\right\}^{\frac{1}{1-\sigma_\ell}}, \tag{12}$$

$$R_i = \frac{\sum_\ell \mathfrak{Y}_{\ell,i}}{\prod_\ell P_{\ell,i}^{\alpha_{\ell,i}}}, \tag{13}$$

and the equivalent variation in country i as the response of real GDP R_i in percent to some change in a fundamental variable (such as bilateral trade costs) as:

$$EV_i = 100\frac{\sum_\ell \mathfrak{Y}_{c,\ell,i} + D_i}{\sum_\ell \mathfrak{Y}_{b,\ell,i} + D_i} - 100, \tag{14}$$

where $\mathfrak{Y}_{b,\ell,i}$ and $\mathfrak{Y}_{c,\ell,i}$ denote GDP of country i in sector ℓ in the benchmark and the counterfactual equilibrium, respectively.

3 Stochastic process and estimation

To compute the counterfactual equilibrium, the unknown parameters σ_ℓ and α_ℓ, as well as the bilateral sectoral trade barriers $t_{\ell,ij}$ need to be estimated from the data. This section shows how these parameters can be estimated from a panel data set of country-pairs. While the estimation procedures could also be implemented with cross-sectional data, the approach discussed here is more general and allows to exploit efficiency gains resulting from repeated observations over time. Importantly, trade barriers will be identified by additional within-country-pair variation.

Notationally, the adoption of the time dimension is introduced by adding a subscript $t = 1, \ldots, T$ to the variables. This increases the parameters to be estimated to $\alpha_{\ell,t}$ and $t_{\ell,ijt}$. For reasons of simplicity, we assume that consumers' tastes as captured by σ_ℓ are stable over time, but our empirical strategy does not require this assumption for identification of σ_ℓ.

With data on $\mathfrak{Y}_{\ell,jt}$ at hand, the share of income which is spent on sector ℓ can easily be solved for each country j from

$$\alpha_{\ell,jt} = \frac{\mathfrak{Y}_{\ell,jt}}{\sum_\ell \mathfrak{Y}_{\ell,jt}}. \tag{15}$$

In contrast, obtaining $t_{\ell,ijt}$ and σ_ℓ requires more assumptions, and we devote the remainder of the section to this problem.

3.1 Empirical bisectoral gravity model

Following the standard specification in the empirical literature on gravity models for trade, we specify unobserved trade barriers to be an exponential function of K observed proxy variables $Z_{ijt} = (Z_{1,ijt}, \ldots, Z_{K,ijt})$:

$$\tau_{\ell,ijt} = \exp(Z'_{\ell,ijt} b_\ell), \tag{16}$$

where b_ℓ is a conforming parameter vector. In general, we assume that intranational trade costs are zero such that $\tau_{\ell,iit} = 1$ for all i and t. Equation (16) then reduces the problem of estimating $N \times (N-1) \times T$ elements $\tau_{\ell,ijt}$ to one of estimating a K-dimensional vector b_ℓ for each equation ℓ. For this purpose, a stochastic counterpart to (9) may be written as

$$X_{\ell,ij} = \exp(Z'_{\ell,ijt} b_\ell)^{1-\sigma_\ell} \mu_{\ell,it} m_{\ell,jt} u_{\ell,ijt}, \tag{17}$$

where $u_{\ell,ijt}$ denotes the random disturbances or measurement error of exports, assumed to be identically distributed over the non-negative real numbers and mean-independent of the remaining terms of the right-hand side of (17).[6] Errors $u_{\ell,ijt}$ are allowed to be correlated over time and across sectors.

Writing $\beta_\ell = b_\ell \times (1 - \sigma_\ell)$ and including a constant in Z_{ijt}, the conditional expectation of (17) is

$$\mathrm{E}(X_{\ell,ijt}|Z_{ijt}, \mu_{\ell,it}, m_{\ell,jt}) = \exp(Z'_{ijt}\beta_\ell)\mu_{\ell,it}m_{\ell,jt}, \tag{18}$$

which can serve as a basis for a number of moment-based estimators of β, $\mu_{\ell,it}$, and $m_{\ell,jt}$.

The terms $\mu_{\ell,it}$ and $m_{\ell,jt}$ collect the sectoral exporter-time and importer-time specific structural components of (9). In addition, they may contain sectoral unobserved exporter-time and importer-time specific trade costs, say $\phi_{\ell,it}$ and $\varphi_{\ell,jt}$, respectively:

$$\mu_{\ell,it} \equiv \mathfrak{Y}_{\ell,it}(Y_{it}/L_{it})^{-\sigma_\ell}\phi_{\ell,it}^{1-\sigma_\ell}, \tag{19}$$

$$m_{\ell,jt} \equiv \frac{\alpha_{\ell,jt}\left(\sum_\ell \mathfrak{Y}_{\ell,jt} + D_{jt}\right)}{\sum_{k=1}^{J} \mathfrak{Y}_{\ell,kt}(Y_{kt}/L_{kt})^{-\sigma_\ell}\tau_{\ell,kjt}^{1-\sigma_\ell}\phi_{\ell,kt}^{1-\sigma_\ell}\varphi_{\ell,jt}^{1-\sigma_\ell}}\varphi_{\ell,jt}^{1-\sigma_\ell}. \tag{20}$$

According to this notation, $t_{\ell,ijt}^{1-\sigma_\ell} = \tau_{\ell,ijt}^{1-\sigma_\ell}\phi_{\ell,it}^{1-\sigma_\ell}\varphi_{\ell,jt}^{1-\sigma_\ell}$ for all $i \neq j$ and t and $t_{\ell,ijt}^{1-\sigma_\ell} = 1$ for all $i = j$ and t implying $\tau_{\ell,iit}^{1-\sigma_\ell} = \phi_{\ell,it}^{\sigma_\ell-1}\varphi_{\ell,it}^{\sigma_\ell-1}$ for all i.[7]

This distinction is important for computing the counterfactual equilibrium where the unobserved exporter-time and importer-time specific trade costs $\phi_{\ell,it}$ and $\varphi_{\ell,jt}$ are held constant, while the remaining, structural parts of $\mu_{\ell,it}$ and $m_{\ell,jt}$ change. Note that $\phi_{\ell,it}^{1-\sigma_\ell}$ can be solved for directly from (19) provided estimates of $\mu_{\ell,it}$ and σ_ℓ, and data on $\mathfrak{Y}_{\ell,it}, Y_{it}, L_{it}$ are available. Similarly, with the same information, solutions for $\varphi_{\ell,it}^{1-\sigma_\ell}$ can be obtained for all countries and

[6] For the sake of simplicity, we will generally assume that the elements in $Z_{\ell,ijt}$ are independent of $u_{\ell,ijt}$ and, hence, that trade preferences are exogenous. As we will outline in Section 4.1, this may be justified since all countries in the sample will grant trade preferences vis-à-vis each other by the end of the sample period we use. Moreover, Baier and Bergstrand (2007) provided evidence that the endogeneity of trade preferences could be overcome to a large extent by the use of panel data cum fixed effects.

[7] We interpret $u_{\ell,ijt}$ as a measurement error of trade flows $X_{\ell,ijt}$. In previous work, some authors advocated an interpretation of the respective (e.g., single-sector, time-invariant) counterpart to $u_{\ell,ijt}$ – or counterparts to what we call $\phi_{\ell,it}^{1-\sigma_\ell}$ and $\varphi_{\ell,jt}^{1-\sigma_\ell}$ – as a stochastic component of $t_{\ell,ijt}^{1-\sigma_\ell}$. As here, the stochastic component was treated as the disturbance term of the gravity model as in (17). Such an interpretation entails a fundamental problem. Notice that the price index of sector ℓ, country j, and time t, $P_{\ell,jt}$, is a nonlinear function of $t_{\ell,ijt}^{1-\sigma_\ell}$. As an ℓjt-specific variable, $P_{\ell,jt}$ is captured by $m_{\ell,jt}$. Notice also that $\mu_{\ell,it}$ is related to $m_{\ell,it}$ by way of the multilateral balance of payments condition. Hence, both $\mu_{\ell,it}$ and $m_{\ell,jt}$ are a function of $u_{\ell,ijt}$ with this interpretation. As a consequence, neither the fixed effects $\mu_{\ell,it}$ and $m_{\ell,jt}$ nor $t_{\ell,ijt}^{1-\sigma_\ell}$ can then be estimated consistently. This fundamental problem does not surface with the interpretation proposed here.

years as implicit solutions to the system in (20) when additionally employing estimates for $m_{\ell,it}$ and $t_{\ell,kjt}^{1-\sigma_\ell}$ along with data on $\alpha_{\ell,jt}$ and Y_{jt}.

Note that we *interpret* the residual terms $\phi_{\ell,it}^{1-\sigma_\ell}$ and $\varphi_{\ell,jt}^{1-\sigma_\ell}$ of country-time-specific effects as unobservable trade costs. Eaton and Kortum (2002) or Caliendo and Parro (2011) would give those terms a different interpretation – associating them in part with exogenous technology draws – and so would Anderson and van Wincoop (2003) – associating them in part with preference parameters. With the chosen interpretation, these measures reflect the degree of (unilateral and multilateral) liberalization such as most-favored nation tariffs or non-tariff barriers on goods under the General Agreement on Tariffs and Trade (GATT) barriers and reductions thereof expressed in the commitments under the General Agreement on Trade in Services (GATS). Hence, the experiments we conduct entail holding those unilateral and multilateral levels of liberalization constant.

Before showing how estimates of σ_ℓ can be obtained, we discuss possible estimators for β_ℓ, $\mu_{\ell,it}$ and $m_{\ell,jt}$ based on (18) in more detail.

Without further assumptions on the error $u_{\ell,ijt}$, the Poisson pseudo-maximum-likelihood (PPML) estimator applied to (18) separately for the goods and services sectors is the most convenient choice. The PPML estimator solves the sample analog to plain orthogonality conditions between conditional-expectation residuals and regressors. Collecting the sectoral parameters to be estimated in the vector $\theta_\ell = (\beta_\ell', \mu_\ell, m_\ell)$, these conditions are

$$\mathrm{E}\left(R_{\ell,ij}(\theta_\ell)' Z_{ij}\right) = 0 \tag{21}$$

where

$$R_{\ell,ij}(\theta_\ell) = X_{\ell,ij} - \exp(Z_{ij}'\beta_\ell)\mu_{\ell,i} m_{\ell,j},$$

and $X_{\ell,ij} = (X_{\ell,ij1}, \ldots, X_{\ell,ijT})'$ and similarly for Z_{ij}, $\mu_{\ell,i}$ and $m_{\ell,j}$. PPML's favorable properties in trade gravity settings have been documented by previous research. It has been argued that PPML's good finite sample performance compared to other asymptotically unbiased estimators – such as nonlinear least squares or Gamma pseudo-likelihood – may stem from PPML's equal weighting of observations in its first order conditions (21) (Santos Silva and Tenreyro, 2006). It is important to emphasize that the OLS estimator of the logarithm of equation (17)

is not asymptotically unbiased under the postulated error assumptions, because higher-order dependence between $u_{\ell,ijt}$ and Z_{ijt} will lead to mean-dependence between $\ln(u_{\ell,ijt})$ and Z_{ijt} in general.

Moment-based estimation of (18) can account for the exporter-time and importer-time specific terms, $\mu_{\ell,it}$ and $m_{\ell,jt}$, by treating them as fixed effects to be estimated. Due to the quadratic nature of the data, the number of observations available increases at a much faster rate than the additional parameters $\mu_{\ell,it}$ and $m_{\ell,jt}$ when the number of countries grows without bound. This implies that estimation is not affected by the classical incidental parameters problem arising under standard asymptotics.[8] Thus, the set of regressors Z_{ijt} can be enlarged to include exporter-time and importer-time indicator variables whose coefficients will provide consistent estimates of $\ln(\mu_{\ell,jt})$ and $\ln(m_{\ell,jt})$.

3.2 System estimation of the bisectoral gravity model

Since the error in the services equation is very likely to be correlated with the error in the goods equation ($\ell = S$ and $\ell = G$ in equation (17), respectively), this suggests developing a system estimator in the tradition of seemingly unrelated regression. Such an estimator should be able to exploit the error correlation to increase efficiency. To implement it, the assumptions on the stochastic process of the errors need to be extended to second moments. While potential efficiency gains require these assumptions to be correct, violating them will not compromise consistency as long as the conditional expectation function (18) is correctly specified.

In addition to the correlation between sectors, the specification of the variance of the system should also account for serial correlation. Neglecting potential correlation over time might mislead inference, reporting standard errors which overestimate the precision of the estimated parameters. A parsimonious way of modeling autocorrelation is through a random effects framework which imposes equicorrelated errors. Thus, assume the disturbances of exports to be composed of two independent parts, a time-invariant component $\eta_{\ell,ij}$ and an idiosyncratic

[8]Formally, the asymptotic bias of fixed effects estimators in nonlinear panels is proportional to the square root of the ratio of the number of fixed effects to the number of observations available to estimate any specific fixed effect (see Hahn and Newey, 2004). In a quadratic panel, this ratio is zero asymptotically.

time-variant component $\nu_{\ell,ijt}$:

$$u_{\ell,ijt} = \eta_{\ell,ij}\nu_{\ell,ijt}, \quad \eta_{\ell,ij} \sim \text{IID}(1, \omega^2_{\ell,\eta}), \quad \nu_{\ell,ijt} \sim \text{IID}(1, \omega^2_{\ell,\nu}), \quad \eta_{\ell,ij} \perp\!\!\!\perp \nu_{\ell,ijt}. \tag{22}$$

To model correlation between sectors assume that both idiosyncratic shocks $\nu_{\ell,ijt}$ at a given time and country-pair-specific components $\eta_{\ell,ij}$ are correlated between sectors. Between time periods, however, random shocks $\nu_{\ell,ijt}$ are assumed independent between sectors:

$$\text{Cov}(\eta_{S,ij}, \eta_{G,ij}) = \omega_{SG,\eta}, \quad \text{Cov}(\nu_{S,ijt}, \nu_{G,ijt}) = \omega_{SG,\nu}, \quad \nu_{S,ijt} \perp\!\!\!\perp \nu_{G,ijs} \text{ for } t \neq s. \tag{23}$$

This set of assumptions on the errors together with the multiplicative model (17) imply a specific conditional variance for the vector of a country-pair's exports over time and over sectors:

$$\Omega_{ij} = \text{Var}(X_{ij}|Z_{ij}, \mu_i, m_j) = \text{diag}(\exp(Z'_{ij}\beta)\mu_i m_j)\, \mathbf{\Omega}\, \text{diag}(\exp(Z'_{ij}\beta)\mu_i m_j), \tag{24}$$

where $X_{ij} = (X'_{S,ij}, X'_{G,ij})'$ and analogously for β, μ_i and m_j; $\text{diag}(\cdot)$ denotes the zero matrix with the vector in the argument as diagonal. The middle term in (24), $\mathbf{\Omega}$, represents the $2T \times 2T$-variance matrix of the error vector of country-pair ij, $u_{ij} = (u'_{S,ij}, u'_{G,ij})'$, which ultimately is composed of the constant scalar variance terms of (22) and (23):

$$\mathbf{\Omega} = \text{Var}(u_{ij}|Z_{ij}, \mu_i, m_j) = \begin{pmatrix} \Omega_S & \Omega_{SG} \\ \Omega_{SG} & \Omega_G \end{pmatrix}, \tag{25}$$

with

$$\Omega_S = \begin{pmatrix} o^2_S & & & \\ \bar{o}^2_S & \ddots & & \\ \vdots & \ddots & \ddots & \\ \bar{o}^2_S & \cdots & \bar{o}^2_S & o^2_S \end{pmatrix}, \quad \Omega_G = \begin{pmatrix} o^2_G & & & \\ \bar{o}^2_G & \ddots & & \\ \vdots & \ddots & \ddots & \\ \bar{o}^2_G & \cdots & \bar{o}^2_G & o^2_G \end{pmatrix}, \quad \Omega_{SG} = \begin{pmatrix} o_{SG} & & & \\ \bar{o}_{SG} & \ddots & & \\ \vdots & \ddots & \ddots & \\ \bar{o}_{SG} & \cdots & \bar{o}_{SG} & o_{SG} \end{pmatrix}. \tag{26}$$

Thus, in terms of the six error variances from (22) and (23), the six distinct entries of $\mathbf{\Omega}$ are

$$\begin{aligned}
o_\ell^2 &= \mathrm{Var}(u_{\ell,ijt}) = \omega_{\ell,\eta}^2\omega_{\ell,\nu}^2 + \omega_{\ell,\eta}^2 + \omega_{\ell,\nu}^2, \\
\bar{o}_\ell^2 &= \mathrm{Cov}(u_{\ell,ijt}, u_{\ell,ijs}) = \omega_{\ell,\eta}^2, \\
o_{SG} &= \mathrm{Cov}(u_{S,ijt}, u_{G,ijt}) = \omega_{SG,\eta}\omega_{SG,\nu} + \omega_{SG,\eta} + \omega_{SG,\nu}, \\
\bar{o}_{SG} &= \mathrm{Cov}(u_{S,ijt}, u_{G,ijs}) = \omega_{SG,\eta}.
\end{aligned}$$

Note that in contrast to a linear specification of the model, the multiplicativity of this model implies a heteroskedastic export variance even though homoskedastic errors have been postulated, cf. (24), capturing a fundamental stylized fact of trade data. By the same token, the conditional expectation residuals –or additive errors–, $R_{ij}(\theta_\ell)$, are also heteroskedastic. The assumption of constant variance of exports or of additive errors implicitly imposed in many linear applications has been seriously challenged by a strand of the recent empirical trade literature. Thus, multiplicative models with homoskedastic errors incorporate much of this critique.

Efficient estimation based on the moment condition of zero conditional-expectation residuals of country-pairs should weight these by the inverse of their variance, Ω_{ij}^{-1}. We will refer to this estimator as the system generalized nonlinear least squares estimator (SGNLS). The SGNLS estimator $\hat{\theta}$ of $\theta = (\theta_S', \theta_G')$ is

$$\hat{\theta} = \arg\min_\theta Q_J(\theta) = \sum_{i=1}^{J}\sum_{j=1}^{J} R_{ij}(\theta)'\Omega_{ij}^{-1}R_{ij}(\theta), \tag{27}$$

where $R_{ij}(\theta)$ is the $2T$-vector of country-pair ij's conditional expectation residuals, $R_{ij}(\theta) = (R_{S,ij}(\theta_S)', R_{G,ij}(\theta_G)')$. Because of the exponential conditional mean function (18) and the conditional variance Ω_{ij} which is quadratic in the mean, this model bears a close resemblance to some count data panel models that have been proposed in the literature. SGNLS estimation of the model, consequently, is very much in the spirit of Gourieroux, Monfort and Trognon's (1984a, 1984b) quasi-generalized PML estimator and Brännäs and Johansson's (1996) sequential GMM estimator for panel count data models. The weighting implied by the variance-covariance structure of this application is different from the weighting proposed in count data articles, since there the consideration of count models conveys an additional stochastic com-

ponent even when controlling for unobserved heterogeneity, while in this application X_{ijt} is deterministic given Z_{ijt}, the fixed effects and u_{ijt}.

The SGNLS estimator cannot be used in practice because its weighting matrix is unknown. A system *feasible* generalized nonlinear least squares (SFGNLS) estimator for the bisectoral gravity model replaces the unobserved Ω_{ij} in (27) with consistent estimates: Estimates for β_ℓ, $\mu_{\ell,it}$ and $m_{\ell,jt}$ can be obtained by Poisson pseudo-maximum-likelihood estimation; estimates for the six elements of the error variance matrix can then be obtained using these Poisson estimates in auxiliary regressions, as explained below.

Let $\Lambda_{\ell,ijt}$ denote the conditional expectation function (18), and $\hat{\Lambda}_{\ell,ijt} = \exp(Z'_{ijt}\hat{\beta}_\ell)\hat{\mu}_{\ell,it}\hat{m}_{\ell,jt}$ the corresponding prediction using the Poisson estimates. Under the error assumptions,

$$\mathrm{Var}(X_{\ell,ijt}|Z_{ijt}, \mu_{\ell,it}, m_{\ell,jt}) = o_\ell^2(\Lambda_{\ell,ijt})^2,$$

so that a consistent estimator of o_ℓ^2 may be obtained as the solution to OLS estimation of the two auxiliary regressions

$$\hat{R}_{\ell,ijt} = \mathrm{o}_\ell^2(\hat{\Lambda}_{\ell,ijt})^2 + error, \quad \ell = S, G,$$

where $\hat{R}_{\ell,ijt}$ is the conditional expectation residual evaluated at Poisson estimates. Under correct specification of the model, standard asymptotic arguments imply that plim $\hat{\mathrm{o}}_\ell^2 = o_\ell^2$.

As $\mathrm{Cov}(X_{S,ijt}, X_{G,ijt}) = o_{SG}\Lambda_{S,ijt}\Lambda_{G,ijt}$ one can proceed analogously to before and obtain the desired estimate from OLS estimation of

$$\hat{R}_{S,ijt}\hat{R}_{G,ijt} = \mathrm{o}_{SG}\,\hat{\Lambda}_{S,ijt}\hat{\Lambda}_{G,ijt} + error.$$

Estimates for the remaining three elements $(\bar{o}_S^2, \bar{o}_G^2, \bar{o}_{SG}^2)$ can be obtained as the OLS estimates from the following three linear regressions:

$$\begin{aligned}\hat{R}_{\ell,ijt}\hat{R}_{\ell,ijs} &= \bar{\mathrm{o}}_\ell^2\hat{\Lambda}_{\ell,ijt}\hat{\Lambda}_{\ell,ijs} + \text{error}, \quad \ell = S, G,\\ \hat{R}_{S,ijt}\hat{R}_{G,ijs} &= \bar{\mathrm{o}}_{SG}\hat{\Lambda}_{S,ijt}\hat{\Lambda}_{G,ijs} + \text{error}.\end{aligned}$$

Note that since the equations are valid for all $t \neq s$, the number of observations that can be

used for each of these regressions is larger than the total number of observations in the data-set, $N(N-1)T$, as soon as $T > 2$.[9] Because the six auxiliary regressions are run independently, the elements of $\mathbf{\Omega}$ are estimated without constraint. Therefore, if $\hat{o}_\ell^2 < \hat{\tilde{o}}_\ell^2$ or $\hat{o}_{SG}^2 < \hat{\tilde{o}}_{SG}^2$, this would have to be interpreted as a sign of model misspecification. In the results presented in the following section, the magnitude ordering of the variance components conformed to the logical predictions.

Standard errors for the SFGNLS estimator are given in the appendix. If the error structure is misspecified, this variance estimator is inconsistent. In this case, a more general heteroscedasticity-robust Eicker-White variance estimator can be used to conduct valid inference. Details on such robust standard errors can be found in the appendix, too.

3.3 Sectoral elasticities of substitution

The final parameters needed to conduct counterfactual analysis are the sectoral elasticities of substitution. As in the standard one-sector model, without further assumptions neither σ_S nor σ_G are identified. However, the basic model structure of (9) is sufficient to identify the difference between sectoral elasticities of substitution, $\sigma_G - \sigma_S$.

To see this, consider (9) again, but with exporter-time and importer-time specific terms collected in μ_{it} and m_{jt} as in (17):

$$X_{\ell,ijt} = \tau_{\ell,ijt}^{1-\sigma_\ell} \mu_{it} m_{jt}.$$

If a base exporting country, say i', can be found that exports to every other country, exports can be normalized by exports of the base country, $\widetilde{X}_{S,ijt} \equiv X_{S,ijt}/X_{S,i'jt}$. Normalizing $\mathfrak{Y}_{\ell,i}$ and $t_{\ell,ijt}$ in the same way, using (9) and the equation above one obtains

$$\frac{\widetilde{X}_{S,ijt}/\widetilde{\mathfrak{Y}}_{S,it}}{\widetilde{X}_{G,ijt}/\widetilde{\mathfrak{Y}}_{G,it}} = \left(\frac{\widetilde{Y}_{it}}{\widetilde{L}_{it}}\right)^{\sigma_G-\sigma_S} \frac{\widetilde{t}_{S,ijt}^{1-\sigma_S}}{\widetilde{t}_{G,ijt}^{1-\sigma_G}}. \tag{28}$$

Hence, $\sigma_G - \sigma_S$ can be estimated directly as a parameter on normalized per-capita GDP in a

[9] As is custom in the literature, we do not employ data for intranational sales where $i = j$ in estimation, but we solve the model (and impose corresponding market clearing constraints) covering all possible N^2T data points.

Poisson pseudo-maximum-likelihood regression of (28), i.e. a regression of the left-hand side of (28) on normalized per-capita GDP and $\widetilde{Z}_{ijt}$.

Finally, we will use additional data on custom tariffs to estimate σ_G from the sample. Denoting the average custom tariff rate for goods trade agreement (GTA) members as $\bar{b}_{GTA}$ and the rate corresponding to country-pairs not sharing a GTA as $\bar{b}_{non-GTA}$, note that the β-coefficient on a GTA indicator variable ($GTA_{ijt} = 1$ if countries i and j have a GTA in year t) in the goods-sector gravity regressions of (18) is

$$\beta_{GTA} = (1 - \sigma_G)[(\ln(1 + \bar{b}_{GTA}) - (\ln(1 + \bar{b}_{non-GTA})]. \tag{29}$$

Thus, σ_G can be readily solved for when knowing $\bar{b}_{GTA}$, $\bar{b}_{non-GTA}$ and having an estimate of β_{GTA}.

4 The effect of adopting trade agreements

The goal of the empirical analysis is to quantify the impact of preferential liberalization of goods and services trade on the two types of trade flows consistent with multi-country general equilibrium. Two ingredients are vital for such an analysis. First, we aim at obtaining parameter estimates which are consistent with the data and with multi-country and two-sector general equilibrium. Second, we want to quantify the impact of a change in preferential trade agreements of either kind on outcome in a comparative static analysis which is based on the multi-country two-sector model outlined above.

4.1 Data

We utilize data on bilateral goods and services exports published by the Organisation for Economic Co-operation and Development (OECD). In particular, we use yearly data on bilateral exports among all pairs of 16 European OECD countries[10] from the OECD's Monthly Statistics of International Trade and the Statistics on International Trade in Services for the years 1999 to 2006. Neither goods trade exports nor services trade exports display a large number of

[10]Austria, Belgium, Czech Republic, Denmark, Spain, Finland, France, Great Britain, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Slovakia, and Sweden.

zeros in this set of European countries (there is no observation of zero bilateral services trade in the data).[11] Most of the covered countries' trade of either type is intra-EU trade. About 75% of the observations are covered by a goods trade agreement, *GTA*, and 72% are covered by a services trade agreement, *STA*. In the data, services trade agreements do never come in isolation (i.e., without a goods trade agreement), but not all units whose goods trade is liberalized preferentially entertain a similar liberalization of services trade. These facts are summarized in Table 1.[12] Information about these types of liberalization is available from the World Trade Organization (WTO).

— Table 1 about here —

Moreover, the table suggests that the average distance is somewhat more than 1,000 kilometers. This is less than in trade data-sets with many more countries, since the services data covered by the OECD are concentrated in Europe in our sample. Therefore, more than 10% of the country pairs also share a common land border, about 7% had colonial ties in the past, and somewhat more than 4% share a common language. The information on these geographical and cultural variables stems from the Centre d'Études Prospectives et d'Informationons Internationales (CEPII).

4.2 Parameter estimates

Table 2 contains our baseline Poisson pseudo-maximum-likelihood estimates of the empirical gravity equation (18) for goods exports X_G and services exports X_S. The first two columns with results are for a traditional log-distance specification, while the last two columns depict estimates from a specification where log-distance's impact on exports is estimated freely for every quintile of the distance distribution.

— Table 2 about here —

[11] This would be different when using disaggregated data of either type. However, using disaggregated data about services trade involves serious measurement problems so that we refrain from pursuing such an approach.

[12] All dyads in the data grant goods trade preferences under a GTA at the end of the sample period (2006). Hence, there is a gradual adoption of GTAs by all and of STAs by almost all country-pairs between the beginning and the end of the sample period. This and the use of fixed effects (see Baier and Bergstrand, 2007, for evidence) renders the problem of endogeneity of trade preferences relatively unimportant so that we could ignore it in the outline of the econometric approach in Section 3.

While our primary purpose of running these regressions is to get estimates for the trade barriers $t_{\ell,ijt}^{1-\sigma_\ell}$, the estimated β shown in the table can be interpreted in their own as average partial equilibrium effects of these regressors, i.e., as (approximate) percentage changes of bilateral trade barriers.

The effect of distance between trading partners seems to have a similar quantitative impact on services and goods exports when considering the log-distance specification, but the estimates of the more flexible log-distance quintile specification reveal substantial differences, which suggests that the first specification may be too restrictive. Distance is about twice as hindering to trade in the services sector, this ratio holding roughly for all quintiles. Compared to this stark contrast between sectors, the effect across quintiles is less pronounced, the trade-impeding effect of distance slightly magnifying for country-pairs farther apart.

The remaining variables, including the key variables of interest *GTA* and *STA*, are all binary, so that questions about the correct functional form are less important. The fact that their estimated coefficients vary little between the two specifications indicates that they are only weakly related to distance in our data.

Both *GTA* and *STA* are positive and statistically significant, a result which is in line with trade-enhancing effects of trade liberalization. The estimated coefficient of *STA* is about three times as large as *GTA*'s, suggesting that trade in services may react more sensitively to liberalization. Taken at face value, the estimates imply that the partial effects of liberalization are about 48.75% more trade in goods and about 219.63% more services trade.

The results relating to the other variables reinforce the picture of heterogeneous effects across sectors. For instance, sharing a common border has a large and statistically significant effect on trade, but between 27% to 35% less so for services than for goods exports. Having historical ties seem to matter only for the goods sector. The importance of such ties is much more modest (only about 15% in the first specification) in the set of developed countries we are analyzing than comparable estimates from work using data which includes developing countries. The coefficient on sharing a common language is small and insignificant for the services sector. For the goods sector, it is negative, which is counterintuitive and poses a riddle since in the raw data country-pairs with common languages trade almost five times the volume of country-pairs with different languages. The explanation here probably relates to the tight geographic area that

we are considering and the fact that we are controlling for common border: Among contiguous countries a shared language is related to more trade, as expected. But among non-contiguous countries only Austria and Belgium share a common language, and their trade volume is low. Since there are much more country-pairs that are non-contiguous than contiguous, conditional on having a common border the incidentally negative relationship between language and trade dominates in our data.

An alternative measure for services exports

An important concern relates to the quality of the services exports measure. Sources vary with regards to what is included in or qualifies as a service. To assess the sensitivity of our data to potential misclassification or measurement error in our dependent variable we consider an alternative measure that is based on data from GTAP and provided by Francois, Pindyuk, and Woerz (2009). Table 3 replicates the services exports estimations from Table 2 with this alternative variable. As can be read off Table 1 the mean of the alternative X_S variable is about 10% smaller than the one from the OECD data, and its distribution has also a more narrow waist (the standard deviation is about 12% smaller than in the OECD sample). While in the services exports reported by Francois, Pindyuk, and Woerz (2009) there are 11.72% of observations with zero services export flows, all services exports are positive in the sample based on OECD data. The correlation between the two variables is only 84.95% (and 86.85% in the sample of positive exports of the original variable) which suggests that there are some substantial differences between the two measures.

— Table 3 about here —

Comfortingly, however, a glance at Table 3 shows that despite these differences the estimated coefficients are remarkably similar to the ones presented before. The estimates are less precise, a consequence of the reduced variation in the alternative dependent variable. We interpret these results as a sign of robustness, and proceed with our previous measure of services trade.

System estimation of the bisectoral gravity model

The Poisson estimates can be used as preliminary estimates to construct the efficient weight matrices needed for the system feasible generalized nonlinear least squares (SFGNLS) estimator

presented in the previous section. In contrast to Poisson regression, the objective function of nonlinear least squares with exponential mean function is known not to be globally concave (Gourieroux, Monfort and Trognon, 1984b) which can complicate optimization. The additional weighting of the SFGNLS can exacerbate this problem. We encountered some difficulties maximizing the SFGNLS objective function. In addition to the coefficients of the variables Z the optimization is over the complete set of exporter-year and importer-year indicator variables, which amounts to 256 extra coefficients in our data per sector. To ease the problem, we replaced the set of indicator variables with a new variable containing the predicted fixed effects from the Poisson regression. This restriction on the SFGNLS fixed effects to be proportional to the Poisson estimates reduces the 512 fixed effects to be estimated to only one parameter per sector. Table 4 presents the SFGNLS estimates with this simplification. The row named *Estimated FE* in the lower part of the table displays the estimated coefficient on the Poisson fixed effects. It is remarkable that they are all close to one, suggesting that the SFGNLS estimates of the fixed effects should be similar to Poisson's.

— Table 4 about here —

It is equally reassuring to note that the remaining SFGNLS estimates are comparable to the Poisson estimates. This is an important result because it increases our confidence in our specification of the conditional expectation function, since both estimators should deliver consistent —and therefore similar— estimates of β. The table contains two standard errors per estimated coefficient. The first standard error is based on the SFGNLS variance specification. While these standard errors are comparable in magnitude to the Poisson standard errors for most variables, they are about one order of magnitude smaller for *GTA* and *STA*. This suggests that efficiency gains from system estimation are largest for variables excluded from one sector.

The fact that in general the standard errors are about as large as those obtained from separate sector-wise estimation implies that the efficiency gains from joint estimation of both sectors are offset by accounting for intertemporal correlation. Table 5 gives an overview of the estimated error correlations. The upper panel shows the estimated elements of the error variance-covariance matrix from the auxiliary OLS regressions, and the lower panel displays the error correlations calculated from these. The correlations suggest that country-pair specific,

time-invariant components are responsible for most of the error in both sectors, the services sector being affected relatively more by temporary shocks than the goods sector.[13] The correlation between sectors is estimated to be about 30%.

— Table 5 about here —

While the random effects structure of the error is likely to pick up some autocorrelation, its structure is quite rigid. It is unable, for instance, to map correlation fading over time. Moreover, it imposes homoskedasticity. The second parentheses below the coefficient estimates of Table 4 show clustered standard errors which are robust to any kind of autocorrelation and heteroskedasticity. Since these standard errors are asymptotically equivalent to the first if the error assumptions hold, the large discrepancies imply that the random effects error structure is not supported by the data. The cluster-robust standard errors are substantially larger than the ones presented in Table 2, but they do not overthrow the inference conducted so far (with the exception of the coefficient on colonial ties in the log-distance specification of X_G which is now insignificant).

Elasticities of substitution for goods and for services

The last input for the calculation of the comparative static effects are the elasticities of substitution, σ_ℓ. Table 6 contains the corresponding estimates, obtained from regressions (28) and (29). Again, the differences between the two specifications are minor. There is a visible difference between the sectors, though, the services substitution elasticity being smaller. The estimates in Table 6 lie within the range of elasticities reported by previous literature, which generally extend from about five to fifteen.

— Table 6 about here —

Goodness of fit

Certainly, one would desire a structural general equilibrium model to capture the main features of the data well enough in order to find a quantification of comparative static effects meaningful. While previous research of such models provides evidence that single-sector goods trade models

[13]The time-invariant part makes up 92-96% for goods, but "only" 74-79% for services.

capture aggregate bilateral goods trade data sufficiently well (see Eaton and Kortum, 2002; Bergstrand, Egger, and Larch, 2012), much less is known as to how well goods *and* services trade can be portrayed in the way suggested in Sections 2 and 3. Certainly, the goodness of fit of the model should not generally be judged from the predictions of the stochastic model cum fixed effects but on the ones of the structural model, i.e., of (9) subject to (10), and its correlation with the data.

With the nonlinear model estimates at hand, we may consider correlations of such predictions under several assumptions – e.g., that there are unobservable trade costs in $\hat{\mu}_{it}$ and $\hat{m}_{jt}$ versus that there are none ($\phi_{it} = \varphi_{jt} = 1$), or that multilateral trade may be unbalanced for any country j and year t ($\mathfrak{X}_{jt} \neq 0$) or not. Such correlations between structural model predictions and data are illustrated and quantified for either sector in the configuration with and without unobservable trade costs in Figure 1 which assumes balanced trade and in Figure 2 which allows trade to be unbalanced as in (9) subject to (10). In general, those figures suggest that accounting for both unobserved trade costs and trade imbalances is important for a good match of predicted with observed trade bilateral flows of either kind. While goods trade is predicted somewhat more accurately than bilateral services trade, either type of trade is predicted with relatively great success.[14]

4.3 Comparative static effects of adopting trade agreements

In this subsection, we will assess the impact of trade preferences on outcomes such as goods and services trade, welfare, and the sectoral allocation of labor in three alternative comparative static experiments: (i) adopting goods trade agreements (GTAs) only from a situation without any GTAs but service trade agreements (STAs) as observed; (ii) adopting STAs only from a situation without any STAs but GTAs as observed; and (iii) adopting both types of preferences simultaneously from a situation without any preferential trade agreements in the outset in the sample of 16 countries considered in general equilibrium. We use the parameters from the distance-quintiles specification in Table 2 (last two columns). Notice that (i) corresponds to

[14]Notice that the predictions in Figures 1 and 2 are based on bilateral export levels rather than logs. Those correlations tend to be lower than the ones for data in logs. For instance, normalized bilateral goods exports among U.S. states and Canadian provinces in the model of Anderson and van Wincoop (2003) are correlated with the corresponding data at a correlation coefficient of about 0.37 (see Bergstrand, Egger, and Larch (2012).

setting GTA_{ijt} to zero in the model of $X_{G,ijt}$. Analogously, (ii) corresponds to setting STA_{ijt} to zero in the model of $X_{S,ijt}$, while (iii) corresponds to setting both GTA_{ijt} and STA_{ijt} to zero in both models. We will do so from the perspective of the year 2006 in the data. Hence, the comparative static experiments will compare model predictions for observed trade costs as of 2006 and counterfactual trade costs with GTA_{ij2006} and/or STA_{ij2006} set counterfactually to zero.

According to the structure of the above model, such changes will induce effects on economies through three channels. First, they will affect the relative consumer (and, through general equilibrium, producer) prices and thereby change relative bilateral and multilateral demand for goods versus services. Second, induced by the latter, they will change labor demand and, hence, equilibrium employment in the two sectors.

We report on the three counterfactual experiments in two tables each. One summarizes changes in intranational and (average bilateral) international nominal trade flows for goods and services, for net flows of workers into (in case of a positive sign) or out of (in case of a negative sign) a sector GDP, and welfare for each country and for the average economy covered. A second table for each experiment sheds light on the heterogeneity of responses of international trade flows (for each country and for the average) to the adoption of trade preferences. The source of this heterogeneity are heterogeneous endowments and trade costs across countries and country-pairs in multi-country nonlinear general equilibrium. Throughout, we use the first country in alphabetical order (Austria) as the numéraire. Accordingly, the comparative static changes in nominal GDP for that country are zero in all experiments.

— Tables 7 and 8 about here —

Tables 7 and 8 summarize the findings for the comparison of a world with preferences as observed in 2006 in comparison to an unobserved counterfactual situation without any goods preferences (but services preferences as observed). Table 7 clearly indicates that goods preferences reduce GDP for all countries relative to Austria (see the first column in the table) but less so for relatively small countries (e.g., Portugal, Belgium-Luxembourg, or Ireland). Clearly, weighting these responses by GDP leads to an average negative effect. The source of these negative effects (relative to Austria) is the destruction of jobs in some of the countries' manufacturing (i.e., goods) sector induced by terms of trade effects. A destruction of jobs in goods

production is accommodated by a creation of jobs in the respective countries' service sector (by way of the assumption of labor market clearing). Yet, this does not accommodate the negative impact of goods preferences on the average wage relative to Austria and, hence, GDP. However, the detrimental effects on average wages do not mean that consumers would be against goods preferences. The reason is that goods preferences directly reduce the consumer price index for goods and the effect on the latter may – and for many countries actually does – outweigh the loss in nominal income (relative to Austria). The impact of goods preferences on welfare is summarized in the second column of Table 7. Obviously, many countries in the sample gain in relative terms from the corresponding preferences. This would not need to be the case, since we consider a simultaneous implementation of preferences and welfare losses from trade diversion in a country through the introduction of trade preferences elsewhere could outweigh trade creation effects from preferences in that country. As said before, the positive relative welfare response to goods preferences does not so much root in the large response of international goods trade (see column 6 of Table 7) in conjunction with the response of services trade (the last column of Table 7). The trade changes are offset to a significant extent by diversion of consumption from domestic producers in either sector (see column 5 and the penultimate column of Table 7). The main reason for the welfare gains is the direct reduction of goods price indices.

Several remarks are in order. First, notice that the net labor flows in percent are quite small (less than one-tenth of a percent in all countries except Ireland). A structural model which would not allow trade costs to play as much role as we do would come up with larger responses of labor flows.[15] In the appendix, we document this in tables corresponding to Tables 7 and 8 (and also to the ones for the other experiments). While Tables 7 and 8 do not assume that the trade cost terms $\phi_{\ell,it}$ and $\varphi_{\ell,jt}$ in Section 3.1 are unity, Tables 13-18 in Appendix B and Tables 25-30 in Appendix D do. We will discuss the corresponding difference in outcome in Subsection 4.4, below.[16]

[15]For instance, Eaton and Kortum (2002), Anderson and van Wincoop (2003), or Anderson and Yotov (2010), do not interpret the exporter-specific and importer-specific components of exports beyond the price index, firm numbers (which corresponds to average productivity in Eaton and Kortum, 2002, and to a preference parameter in Anderson and van Wincoop, 2003) as trade costs that may be correlated with other variables in the model. However, the procedure adopted here minimizes the discrepancy between the data and the model without trivially (and, from a philosophy-of-science point of view, very problematically) eliminating it as in some calibration studies.

[16]Also, we will discuss the importance of allowing for trade imbalances there.

Second, not only goods trade but also services trade responds to changes in goods preferences. The reasons for this are general equilibrium effects. The countries which see a net loss of workers in the services sector in response to goods preferences do not necessarily loose out on international trade in services in Table 7. An increase in services trade may be stimulated by terms of trade (and corresponding relative wage) reductions and, in turn, indirect changes in services price indices. In most but not all countries, an introduction of goods preferences alone leads to welfare gains relative to Austria.

While effects on international trade in goods and services as in Table 7 are useful to understand (weighted) average responses of bilateral trade, it should be recognized that those effects vary largely across trading partners. We shed light on this fact in Table 8. This table summarizes location parameters of the distribution of nominal bilateral goods trade responses at the top and ones of nominal bilateral services trade responses at the bottom. At the bottom of each block, we report unweighted average location parameters. The table indicates that the treatment effect of an introduction of goods trade preferences is largely heterogeneous. It is a general feature of new trade theory models that responses to homogeneous changes in trade costs are heterogeneous as long as countries differ in trade cost levels, endowments, and possibly other fundamental dimensions. Clearly, there is heterogeneity of the responses across importers (compare the numbers within a row across columns) and there is heterogeneity across exporters (compare the numbers within a column across rows). The reason is not that countries did not provide and were not granted goods preferences in a homogeneous way. All countries in the sample were covered by goods preferences by 2006. Bilateral goods trade is stimulated unambiguously by goods preferences, since there is no scope for goods trade diversion between autarky and full coverage with such preferences by 2006. But countries differ in other regards (e.g., Ireland is small, while the United Kingdom is large; some of them have services preferences in a given year but not all do; etc.), rendering them quite heterogeneously responsive to the introduction of goods preferences. For instance, the difference between the average maximum-to-minimum response is more than 17 times that of the average median response. Most of the country-pairs display changes in bilateral goods trade in the double digits in response to introducing goods preferences.

The responsiveness of the indirectly affected services trade is even more heterogeneous. The

average interquartile range (25 percent to 75 percent) includes zero. More than half of the country-pairs faces a decline of bilateral services trade in response to goods preferences. Here, the difference between the average maximum-to-minimum response is more than ten times as high as the absolute value of the average median response. Most country-pairs' service trade responses to goods preferences are in the double digits.

— Tables 9 and 10 about here —

Tables 9 and 10 summarize the comparative static effects of an equilibrium with (goods and) services preferences as of 2006 relative to one without any services preferences (but goods preferences as observed). The insights gained about the effects of goods preferences from Table 7 are useful to cut the associated discussion of responses to services preferences shorter. Similar to goods preferences, services preferences have ambiguous effects on GDP, labor flows, intra- and international goods trade, and on intra-national services sales. However, as goods preferences, they induce positive welfare effects and positive effects on the trade they directly address on average (relative to Austria). Notice that, unlike goods preferences, the unambiguous welfare gains from services preferences in the sample were less predictable. The reason is that the coverage of services preferences in the sample is smaller than that for goods preferences in 2006. Hence, there is scope for detrimental trade diversion effects. Those do not materialize in a dominant way according to Table 9. Moreover, the response of services trade to services preferences is much stronger than that of goods trade to goods preferences. The two reasons for this greater sensitivity of services trade are the lower elasticity of substitution among different traded services than among traded goods and that the amount of services trade and production is smaller due to higher overall trade costs in that sector relative to goods trade.

Table 10 sheds light on the heterogeneity of trade responses within and across exporters akin to Table 8. Similar to goods preferences, services preferences induce great heterogeneity in international bilateral trade responses. Bilateral services trade is stimulated unambiguously by services preferences, so that there is no evidence of negative net trade diversion with such preferences as of 2006. The difference between the average maximum-to-minimum response is with less than 50 percent of the average median response smaller than the corresponding heterogeneity of goods trade to goods preferences was in Table 8. But it would be obviously inadequate to assume a homogeneous treatment effect of services preferences on services trade

across all country-pairs. All of the country-pairs display changes in bilateral services trade in the triple digits in response to introducing services preferences.

The responsiveness of the indirectly affected goods trade is more heterogeneous in relative terms (analogous to the insights gained from Table 8). The average interquartile range again includes zero. Almost one-half of the country-pairs faces a decline of bilateral goods trade in response to services preferences. The difference between the average maximum-to-minimum response (more than 100 percentage points) is almost five times as high as the absolute value of the average median response (about 20 percent). Many country-pairs' goods trade responses to services preferences are in the double digits.

— Tables 11 and 12 about here —

The joint inception of goods and services preferences relative to no preferences whatsoever using data of 2006 is studied in Tables 11 and 12. The cells in Table 11 represent convex combinations of the respective cells in Tables 7 and 9, and those in Table 12 are convex combinations of the respective cells in Tables 8 and 10. A simultaneous inception of goods and services preferences raises welfare in the average country by about 0.7 percent. The corresponding change was about 0.4 percent for goods preferences alone and about 0.3 percent for services preferences alone. International goods trade and services trade are predicted to rise by about 46 percent and about 236 percent, respectively, for the average economy through a joint inception of both types of preferences. Recall that goods preferences raised international goods trade by about 48 percent in Table 7 and services preferences raised international services trade by about 240 percent in Table 9. Similarly, the conclusions regarding the heterogeneity of responses of bilateral trade in Table 12 largely correspond to the effects of preferences on those trade flows which are directly affected by the preferences in Tables 8 and 10.

4.4 Discussion of the effects of trade preferences on trade flows

Notice that the magnitude of welfare (real wage) effects in this model compares well with the magnitude of such effects estimated in a different model by Caliendo and Parro (2011; see their Table 6) who quantify the effects of NAFTA in a structural gravity model. The obtained effects compare similarly well with the findings of Ossa (2011, see his Table 5) for the adoption of Nash

tariff rates on goods and for the removal of all tariffs on intra-European Community trade in Eaton and Kortum (2002; see the mobile labor case in their Table XII) for goods trade only. While the average nominal bilateral goods trade effects seem large, they also compare well with the ones from removing all tariffs on intra-European Community trade in Eaton and Kortum (2002) and in Balistreri, Hillberry, and Rutherford (2011; see their Table 6). The responsiveness of services trade is stronger than that of goods trade. The reason for that is that the service sector is bigger than the goods sector in the average economy but trade costs are bigger as well. Hence, it is consistent for the same change in trade costs to have a bigger impact on services trade flows than on goods trade flows in such a situation and in a model as the adopted one.

How do the comparative static effects in a model with estimated unobservable trade costs and trade imbalances discussed in the previous subsection compare to ones ignoring country-specific unobserved trade costs and trade imbalances? A comparison of Tables 7-12 with Tables 13-18 in Appendix B provides insights in the effect of disregarding unobserved trade costs trade while allowing for unbalanced trade. In that regard, for instance, Table 17 suggests that the projected welfare effects of adopting goods *and* services trade preferences are largely biased upwards *on average* (not even speaking about individual countries) in comparison to the results allowing for unobserved trade costs in Table 11. A comparison of Tables 7-12 with Tables 19-24 in Appendix C provides insights in the effect of disregarding unbalanced trade while allowing for unobserved trade costs. For instance, Table 23 suggests that the projected welfare effects of adopting goods *and* services trade preferences are unbiased *on average* in comparison to the results allowing for unbalanced trade in Table 11, but the welfare effects of some individual countries are biased to a larger extent. A comparison of Tables 7-12 with Tables 25-30 in Appendix D provides insights in the effect of disregarding both unbalanced trade and unobserved trade costs. Akin to Table 17, Table 29 suggests that the projected welfare effects of adopting goods *and* services trade preferences are largely biased upwards *on average* in comparison to the results allowing for unbalanced trade in Table 11. Hence, allowing for both unbalanced trade and, even more so, for unobservable country-specific trade costs is important for quantitative analysis.

A particularly pertinent question for the analysis at stake is how big of a problem the assumption of a one-sector economy would be in comparison to the two-sector framework.

Notice that this question can not be answered directly under the ramifications of the model in Sections 2 and 3. However, it is straightforward to condense the model to a one-sector framework with a goods sector only as in Bergstrand, Egger, and Larch (2012). In order to isolate the role of the multi-sector general equilibrium framework for comparative static analysis, one would consider results based on the same parameter vector (i.e., the parameters in the penultimate column of Table 4) for such an analysis as for the one in Tables 7-12. We have done so in Tables 31 and 32 in Appendix E when allowing for unobservable trade costs and trade imbalances in the goods sector (other configurations are available from the authors upon request). Notice that both goods and services trade preferences actually change in the background, but the latter can not possibly be accounted for in the comparative static experiments in Tables 31 and 32. Hence, the numbers in Table 31 in Appendix E should be compared to the ones in Table 11 and the ones in Table 32 in Appendix E to those in Table 12. Quite obviously, assuming a one-sector model leads to much bigger average effects on GDP, welfare, and intra- as well as international goods trade flows than in the two-sector model. Moreover, the variability of the corresponding responses across the covered economies is much bigger in the one-sector than in the two-sector model. Consistent with this, the variability of bilateral international goods trade responses is also much bigger in the one-sector model than in the two-sector model (compare the entries in Table 32 in Appendix E with the corresponding ones in Table 12). A key reason for this greater responsiveness of aggregates in the comparative static analysis in the one-sector model lies in the assumption of all labor to be employed in manufacturing in conjunction with the assumption for it to be fully exposed to the adoption of goods preferences (i.e., not to be able to *escape* to another sector) in contrast to the two-sector model. This comparison sheds light on the importance of considering service production and transactions explicitly in quantitative general equilibrium work.

5 Conclusions

This paper proposes a structural systems estimation strategy for multi-sectoral trade models. We outline procedures which entertain the desirable properties of single-equation estimators for gravity models as proposed by Santos Silva and Tenreyro (2006) for the multi-equation case.

These procedures are utilized to estimate a gravity model with two sectors, goods and services, using data for 16 European economies for which bilateral goods and services trade data are both available. In that data-set, we focus our interest on the relative importance of preferential access to goods versus services markets for welfare and other outcomes. We determine a full set of key parameters from this system of equations so that a comparative static analysis of the consequences of preferences does not have to rely on assumptions about parameters of variables beyond the ones measured or estimated from the data at hand.

We use data from 2006 to conduct three comparative static experiments regarding the relative importance of goods and services trade preferences. In particular, we compare a situation *with* versus one *without* specific types of preferences ceteris paribus. These comparative static experiments suggest that the welfare effects of services preferences in Europe are comparable and only slightly smaller than those of goods preferences for the average covered economy. Sector-specific preferences stimulate their sector's trade significantly. The responsiveness of services trade is much bigger than that of goods trade to the respective preferences. Yet, in general, welfare gains from preferences mainly accrue to changes in consumer prices. A joint inception of goods and services preferences as of 2006 is found to have increased welfare in the 16 countries covered by about 0.7 percent (relative to Austria). This welfare gain is around 11 percent larger than the sum of the welfare effects of an independent inception of goods preferences and services preferences alone.

Most notably, the proposed model leads to much more moderate gains of goods and service preferences for the average economy than a one-sector goods-only model based on the same structural parameters would. Hence, there is an inherent danger of mis-attributing activity (GDP or employment) in the service sector to the goods sector in one-sector structural trade models aiming at a quantification of the consequences of (preferential bilateral or non-preferential multilateral) trade liberalization. The consequence of a structural one-sector modeling may be severely upward-biased gains from trade through structural aggregation bias.

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Appendix A: Variance of the SFGNLS estimator

The asymptotic variance of the SFGNLS estimator (i.e. $\hat{\theta}$ in (27) with Ω_{ij} replaced by an estimate $\widehat{\Omega}_{ij}$) can be estimated consistently by

$$\widehat{\mathrm{Var}}(\hat{\theta}) = \frac{1}{M}\left(\frac{1}{M}\sum_i\sum_j \hat{\Delta}_{ij}'\widehat{\Omega}_{ij}^{-1}\hat{\Delta}_{ij}\right)^{-1},$$

with $M = N(N-1)$ the number of country-pairs, provided the model assumptions hold. Here, the deterministic counterpart to $\hat{\Delta}_{ij}$ represents

$$\Delta_{ij} = \frac{\partial \Lambda_{ij}}{\partial \beta} = \begin{pmatrix} \frac{\partial \Lambda_{S,ij}}{\partial \beta_S} & \frac{\partial \Lambda_{S,ij}}{\partial \beta_G} \\ \frac{\partial \Lambda_{G,ij}}{\partial \beta_S} & \frac{\partial \Lambda_{G,ij}}{\partial \beta_G} \end{pmatrix} = \begin{pmatrix} \mathrm{diag}(\Lambda_{S,ij})Z_{ij} & \mathbf{0}_{(T\times K)} \\ \mathbf{0}_{(T\times K)} & \mathrm{diag}(\Lambda_{G,ij})Z_{ij} \end{pmatrix},$$

where $\hat{\Delta}_{ij}$ is obtained by evaluating Δ_{ij} $\hat{\theta}$. The notation $\mathbf{0}_{(T\times K)}$ denotes the $T \times K$-dimensional matrix of zeros.

Under misspecification of the weighting matrix, a consistent estimate of the asymptotic variance can be calculated using

$$\widehat{\mathrm{Var}}_{\mathrm{robust}}(\hat{\theta}) = \frac{1}{M}\left(\frac{1}{M}\sum_i\sum_j \hat{\Delta}_{ij}'\widehat{\Omega}_{ij}^{-1}\hat{\Delta}_{ij}\right)^{-1}\left(\frac{1}{M}\sum_i\sum_j \hat{\Delta}_{ij}'\widehat{\Omega}_{ij}^{-1}\widehat{\Xi}_{ij}\widehat{\Omega}_{ij}^{-1}\hat{\Delta}_{ij}\right)\left(\frac{1}{M}\sum_i\sum_j \hat{\Delta}_{ij}'\widehat{\Omega}_{ij}^{-1}\hat{\Delta}_{ij}\right)^{-1}$$

with $\widehat{\Xi}_{ij} = \hat{R}_{ij}\hat{R}_{ij}'$. This variance estimator is fully robust against any kind of misspecification of the error variance-covariance assumptions, with the exception of cross-sectional dependence.

Variance adjustment for two-step estimation

The SFGNLS estimation procedure is carried out in two steps. First, consistent estimates of θ are obtained via Poisson pseudo-maximum-likelihood, and these are used to estimate the variance elements. Second, θ is estimated efficiently by SFGNLS using weights constructed with the estimated variance matrix. Thus, in principle, the variance of the SFGNLS estimator needs to be adjusted to take into account the fact that the weighting matrix is measured with sampling error. Some two-step (M-)estimators' asymptotic variance does not depend on the

variance of the first step estimation. The following is to show that this is the case for the SFGNLS estimator.

A sufficient condition for the second step variance not to depend on the first step estimates is that the partial derivative of the expected gradient of the second-step estimator with respect to the first-step parameters, evaluated at their true values, is zero (cf. Wooldridge, 2010). For the estimator under consideration, the gradient is $\sum_i \sum_j (R'_{ij}\Omega_{ij}^{-1}\Delta_{ij})'$. Every one of the rows is a linear combination containing elements of R_{ij}, Δ_{ij} and Ω_{ij}^{-1}. The derivative is to be taken with respect to the distinct six elements of $\mathbf{\Omega}$ of which Ω_{ij}^{-1} is a function. The kth row of one element in the sum of the gradient can be written down as

$$\sum_{t=1}^{2T} \Delta_{tk} \left(\sum_{s=1}^{2T} R_s \Omega_{ts}^{-1} \right),$$

where the subscript ij has been neglected. All elements in the preceding formula are scalars, so that derivatives with respect to elements of $\mathbf{\Omega}$ will yield expressions of the form

$$\sum_{s=1}^{2T} R_s f(\Lambda, \mathbf{\Omega}).$$

The function $f(\Lambda, \mathbf{\Omega})$ is constant if Z is conditioned for, so that by a standard law of iterated expectations argument

$$\mathrm{E}[\sum_i \sum_j \sum_{s=1}^{2T} R_{ijs} f(\Lambda_{ij}, \mathbf{\Omega})] = \mathrm{E}[\sum_i \sum_j \sum_{s=1}^{2T} E(R_{ijs}|Z) f(\Lambda_{ij}, \mathbf{\Omega})] = 0,$$

as long as the conditional expectation function is correctly specified. This implies that the asymptotic variance of this estimator is independent of the variance of the first stage estimators. Hence, for a sufficiently large number of observations the variance adjustment may be neglected.

Table 1: Descriptive Statistics, N=1,920

Variable	Mean	Std. deviation
X_G (Goods exports)	4,363.2359	7,860.7053
X_S (Services exports)[a]	1,130.3192	2,480.8476
Alternative X_S[b]	1,014.8738	2,184.2832
Goods Trade Agreement (GTA)	0.7500	0.4331
Service Trade Agreement (STA)	0.7188	0.4497
Colonial ties	0.0708	0.2566
Land border	0.1250	0.3308
Language	0.0417	0.1999
(log-)Distance	6.9660	0.6664
(log-)Distance, 1th quintile	1.1819	2.3775
(log-)Distance, 2th quintile	1.3557	2.7126
(log-)Distance, 3th quintile	1.4196	2.8402
(log-)Distance, 4th quintile	1.4682	2.9374
(log-)Distance, 5th quintile	1.5406	3.0830

[a] *Source*: OECD, [b] *Source*: Francois, Pindyuk and Woerz (2009)

Table 2: Gravity models for goods and services trade - Poisson fixed effects PML estimates

Specification	*(log-)Dist.*		*(log-)Dist. quintiles*	
Dep. var.	X_G	X_S	X_G	X_S
Goods Trade Agreement (GTA)	0.3971		0.3790	
	(0.0456)		(0.0466)	
Service Trade Agreement (STA)		1.1620		1.1836
		(0.1943)		(0.2011)
Colonial ties	0.1565	0.0196	0.2769	-0.0202
	(0.0489)	(0.1151)	(0.0505)	(0.1245)
Land border	0.7886	0.5693	0.7370	0.4813
	(0.0276)	(0.0657)	(0.0270)	(0.0685)
Language	-0.3249	0.0002	-0.2663	0.0795
	(0.0525)	(0.1087)	(0.0530)	(0.1181)
(log-)Distance	-0.6910	-0.7485		
	(0.0247)	(0.0428)		
(log-)Distance, 1st quintile			-0.2872	-0.7891
			(0.0529)	(0.0868)
(log-)Distance, 2nd quintile			-0.3370	-0.7970
			(0.0487)	(0.0780)
(log-)Distance, 3rd quintile			-0.3422	-0.7617
			(0.0458)	(0.0728)
(log-)Distance, 4th quintile			-0.3643	-0.7801
			(0.0448)	(0.0737)
(log-)Distance, 5th quintile			-0.4179	-0.8329
			(0.0442)	(0.0706)
Observations	1,920			
Countries	16			
Time period	1999 – 2006			

Notes: Robust standard errors in parentheses. All regressions include exporter-year and importer-year fixed effects.

Table 3: Gravity models for services trade, alternative dep. var. - Poisson fixed effects PML estimates

Specification	*(log-)Dist.*	*(log-)Dist. quintiles*
Service Trade Agreement (STA)	1.2854	1.3459
	(0.1771)	(0.1859)
Colonial ties	-0.1067	-0.1414
	(0.0856)	(0.0904)
Land border	0.5881	0.4840
	(0.0503)	(0.0541)
Language	0.0467	0.1490
	(0.0765)	(0.0846)
(log-)Distance	-0.6512	
	(0.0400)	
(log-)Distance, first quintile		-0.7062
		(0.0726)
(log-)Distance, second quintile		-0.7033
		(0.0649)
(log-)Distance, third quintile		-0.6742
		(0.0605)
(log-)Distance, fourth quintile		-0.7000
		(0.0615)
(log-)Distance, fifth quintile		-0.7484
		(0.0592)
Observations	1,920	
Countries	16	
Time period	1999 – 2006	

Notes: Robust standard errors in parentheses. All regressions include exporter-year and importer-year fixed effects.

Table 4: Gravity models for goods and services trade - System FGNLS estimates

Specification	*(log-)Dist.*		*(log-)Dist. quintiles*	
Dep. var.	X_G	X_S	X_G	X_S
Goods Trade Agreement (GTA)	0.2436		0.2396	
	(0.0021)		(0.0026)	
	(0.0255)		(0.0229)	
Service Trade Agreement (STA)		1.0628		1.1993
		(0.0096)		(0.0113)
		(0.0852)		(0.0763)
Colonial ties	0.2202	0.0092	0.5372	0.0142
	(0.0322)	(0.0696)	(0.0316)	(0.0807)
	(0.2144)	(0.3726)	(0.1196)	(0.2526)
Land border	0.8254	0.5620	0.7958	0.5718
	(0.0263)	(0.0535)	(0.0267)	(0.0611)
	(0.1285)	(0.2680)	(0.0760)	(0.1524)
Language	-0.3129	0.0156	-0.4149	0.1782
	(0.0339)	(0.0681)	(0.0334)	(0.0734)
	(0.1781)	(0.2987)	(0.1210)	(0.2337)
(log-)Distance	-0.7664	-0.9068		
	(0.0024)	(0.0071)		
	(0.0306)	(0.0630)		
(log-)Distance, first quintile			-0.3268	-0.9816
			(0.0036)	(0.0092)
			(0.0259)	(0.0543)
(log-)Distance, second quintile			-0.3660	-0.9461
			(0.0026)	(0.0091)
			(0.0177)	(0.0608)
(log-)Distance, third quintile			-0.3850	-0.9449
			(0.0028)	(0.0086)
			(0.0225)	(0.0592)
(log-)Distance, fourth quintile			-0.4189	-0.9862
			(0.0028)	(0.0080)
			(0.0208)	(0.0551)
(log-)Distance, fifth quintile			-0.4544	-1.0115
			(0.0025)	(0.0116)
			(0.0196)	(0.0705)
Estimated FE	1.0727	1.1533	1.0570	1.1469
	(0.0018)	(0.0050)	(0.0023)	(0.0056)
	(0.0282)	(0.0554)	(0.0251)	(0.0456)
Observations	1,920			
Countries	16			
Time period	1999 – 2006			

Notes: (Robust) standard errors in (second) parentheses.

Table 5: Gravity models for goods and services trade - Estimated error correlations

Panel A. Estimated error variance matrix elements

Specification	(log-)Dist.		(log-)Dist. quintiles	
	o^2	$\bar{o}^2$	o^2	$\bar{o}^2$
Services sector	0.0870	0.0687	0.0778	0.0573
	(0.0260)	(0.0130)	(0.0219)	(0.0112)
Goods sector	0.0110	0.0106	0.0099	0.0091
	(0.0014)	(0.0006)	(0.0010)	(0.0005)
Between sectors	0.0093	0.0080	0.0076	0.0064
	(0.0022)	(0.0008)	(0.0028)	(0.0010)

Panel B. Implied error correlations

Specification	(log-)Dist.	(log-)Dist. quintiles
Within sectors:		
Serial correlation services	78.97%	73.65%
Serial correlation goods	96.36%	91.92%
Between sectors:		
Correlation services/goods	30.06%	27.38%
Serial corr. services/goods	25.86%	23.06%

Notes: Robust standard errors in parentheses.

Table 6: Estimates for sectoral elasticities of substitution

Specif.	*(log-)Dist.*	*(log-)Dist. quintiles*
$\hat{\sigma}_G$	7.9849	7.6663
	(0.8015)	(0.8193)
$\hat{\sigma}_S$	5.9591	5.5543
	(0.9306)	(0.9633)

Table 7: Comparative static effects in percent of incepting goods preferences accounting for trade imbalances

			Net labor flow between sectors into (+)/out(-)		Goods trade		Services trade	
Country	GDP in %	EV in %	Goods in %	Serivces in %	Intra in %	Inter in %	Intra in %	Inter in %
Austria	0.000	0.417	0.024	-0.017	-0.085	-54.511	-3.645	-56.298
Belgium-Luxembourg	-12.034	1.526	0.082	-0.044	-38.538	31.085	-12.832	-18.451
Czech Republic	-22.113	-0.198	0.011	-0.011	-22.203	180.890	-22.128	52.231
Denmark	-14.116	0.574	0.000	0.000	-23.454	41.137	-13.982	-3.754
Finland	-13.968	0.573	-0.012	0.009	-20.433	37.459	-13.887	-3.655
France	-14.090	0.397	-0.020	0.009	-19.541	37.481	-14.036	-2.967
Hungary	-20.170	-0.127	0.005	-0.004	-20.234	135.433	-20.109	36.335
Ireland	-11.933	1.797	0.100	-0.074	-36.309	32.134	-15.456	-21.422
Italy	-14.848	0.088	0.002	-0.001	-16.760	49.568	-14.833	0.209
Netherlands	-14.172	0.514	0.010	-0.006	-23.357	43.263	-14.086	-4.053
Poland	-5.792	0.020	0.000	0.000	-5.869	-28.937	-5.880	-39.375
Portugal	-5.683	0.200	-0.004	0.002	-6.844	-29.743	-6.306	-39.550
Slovak Republic	-22.015	-0.187	0.014	-0.008	-22.110	179.114	-22.065	51.820
Spain	-14.065	0.123	-0.005	0.004	-15.635	39.065	-14.022	-3.697
Sweden	-14.080	0.556	-0.004	0.003	-21.876	40.001	-13.970	-3.668
United Kingdom	-13.871	0.227	-0.011	0.007	-16.737	36.080	-13.745	-4.391
Average	-13.309	0.406	0.012	-0.008	-19.374	48.095	-13.811	-3.793

Table 8: Heterogeneity of comparative static effects in percent of incepting goods preferences across countries on their bilateral trade flows accounting for trade imbalances

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	-78.244	-78.244	-63.586	-57.414	-54.178	-5.272	-5.272
Belgium-Luxembourg	-45.997	-45.997	-5.400	5.981	15.399	262.322	262.322
Czech Republic	14.488	14.488	99.086	123.038	142.859	662.512	662.512
Denmark	-41.457	-41.457	-2.013	14.889	25.099	292.777	292.777
Finland	-42.791	-42.791	-4.244	11.987	22.250	283.832	283.832
France	-42.747	-42.747	-4.172	12.072	22.342	284.121	284.121
Hungary	-4.183	-4.183	67.846	88.039	104.751	542.862	542.862
Ireland	-45.498	-45.498	-6.346	6.960	16.465	265.669	265.669
Italy	-37.879	-37.879	3.977	21.912	32.746	316.788	316.788
Netherlands	-40.616	-40.616	-0.604	16.540	26.897	298.424	298.424
Poland	-68.391	-68.391	-47.093	-38.125	-33.423	112.075	112.075
Portugal	-68.745	-68.745	-47.687	-38.819	-34.171	109.695	109.695
Slovak Republic	12.955	12.955	97.867	121.672	141.372	657.843	657.843
Spain	-41.974	-41.974	-2.877	13.587	22.967	289.314	289.314
Sweden	-41.844	-41.844	-2.660	13.840	24.272	290.181	290.181
United Kingdom	-43.192	-43.192	-4.916	11.202	19.651	281.139	281.139
Average	-38.507	-38.507	4.824	20.460	30.956	309.018	309.018

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	-75.204	-75.204	-59.279	-57.720	-51.824	-29.479	-29.479
Belgium-Luxembourg	-56.786	-56.786	-29.031	-26.314	-15.637	67.930	67.930
Czech Republic	-21.863	-21.863	31.928	32.791	57.800	202.610	202.610
Denmark	-49.554	-49.554	-17.154	-13.977	2.225	96.034	96.034
Finland	-49.501	-49.501	-17.068	-13.893	2.331	96.238	96.238
France	-49.166	-49.166	-16.360	-13.316	3.010	97.541	97.541
Hungary	-29.925	-29.925	18.719	19.495	42.000	172.311	172.311
Ireland	-58.342	-58.342	-31.587	-28.968	-19.062	61.882	61.882
Italy	-47.621	-47.621	-11.261	-10.681	6.141	103.544	103.544
Netherlands	-49.705	-49.705	-17.403	-14.240	1.918	95.446	95.446
Poland	-66.907	-66.907	-45.652	-43.572	-35.703	28.600	28.600
Portugal	-67.008	-67.008	-45.818	-43.744	-35.899	28.208	28.208
Slovak Republic	-22.329	-22.329	31.587	32.447	57.392	201.828	201.828
Spain	-49.527	-49.527	-17.110	-13.931	2.279	96.138	96.138
Sweden	-49.511	-49.511	-17.083	-13.903	2.312	96.202	96.202
United Kingdom	-49.861	-49.861	-17.659	-14.506	1.602	94.841	94.841
Average	-49.551	-49.551	-16.265	-14.002	1.305	94.367	94.367

Table 9: Comparative static effects in percent of incepting services preferences accounting for trade imbalances

Country	GDP in %	EV in %	Net labor flow between sectors into (+)/out(-) Goods in %	Serivces in %	Goods trade Intra in %	Inter in %	Services trade Intra in %	Inter in %
Austria	0.000	0.534	0.027	-0.018	0.031	27.545	-4.588	266.504
Belgium-Luxembourg	4.034	0.117	0.073	-0.040	10.248	0.476	-0.093	194.400
Czech Republic	-6.784	-0.073	0.010	-0.009	-6.751	104.661	-6.916	417.986
Denmark	3.696	0.587	-0.002	0.002	3.473	-4.511	-0.421	213.192
Finland	4.055	0.294	-0.006	0.005	3.287	-7.196	2.072	208.469
France	4.874	0.198	-0.029	0.014	2.528	-14.426	4.534	199.146
Hungary	-5.178	-0.018	0.004	-0.004	-5.136	80.874	-5.382	380.135
Ireland	4.006	1.399	0.135	-0.094	15.282	6.499	-13.846	179.955
Italy	3.988	0.065	-0.002	0.001	4.006	-6.401	3.593	207.955
Netherlands	3.616	0.281	0.011	-0.006	4.016	-2.647	1.309	211.351
Poland	4.614	0.021	0.001	-0.001	4.603	-10.093	4.399	198.221
Portugal	7.895	0.185	0.005	-0.003	7.406	-27.978	6.214	155.043
Slovak Republic	-6.014	-0.060	0.010	-0.006	-6.001	93.477	-6.103	399.767
Spain	5.064	0.148	-0.007	0.004	4.618	-13.540	4.225	193.699
Sweden	3.783	0.408	0.000	0.000	3.617	-4.836	0.696	211.167
United Kingdom	4.160	0.229	-0.004	0.003	3.558	-7.702	2.704	206.142
Average	2.238	0.270	0.014	-0.010	3.049	13.387	-0.475	240.196

Table 10: Heterogeneity of comparative static effects in percent of incepting services preferences across countries on their bilateral trade flows accounting for trade imbalances

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	-40.651	-40.651	34.275	37.229	43.710	82.054	82.054
Belgium-Luxembourg	-52.320	-52.320	-12.841	9.458	15.455	46.260	46.260
Czech Republic	-0.761	-0.761	110.974	115.614	125.799	186.044	186.044
Denmark	-54.725	-54.725	-17.237	4.687	9.632	38.883	38.883
Finland	-55.917	-55.917	-19.417	1.199	6.743	35.224	35.224
France	-59.137	-59.137	-25.303	-6.192	-3.713	25.348	25.348
Hungary	-17.222	-17.222	87.284	91.403	100.444	153.924	153.924
Ireland	-49.508	-49.508	-7.701	16.749	22.264	54.885	54.885
Italy	-55.545	-55.545	-18.736	2.055	7.646	36.367	36.367
Netherlands	-53.885	-53.885	-15.383	6.630	11.666	41.460	41.460
Poland	-57.160	-57.160	-21.688	-1.652	0.946	31.414	31.414
Portugal	-64.986	-64.986	-35.994	-19.619	-17.495	-11.340	-11.340
Slovak Republic	-11.674	-11.674	99.835	104.231	113.877	170.942	170.942
Spain	-58.684	-58.684	-24.474	-5.151	-2.645	26.739	26.739
Sweden	-54.864	-54.864	-17.492	4.364	9.294	38.454	38.454
United Kingdom	-56.133	-56.133	-19.812	0.703	6.026	34.561	34.561
Average	-46.448	-46.448	6.018	22.607	28.103	61.951	61.951

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	118.743	118.743	267.642	290.420	307.988	382.953	382.953
Belgium-Luxembourg	78.568	78.568	165.246	213.754	232.393	294.263	294.263
Czech Republic	217.309	217.309	410.961	442.621	467.032	571.225	571.225
Denmark	89.144	89.144	180.952	237.588	252.781	317.609	317.609
Finland	86.782	86.782	177.446	228.180	248.372	312.400	312.400
France	81.818	81.818	170.074	219.463	231.563	301.441	301.441
Hungary	182.825	182.825	375.342	404.799	427.510	524.459	524.459
Ireland	68.720	68.720	152.798	201.142	214.687	272.515	272.515
Italy	86.681	86.681	177.291	228.002	248.184	312.181	312.181
Netherlands	88.315	88.315	179.724	236.111	251.238	315.792	315.792
Poland	81.281	81.281	169.273	218.513	230.581	300.259	300.259
Portugal	57.112	57.112	133.374	176.062	186.513	199.280	199.280
Slovak Republic	193.827	193.827	393.836	424.434	448.025	548.762	548.762
Spain	78.707	78.707	165.449	213.995	225.885	294.566	294.566
Sweden	88.139	88.139	179.461	235.794	250.903	315.391	315.391
United Kingdom	85.547	85.547	175.611	226.011	246.071	309.666	309.666
Average	105.220	105.220	217.155	262.306	279.358	348.298	348.298

Table 11: Comparative static effects in percent of incepting goods and services preferences accounting for trade imbalances

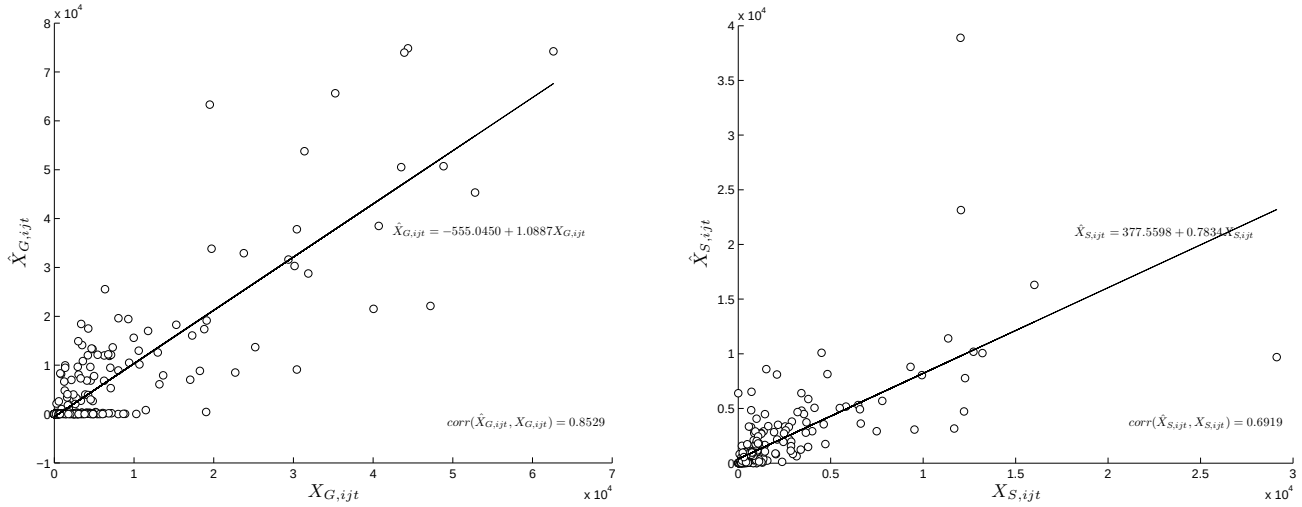
			Net labor flow between sectors into (+)/out(-)		Goods trade		Services trade	
Country	GDP in %	EV in %	Goods in %	Serivces in %	Intra in %	Inter in %	Intra in %	Inter in %
Austria	0.000	0.528	0.026	-0.018	-0.010	78.234	-4.513	282.330
Belgium-Luxembourg	6.943	2.323	0.079	-0.043	-25.401	19.145	2.547	166.935
Czech Republic	-3.169	-0.043	0.010	-0.009	-3.178	119.910	-3.296	349.826
Denmark	4.371	1.260	-0.003	0.002	-7.135	28.295	0.238	216.587
Finland	4.262	0.740	-0.007	0.005	-3.333	28.412	2.293	218.757
France	4.750	0.434	-0.030	0.014	-2.450	20.984	4.417	214.041
Hungary	-1.970	0.001	0.005	-0.004	-1.975	100.710	-2.185	326.252
Ireland	6.793	3.725	0.162	-0.109	-19.332	29.544	-12.368	151.991
Italy	4.005	0.205	-0.002	0.001	1.475	30.813	3.614	221.106
Netherlands	4.307	0.934	0.010	-0.006	-6.848	30.625	2.002	214.498
Poland	3.460	0.023	0.001	-0.001	3.420	36.128	3.254	228.770
Portugal	5.715	0.206	0.004	-0.002	4.934	16.777	4.144	195.186
Slovak Republic	-2.427	-0.035	0.011	-0.006	-2.438	108.668	-2.503	335.031
Spain	4.752	0.240	-0.007	0.005	2.737	23.487	3.930	211.154
Sweden	4.256	0.982	-0.001	0.000	-5.047	29.452	1.173	217.570
United Kingdom	4.070	0.377	-0.006	0.004	0.824	29.820	2.656	221.088
Average	3.132	0.744	0.016	-0.010	-3.985	45.688	0.338	235.695

Table 12: Heterogeneity of comparative static effects in percent of incepting goods and services preferences across countries on their bilateral trade flows accounting for trade imbalances

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	15.932	15.932	61.428	87.992	98.219	126.899	126.899
Belgium-Luxembourg	-22.037	-22.037	0.780	26.424	33.301	52.588	52.588
Czech Republic	49.823	49.823	96.954	129.364	141.841	176.833	176.833
Denmark	-15.296	-15.296	9.493	37.353	44.825	65.780	65.780
Finland	-14.996	-14.996	9.881	36.145	45.339	66.368	66.368
France	-19.524	-19.524	4.028	28.893	36.823	57.505	57.505
Hungary	29.676	29.676	80.566	110.279	121.718	153.798	153.798
Ireland	-15.259	-15.259	9.694	37.415	44.890	65.854	65.854
Italy	-13.226	-13.226	12.169	38.979	47.653	69.831	69.831
Netherlands	-13.842	-13.842	11.373	39.712	47.312	68.626	68.626
Poland	-9.831	-9.831	16.557	44.417	54.169	76.476	76.476
Portugal	-21.675	-21.675	1.248	25.448	33.166	42.782	42.782
Slovak Republic	34.556	34.556	87.362	118.193	130.062	163.349	163.349
Spain	-17.668	-17.668	6.427	31.865	39.978	61.137	61.137
Sweden	-14.457	-14.457	10.578	37.008	46.260	67.422	67.422
United Kingdom	-13.878	-13.878	11.327	37.936	46.423	68.556	68.556
Average	-3.856	-3.856	26.866	54.214	63.249	86.488	86.488

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	170.390	170.390	287.767	294.925	309.523	366.754	366.754
Belgium-Luxembourg	94.019	94.019	137.267	182.393	191.238	209.532	209.532
Czech Republic	228.634	228.634	352.950	361.310	378.359	445.208	445.208
Denmark	126.988	126.988	177.580	231.531	243.785	291.831	291.831
Finland	128.742	128.742	179.728	232.934	246.445	294.860	294.860
France	125.889	125.889	176.240	228.778	240.167	289.938	289.938
Hungary	200.189	200.189	330.506	338.452	354.651	418.197	418.197
Ireland	81.819	81.819	122.347	164.632	172.922	213.858	213.858
Italy	130.512	130.512	181.892	235.502	249.123	297.912	297.912
Netherlands	125.842	125.842	176.182	228.709	242.054	289.858	289.858
Poland	135.600	135.600	188.755	244.111	256.823	306.701	306.701
Portugal	113.197	113.197	160.722	210.309	220.033	268.034	268.034
Slovak Republic	206.032	206.032	338.883	346.985	363.492	428.280	428.280
Spain	123.884	123.884	173.785	225.853	236.063	286.474	286.474
Sweden	127.784	127.784	178.556	232.694	244.986	293.208	293.208
United Kingdom	130.360	130.360	181.707	236.463	248.889	297.653	297.653
Average	140.618	140.618	209.054	249.724	262.410	312.394	312.394

(a) Top panel: With unobserved trade costs



(b) Bottom panel: Without unobserved trade costs

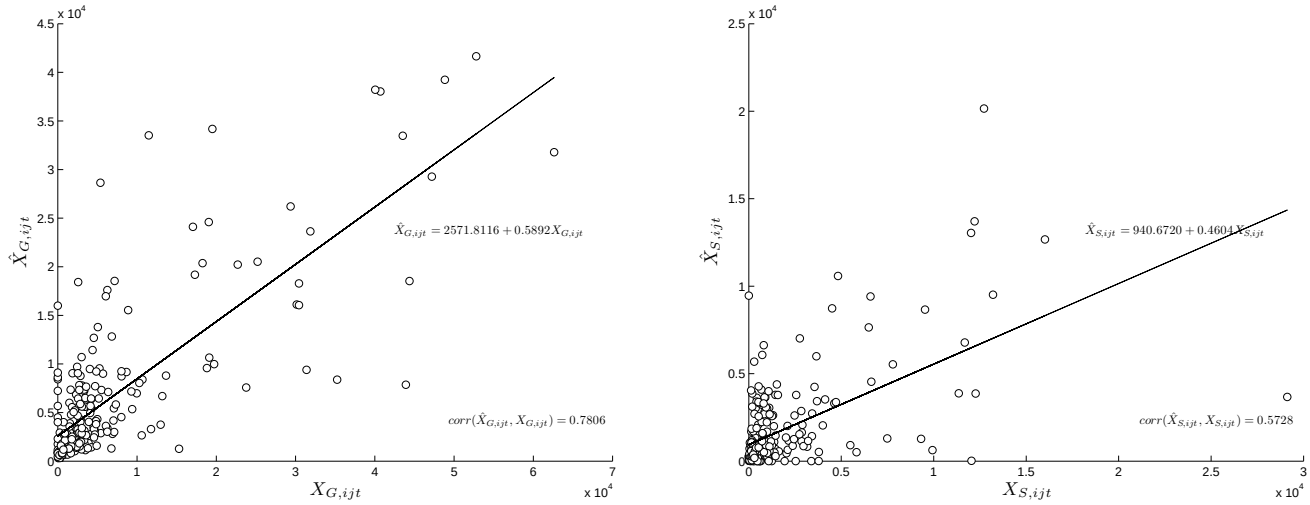
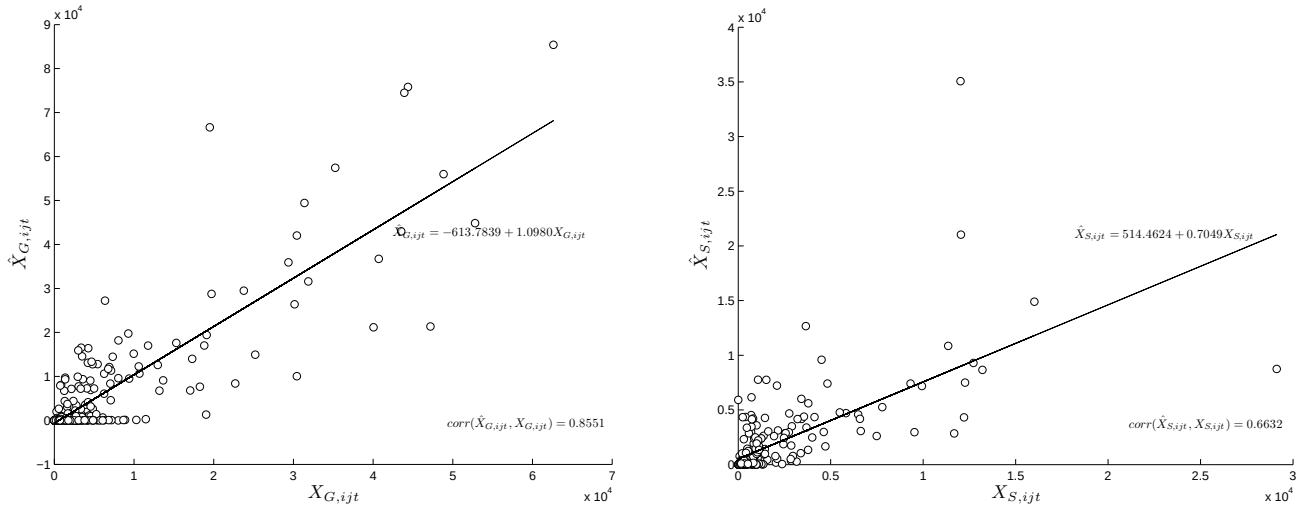


Figure 1: Scatter plots and regression lines of predicted versus actual goods and services trade flows. Cases without unobserved trade costs assume $\phi = \varphi = 1$.

(a) Top panel: With unobserved trade costs



(b) Bottom panel: Without unobserved trade costs

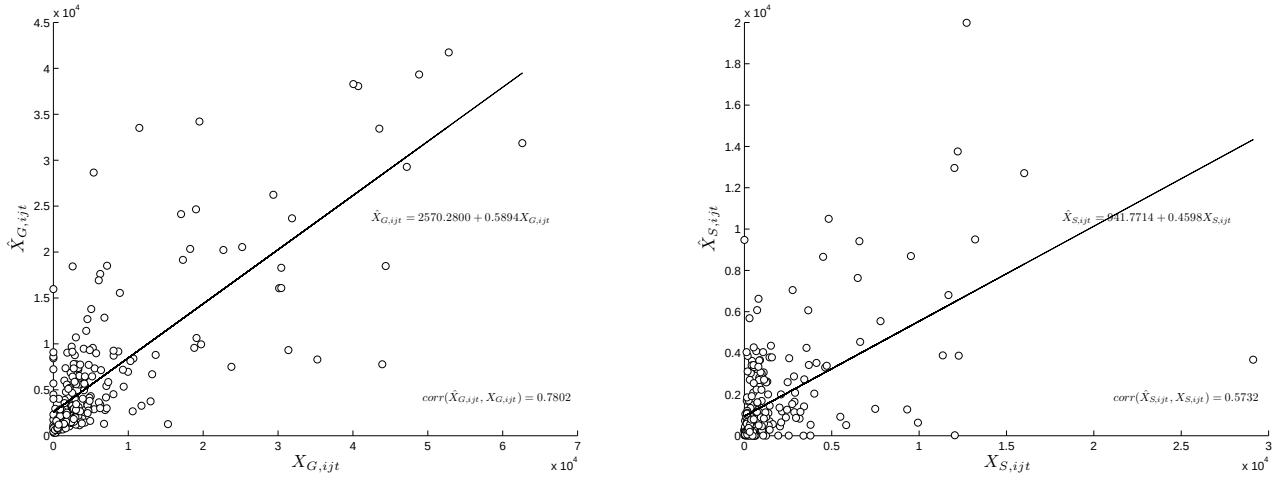


Figure 2: Scatter plots and regression lines of predicted versus actual goods and services trade flows accounting for trade imbalances. Cases without unobserved trade costs assume $\phi = \varphi = 1$.

Appendix B: Comparative statics without unobserved trade costs but with trade imbalances

Table 13: Comparative static effects in percent of incepting goods preferences accounting for trade imbalances, $\phi = \varphi = 1$

			Net labor flow between sectors into (+)/out(-)		Goods trade		Services trade	
Country	GDP in %	EV in %	Goods in %	Serivces in %	Intra in %	Inter in %	Intra in %	Inter in %
Austria	0.000	1.707	0.172	-0.133	-21.568	22.304	-8.393	-17.288
Belgium-Luxembourg	0.198	2.089	0.054	-0.178	-26.477	8.167	-18.939	-22.026
Czech Republic	-0.239	2.536	0.018	-0.030	-28.104	7.747	-3.411	-5.973
Denmark	-0.107	2.065	0.028	-0.033	-27.021	7.739	-3.900	-6.898
Finland	-0.576	1.787	0.027	-0.028	-23.622	10.878	-2.376	-4.275
France	-1.559	1.145	-0.004	0.001	-22.202	15.036	-1.542	3.593
Hungary	-0.457	2.319	-0.002	0.002	-28.691	7.170	-1.082	-1.821
Ireland	0.409	2.506	0.063	-0.865	-27.714	7.651	-86.655	-87.288
Italy	-1.895	0.959	-0.036	0.019	-17.258	13.396	-1.541	7.264
Netherlands	-0.515	1.887	-0.001	0.001	-27.190	7.519	-1.550	-1.627
Poland	-1.690	1.266	-0.030	0.019	-19.184	12.702	-1.225	6.169
Portugal	-0.711	1.476	0.043	-0.033	-22.532	13.703	-2.545	-4.205
Slovak Republic	0.246	1.960	0.058	-0.314	-29.861	8.563	-30.071	-35.178
Spain	-1.798	1.023	-0.015	0.009	-17.045	15.205	-1.530	5.718
Sweden	-0.833	1.754	-0.009	0.007	-24.409	8.818	-1.048	0.507
United Kingdom	-2.105	0.936	-0.039	0.018	-17.380	14.815	-1.643	8.335
Average	-0.727	1.713	0.020	-0.096	-23.766	11.338	-10.466	-9.687

Table 14: Heterogeneity of comparative static effects in percent of incepting goods preferences across countries on their bilateral trade flows accounting for trade imbalances, $\phi = \varphi = 1$

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	15.382	15.382	19.845	21.019	26.306	29.324	29.324
Belgium-Luxembourg	1.692	1.692	5.718	7.060	12.100	14.779	14.779
Czech Republic	1.181	1.181	5.832	6.869	11.537	14.202	14.202
Denmark	1.267	1.267	5.277	6.960	11.632	14.299	14.299
Finland	4.327	4.327	8.457	9.834	15.005	17.753	17.753
France	8.115	8.115	12.396	14.193	19.181	22.029	22.029
Hungary	0.622	0.622	5.247	6.278	10.921	13.571	13.571
Ireland	1.130	1.130	5.312	6.815	11.481	14.145	14.145
Italy	7.094	7.094	11.334	12.747	15.216	19.389	19.389
Netherlands	1.059	1.059	5.060	6.739	11.402	14.064	14.064
Poland	6.316	6.316	10.525	11.928	14.379	19.998	19.998
Portugal	6.912	6.912	11.145	12.555	17.854	20.670	20.670
Slovak Republic	1.750	1.750	6.427	7.470	12.164	14.844	14.844
Spain	8.707	8.707	13.011	14.445	16.952	22.697	22.697
Sweden	2.443	2.443	6.499	7.851	12.712	15.627	15.627
United Kingdom	8.335	8.335	12.624	14.053	16.551	22.277	22.277
Average	4.771	4.771	9.044	10.426	14.712	18.104	18.104

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	-23.964	-23.964	-21.734	-16.145	-14.320	-10.613	-10.613
Belgium-Luxembourg	-28.621	-28.621	-26.528	-21.282	-19.568	-14.004	-14.004
Czech Republic	-13.992	-13.992	-11.470	-5.149	-2.488	3.621	3.621
Denmark	-14.812	-14.812	-12.314	-6.053	-3.526	2.633	2.633
Finland	-12.479	-12.479	-9.913	-3.480	-0.773	5.443	5.443
France	-5.697	-5.697	-2.102	4.948	6.917	13.615	13.615
Hungary	-10.305	-10.305	-7.675	-0.181	1.692	8.063	8.063
Ireland	-88.356	-88.356	-88.015	-87.159	-86.879	-85.972	-85.972
Italy	-2.554	-2.554	2.596	8.446	10.481	17.402	17.402
Netherlands	-10.166	-10.166	-7.531	-0.025	1.850	8.231	8.231
Poland	-3.473	-3.473	1.628	7.422	9.438	16.294	16.294
Portugal	-12.430	-12.430	-9.862	-3.425	-0.717	5.503	5.503
Slovak Republic	-40.516	-40.516	-38.771	-34.399	-32.971	-28.334	-28.334
Spain	-3.877	-3.877	1.203	6.973	8.981	15.808	15.808
Sweden	-8.310	-8.310	-5.621	2.039	3.954	10.466	10.466
United Kingdom	-0.621	-0.621	3.555	9.459	11.513	18.499	18.499
Average	-17.511	-17.511	-14.535	-8.626	-6.651	-0.834	-0.834

Table 15: Comparative static effects in percent of incepting services preferences accounting for trade imbalances, $\phi = \varphi = 1$

			Net labor flow between sectors into (+)/out(-)		Goods trade		Services trade	
Country	GDP in %	EV in %	Goods in %	Serivces in %	Intra in %	Inter in %	Intra in %	Inter in %
Austria	0.000	1.083	0.977	-0.340	82.739	99.637	-36.996	79.486
Belgium-Luxembourg	0.890	8.480	0.184	-0.398	16.855	11.777	-65.044	61.760
Czech Republic	0.034	3.252	0.120	-0.153	5.650	12.663	-33.559	133.104
Denmark	0.617	3.679	0.113	-0.112	8.368	7.209	-30.664	137.806
Finland	0.173	1.448	0.210	-0.160	16.808	20.377	-23.603	127.422
France	0.533	1.163	-0.046	0.015	-2.306	-7.798	-6.104	169.830
Hungary	-0.187	3.882	0.011	-0.011	-6.250	3.442	-24.670	175.778
Ireland	0.719	5.859	0.381	-0.968	33.633	32.179	-97.816	-91.290
Italy	1.006	1.602	-0.130	0.079	-9.524	-18.787	-4.019	181.106
Netherlands	0.959	4.087	-0.141	0.104	-14.318	-19.289	-16.039	191.277
Poland	0.272	1.590	-0.090	0.064	-8.853	-10.297	-6.071	187.182
Portugal	-0.011	0.646	0.255	-0.145	21.318	26.453	-17.335	132.459
Slovak Republic	-0.260	5.491	0.502	-0.737	39.620	54.427	-81.476	-25.997
Spain	0.250	1.157	-0.030	0.019	-2.379	-4.277	-6.553	174.847
Sweden	0.374	2.684	-0.043	0.034	-5.862	-6.235	-14.685	179.065
United Kingdom	0.617	1.214	-0.097	0.050	-7.377	-13.283	-4.104	178.229
Average	0.374	2.957	0.136	-0.166	10.508	11.762	-29.296	124.504

Table 16: Heterogeneity of comparative static effects in percent of incepting services preferences across countries on their bilateral trade flows accounting for trade imbalances, $\phi = \varphi = 1$

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	80.622	80.622	91.514	100.627	108.976	119.664	119.664
Belgium-Luxembourg	1.957	1.957	6.100	13.230	17.292	23.996	23.996
Czech Republic	2.075	2.075	8.230	13.380	18.098	24.139	24.139
Denmark	-2.421	-2.421	1.544	8.386	12.897	18.671	18.671
Finland	9.287	9.287	13.728	21.392	26.443	32.910	32.910
France	-15.824	-15.824	-12.404	-6.517	-4.078	2.371	2.371
Hungary	-6.464	-6.464	-0.823	3.896	8.219	13.754	13.754
Ireland	20.308	20.308	25.196	33.610	39.193	46.313	46.313
Italy	-25.605	-25.605	-22.582	-17.379	-15.223	-13.007	-13.007
Netherlands	-26.306	-26.306	-23.312	-18.158	-16.022	-10.377	-10.377
Poland	-18.327	-18.327	-15.009	-9.297	-5.506	-0.673	-0.673
Portugal	14.725	14.725	19.712	27.432	32.735	39.524	39.524
Slovak Republic	39.939	39.939	48.039	55.084	61.537	69.799	69.799
Spain	-12.826	-12.826	-9.284	-3.187	0.859	6.017	6.017
Sweden	-14.694	-14.694	-11.228	-5.246	-1.303	3.745	3.745
United Kingdom	-20.790	-20.790	-17.572	-12.032	-9.737	-3.669	-3.669
Average	1.604	1.604	6.366	12.826	17.149	23.324	23.324

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	30.232	30.232	64.353	80.873	100.347	108.264	108.264
Belgium-Luxembourg	31.308	31.308	48.851	68.900	76.964	82.576	82.576
Czech Republic	66.878	66.878	111.180	146.881	158.672	166.868	166.868
Denmark	70.474	70.474	115.138	152.197	164.243	172.621	172.621
Finland	64.509	64.509	107.612	128.477	155.001	163.087	163.087
France	95.665	95.665	146.928	171.744	201.006	212.908	212.908
Hungary	96.949	96.949	156.783	191.367	205.281	214.965	214.965
Ireland	-93.809	-93.809	-91.928	-90.840	-90.403	-90.099	-90.099
Italy	103.570	103.570	156.906	182.720	215.237	225.561	225.561
Netherlands	108.664	108.664	163.333	208.693	223.438	233.701	233.701
Poland	107.367	107.367	161.696	187.994	221.428	231.627	231.627
Portugal	68.824	68.824	113.057	134.470	159.721	166.749	166.749
Slovak Republic	-47.398	-47.398	-31.417	-22.181	-18.465	-15.876	-15.876
Spain	98.982	98.982	151.113	176.348	208.428	218.212	218.212
Sweden	100.632	100.632	153.198	196.809	210.983	220.850	220.850
United Kingdom	101.619	101.619	154.445	180.013	210.164	222.428	222.428
Average	62.779	62.779	105.078	130.904	150.128	158.403	158.403

Table 17: Comparative static effects in percent of incepting goods and services preferences accounting for trade imbalances, $\phi = \varphi = 1$

			Net labor flow between sectors into (+)/out(-)		Goods trade		Services trade	
Country	GDP in %	EV in %	Goods in %	Serivces in %	Intra in %	Inter in %	Intra in %	Inter in %
Austria	0.000	3.289	1.167	-0.360	34.208	132.979	-37.698	67.697
Belgium-Luxembourg	1.496	10.984	0.190	-0.405	-18.705	14.434	-66.105	50.201
Czech Republic	0.012	5.870	0.125	-0.159	-24.785	20.330	-34.183	123.767
Denmark	0.808	5.859	0.118	-0.116	-22.865	12.799	-31.258	126.261
Finland	-0.307	3.370	0.220	-0.166	-12.630	32.900	-24.200	123.128
France	-0.842	2.285	-0.046	0.016	-23.301	7.115	-7.366	178.724
Hungary	-0.452	6.141	0.011	-0.011	-31.984	11.713	-25.177	169.575
Ireland	1.454	8.738	0.401	-0.969	-9.935	35.677	-97.922	-92.159
Italy	-0.426	2.448	-0.137	0.085	-22.820	-6.761	-5.332	192.766
Netherlands	0.835	5.895	-0.142	0.105	-36.511	-13.978	-16.560	183.108
Poland	-1.158	2.725	-0.097	0.069	-24.126	3.435	-7.307	199.104
Portugal	-0.737	2.304	0.273	-0.152	-9.132	42.929	-18.176	130.517
Slovak Republic	0.189	7.806	0.546	-0.747	-5.113	64.053	-82.091	-32.941
Spain	-1.349	2.134	-0.034	0.023	-18.038	12.036	-7.973	187.987
Sweden	-0.185	4.382	-0.046	0.036	-27.813	2.685	-15.288	177.401
United Kingdom	-1.248	2.030	-0.106	0.056	-20.980	2.694	-5.770	196.066
Average	-0.119	4.766	0.153	-0.168	-17.158	23.440	-30.150	123.825

Table 18: Heterogeneity of comparative static effects in percent of incepting goods and services preferences across countries on their bilateral trade flows accounting for trade imbalances, $\phi = \varphi = 1$

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	96.815	96.815	116.920	136.497	145.935	175.341	175.341
Belgium-Luxembourg	-2.506	-2.506	5.739	14.595	22.294	36.917	36.917
Czech Republic	1.720	1.720	12.542	22.699	27.595	42.852	42.852
Denmark	-4.131	-4.131	3.976	15.640	20.255	34.635	34.635
Finland	12.680	12.680	22.208	35.919	41.343	58.243	58.243
France	-8.694	-8.694	-0.974	7.321	14.531	28.226	28.226
Hungary	-5.704	-5.704	4.327	13.743	18.282	32.425	32.425
Ireland	15.102	15.102	24.835	38.840	44.381	61.645	61.645
Italy	-19.714	-19.714	-12.925	-5.632	0.020	5.363	5.363
Netherlands	-26.527	-26.527	-20.314	-13.640	-8.467	3.182	3.182
Poland	-11.691	-11.691	-4.224	3.799	10.016	24.018	24.018
Portugal	20.943	20.943	32.232	45.885	51.707	69.847	69.847
Slovak Republic	38.087	38.087	52.777	66.566	73.213	93.924	93.924
Spain	-4.365	-4.365	3.722	12.410	19.369	34.307	34.307
Sweden	-12.575	-12.575	-5.182	2.760	9.664	22.777	22.777
United Kingdom	-12.037	-12.037	-4.599	3.392	9.584	23.532	23.532
Average	4.838	4.838	14.441	25.050	31.233	46.702	46.702

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	27.340	27.340	57.127	69.517	78.349	95.057	95.057
Belgium-Luxembourg	28.940	28.940	42.335	49.416	58.499	76.899	76.899
Czech Republic	67.266	67.266	106.497	125.759	139.484	167.286	167.286
Denmark	69.467	69.467	109.108	128.727	142.636	170.800	170.800
Finland	68.346	68.346	107.726	124.103	135.780	169.009	169.009
France	109.978	109.978	159.095	179.522	194.089	235.536	235.536
Hungary	100.826	100.826	158.210	171.053	187.531	220.910	220.910
Ireland	-94.174	-94.174	-92.509	-92.136	-91.658	-90.690	-90.690
Italy	120.153	120.153	171.651	193.063	214.356	251.797	251.797
Netherlands	111.652	111.652	161.160	185.661	203.030	238.209	238.209
Poland	124.306	124.306	176.773	198.592	221.147	258.426	258.426
Portugal	74.457	74.457	115.267	132.240	144.344	178.770	178.770
Slovak Republic	-50.151	-50.151	-35.907	-32.719	-28.629	-20.343	-20.343
Spain	116.393	116.393	167.010	188.059	209.819	245.788	245.788
Sweden	107.839	107.839	156.456	180.512	197.567	232.117	232.117
United Kingdom	122.405	122.405	174.430	196.064	218.427	255.396	255.396
Average	69.065	69.065	108.402	124.840	139.048	167.810	167.810

Appendix C: Comparative statics with unobserved trade costs but assuming balanced trade

Table 19: Comparative static effects in percent of incepting goods preferences

Country	GDP in %	EV in %	Net labor flow between sectors into (+)/out(-) Goods in %	Serivces in %	Goods trade Intra in %	Inter in %	Services trade Intra in %	Inter in %
Austria	0.000	0.002	0.000	0.000	-0.005	36.393	-0.011	1.446
Belgium-Luxembourg	2.019	2.124	0.022	-0.011	-32.067	24.129	1.401	-9.191
Czech Republic	0.575	0.010	0.000	0.000	0.456	30.905	0.559	-1.402
Denmark	-0.130	0.684	-0.004	0.003	-11.251	38.129	-0.035	2.385
Finland	-0.369	0.450	-0.001	0.001	-7.016	40.528	-0.325	3.413
France	-0.788	0.245	-0.002	0.001	-5.660	44.527	-0.768	5.576
Hungary	0.863	0.008	0.001	-0.001	0.779	28.274	0.826	-2.813
Ireland	2.011	2.086	0.079	-0.058	-27.133	31.002	-1.756	-13.509
Italy	-0.891	0.144	-0.001	0.001	-3.384	45.502	-0.868	6.089
Netherlands	-0.149	0.664	-0.004	0.002	-11.484	38.420	-0.060	2.426
Poland	0.848	0.002	0.000	0.000	0.830	28.333	0.841	-2.701
Portugal	0.142	0.014	0.000	0.000	-0.083	35.074	0.125	0.713
Slovak Republic	0.646	0.006	0.000	0.000	0.547	30.244	0.634	-1.744
Spain	-0.839	0.097	-0.002	0.001	-2.426	44.734	-0.791	5.888
Sweden	-0.239	0.581	-0.003	0.002	-9.181	39.223	-0.160	2.860
United Kingdom	-0.503	0.158	-0.005	0.003	-3.279	41.019	-0.379	4.295
Average	0.200	0.455	0.005	-0.004	-6.897	36.027	-0.048	0.233

Table 20: Heterogeneity of comparative static effects in percent of incepting goods preferences across countries on their bilateral trade flows

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	10.921	10.921	29.548	33.144	51.149	55.807	55.807
Belgium-Luxembourg	0.781	0.781	17.171	20.832	35.234	39.401	39.401
Czech Republic	6.790	6.790	24.723	28.185	41.523	50.004	50.004
Denmark	11.408	11.408	31.535	35.645	51.812	56.490	56.490
Finland	13.542	13.542	32.609	38.243	54.719	59.488	59.488
France	16.678	16.678	36.272	42.061	58.993	63.893	63.893
Hungary	4.817	4.817	22.419	25.816	38.908	47.232	47.232
Ireland	4.824	4.824	23.762	27.629	42.841	47.243	47.243
Italy	17.586	17.586	37.333	43.167	60.231	65.168	65.168
Netherlands	11.611	11.611	31.775	35.893	52.089	56.776	56.776
Poland	4.865	4.865	22.476	25.875	38.972	47.294	47.294
Portugal	9.914	9.914	28.373	31.936	49.474	54.393	54.393
Slovak Republic	6.295	6.295	24.146	27.591	40.867	49.309	49.309
Spain	17.073	17.073	36.734	40.529	59.532	64.449	64.449
Sweden	12.391	12.391	31.286	36.843	53.152	57.872	57.872
United Kingdom	14.190	14.190	33.367	37.068	55.604	60.399	60.399
Average	10.230	10.230	28.970	33.154	49.069	54.701	54.701

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	-4.903	-4.903	-2.708	-0.895	4.517	14.158	14.158
Belgium-Luxembourg	-14.176	-14.176	-12.196	-10.559	-6.549	3.026	3.026
Czech Republic	-7.374	-7.374	-5.237	-3.470	1.801	11.192	11.192
Denmark	-4.078	-4.078	-1.864	0.857	5.424	15.149	15.149
Finland	-3.191	-3.191	-0.792	1.789	6.399	16.213	16.213
France	-1.314	-1.314	1.776	3.763	8.462	18.467	18.467
Hungary	-8.600	-8.600	-6.491	-4.748	-0.477	9.720	9.720
Ireland	-18.159	-18.159	-16.271	-14.710	-10.886	-3.305	-3.305
Italy	-0.618	-0.618	2.235	4.231	8.952	19.001	19.001
Netherlands	-4.044	-4.044	-1.829	0.892	5.462	15.189	15.189
Poland	-8.500	-8.500	-6.389	-4.644	-0.369	9.840	9.840
Portugal	-5.539	-5.539	-3.359	-1.558	3.818	13.395	13.395
Slovak Republic	-7.671	-7.671	-5.540	-3.780	1.376	10.835	10.835
Spain	-1.041	-1.041	2.057	4.050	8.762	18.794	18.794
Sweden	-3.668	-3.668	-1.445	1.288	5.875	15.641	15.641
United Kingdom	-2.418	-2.418	0.636	2.602	7.248	17.141	17.141
Average	-5.956	-5.956	-3.589	-1.556	3.113	12.778	12.778

Table 21: Comparative static effects in percent of incepting services preferences

Country	GDP in %	EV in %	Net labor flow between sectors into (+)/out(-) Goods in %	Serivces in %	Goods trade Intra in %	Inter in %	Services trade Intra in %	Inter in %
Austria	0.000	0.173	0.000	0.000	0.000	-5.905	-1.301	206.108
Belgium-Luxembourg	0.332	0.466	0.018	-0.009	1.539	-6.433	-3.541	198.659
Czech Republic	-2.944	0.030	0.003	-0.002	-2.864	16.812	-3.320	253.419
Denmark	0.253	0.618	-0.004	0.002	-0.224	-7.953	-3.955	203.724
Finland	0.130	0.225	0.003	-0.002	0.219	-6.463	-1.794	203.478
France	0.619	0.114	-0.013	0.006	-0.203	-11.213	0.308	198.638
Hungary	-4.254	0.047	0.004	-0.003	-4.173	28.721	-4.746	277.467
Ireland	0.184	1.514	0.120	-0.082	9.980	4.125	-16.971	180.147
Italy	0.670	0.086	-0.005	0.003	0.406	-10.765	0.236	196.842
Netherlands	0.245	0.348	0.000	0.000	-0.039	-7.519	-2.126	202.637
Poland	-4.188	0.009	0.001	-0.001	-4.172	27.722	-4.281	277.022
Portugal	-1.643	0.079	0.003	-0.002	-1.549	6.276	-2.311	231.394
Slovak Republic	-3.337	0.027	0.003	-0.001	-3.263	20.224	-3.592	260.832
Spain	0.787	0.129	-0.004	0.003	0.566	-11.446	-0.020	195.159
Sweden	0.172	0.406	0.002	-0.001	0.102	-6.851	-2.945	203.438
United Kingdom	0.012	0.192	0.001	-0.001	-0.082	-5.835	-1.381	205.650
Average	-0.810	0.279	0.008	-0.006	-0.235	1.469	-3.234	218.413

Table 22: Heterogeneity of comparative static effects in percent of incepting services preferences across countries on their bilateral trade flows

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	-28.535	-28.535	-18.481	0.762	1.942	6.374	6.374
Belgium-Luxembourg	-28.836	-28.836	-18.824	-0.422	1.364	5.926	5.926
Czech Republic	-12.558	-12.558	11.089	23.288	24.732	30.155	30.155
Denmark	-29.997	-29.997	-20.149	-2.046	-0.211	4.197	4.197
Finland	-28.920	-28.920	-18.920	-0.538	1.393	5.802	5.802
France	-32.309	-32.309	-22.785	-5.281	-3.582	0.757	0.757
Hungary	-3.458	-3.458	21.741	35.110	36.692	42.636	42.636
Ireland	-20.949	-20.949	-9.828	11.457	12.762	17.665	17.665
Italy	-31.963	-31.963	-22.391	-4.796	-3.089	1.272	1.272
Netherlands	-29.681	-29.681	-19.788	-1.604	0.306	4.668	4.668
Poland	-4.882	-4.882	20.841	34.111	35.681	41.581	41.581
Portugal	-19.968	-19.968	-5.486	12.840	14.161	19.125	19.125
Slovak Republic	-10.156	-10.156	14.140	26.674	28.157	33.730	33.730
Spain	-32.437	-32.437	-22.932	-5.461	-3.765	-0.295	-0.295
Sweden	-29.200	-29.200	-19.240	-0.931	0.992	5.384	5.384
United Kingdom	-28.489	-28.489	-18.428	0.827	2.007	6.443	6.443
Average	-23.271	-23.271	-9.340	7.749	9.346	14.089	14.089

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	155.939	155.939	181.272	219.947	223.405	237.537	237.537
Belgium-Luxembourg	149.739	149.739	174.457	212.195	215.569	229.358	229.358
Czech Republic	192.561	192.561	239.207	268.479	269.676	285.830	285.830
Denmark	153.625	153.625	178.731	219.441	220.479	234.484	234.484
Finland	153.802	153.802	178.924	217.270	220.461	234.718	234.718
France	150.377	150.377	175.160	212.990	216.141	230.198	230.198
Hungary	212.894	212.894	260.717	291.834	293.111	310.281	310.281
Ireland	132.990	132.990	156.054	193.456	194.411	207.268	207.268
Italy	148.960	148.960	173.608	211.214	214.352	228.333	228.333
Netherlands	153.089	153.089	178.139	216.382	219.701	233.777	233.777
Poland	210.836	210.836	260.412	291.497	292.770	309.923	309.923
Portugal	175.524	175.524	203.195	247.013	248.152	263.360	263.360
Slovak Republic	198.304	198.304	245.883	275.714	276.937	293.394	293.394
Spain	147.602	147.602	172.114	209.520	212.641	225.591	225.591
Sweden	153.577	153.577	178.676	219.381	220.417	234.411	234.411
United Kingdom	155.570	155.570	180.866	219.478	222.940	237.041	237.041
Average	165.337	165.337	196.089	232.863	235.073	249.719	249.719

Table 23: Comparative static effects in percent of incepting goods and services preferences

Country	GDP in %	EV in %	Net labor flow between sectors into (+)/out(-) Goods in %	Serivces in %	Goods trade Intra in %	Inter in %	Services trade Intra in %	Inter in %
Austria	0.000	0.173	0.000	0.000	-0.005	26.409	-1.304	208.439
Belgium-Luxembourg	2.478	2.642	0.025	-0.013	-31.792	11.911	-1.658	169.900
Czech Republic	-2.917	0.039	0.003	-0.002	-2.967	56.829	-3.293	255.593
Denmark	0.211	1.289	-0.005	0.003	-11.080	24.943	-3.980	206.860
Finland	-0.205	0.672	0.003	-0.002	-6.708	29.330	-2.109	210.984
France	0.047	0.350	-0.014	0.006	-5.481	24.678	-0.258	209.613
Hungary	-3.756	0.054	0.004	-0.003	-3.777	67.004	-4.259	270.774
Ireland	2.245	3.823	0.146	-0.096	-23.583	27.157	-16.065	151.199
Italy	-0.053	0.226	-0.005	0.003	-2.758	26.481	-0.478	210.039
Netherlands	0.205	0.997	-0.001	0.000	-11.103	25.536	-2.145	205.710
Poland	-3.740	0.010	0.001	-0.001	-3.745	66.290	-3.834	271.312
Portugal	-1.756	0.093	0.003	-0.002	-1.899	44.086	-2.425	235.784
Slovak Republic	-3.163	0.033	0.003	-0.001	-3.200	59.696	-3.419	260.350
Spain	0.019	0.222	-0.005	0.003	-1.708	25.792	-0.770	209.034
Sweden	-0.012	0.979	0.001	-0.001	-8.852	27.557	-3.104	208.693
United Kingdom	-0.561	0.340	0.000	0.000	-3.189	31.921	-1.910	217.120
Average	-0.685	0.746	0.010	-0.007	-7.615	35.976	-3.188	218.838

Table 24: Heterogeneity of comparative static effects in percent of incepting goods and services preferences across countries on their bilateral trade flows

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	8.508	8.508	13.987	31.758	35.682	44.423	44.423
Belgium-Luxembourg	-5.514	-5.514	-0.387	15.268	21.358	27.203	27.203
Czech Republic	32.523	32.523	39.215	61.671	70.213	78.411	78.411
Denmark	6.480	6.480	11.857	29.296	36.764	43.351	43.351
Finland	10.316	10.316	15.886	33.953	41.690	48.514	48.514
France	6.703	6.703	12.091	29.566	33.425	43.650	43.650
Hungary	41.186	41.186	48.772	71.488	80.548	89.243	89.243
Ireland	7.274	7.274	13.534	30.869	37.783	44.419	44.419
Italy	8.352	8.352	13.823	31.568	35.486	45.870	45.870
Netherlands	6.950	6.950	12.351	30.474	37.368	43.983	43.983
Poland	40.002	40.002	48.172	70.796	79.820	88.480	88.480
Portugal	22.449	22.449	28.633	49.383	57.275	64.849	64.849
Slovak Republic	34.789	34.789	42.655	64.436	73.124	81.462	81.462
Spain	7.884	7.884	13.332	31.001	34.902	45.241	45.241
Sweden	8.736	8.736	14.227	32.036	39.662	46.388	46.388
United Kingdom	12.654	12.654	18.343	36.792	44.130	51.662	51.662
Average	15.581	15.581	21.656	40.647	47.452	55.447	55.447

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	163.437	163.437	181.125	216.603	223.374	263.767	263.767
Belgium-Luxembourg	132.604	132.604	148.221	179.546	185.269	196.352	196.352
Czech Republic	200.744	200.744	241.266	262.393	269.166	315.276	315.276
Denmark	161.711	161.711	179.285	215.359	221.255	261.384	261.384
Finland	165.330	165.330	183.146	218.873	225.697	266.378	266.378
France	164.556	164.556	182.320	217.944	224.459	265.313	265.313
Hungary	213.578	213.578	254.838	276.797	283.834	331.786	331.786
Ireland	115.166	115.166	129.615	158.593	163.880	197.111	197.111
Italy	164.857	164.857	182.647	218.301	224.903	265.727	265.727
Netherlands	161.113	161.113	178.646	213.809	220.520	260.558	260.558
Poland	213.200	213.200	255.413	277.403	284.450	332.483	332.483
Portugal	185.078	185.078	209.023	243.515	249.935	293.644	293.644
Slovak Republic	204.520	204.520	245.564	266.945	273.794	320.494	320.494
Spain	164.004	164.004	181.735	217.279	223.784	264.553	264.553
Sweden	163.331	163.331	181.011	217.308	223.232	263.618	263.618
United Kingdom	170.265	170.265	188.412	225.670	231.748	273.193	273.193
Average	171.468	171.468	195.142	226.646	233.081	273.227	273.227

Appendix D: Comparative statics without unobserved trade costs and assuming balanced trade

Table 25: Comparative static effects in percent of incepting goods preferences, $\phi = \varphi = 1$

Country	GDP in %	EV in %	Net labor flow between sectors into (+)/out(-) Goods in %	Serivces in %	Goods trade Intra in %	Inter in %	Services trade Intra in %	Inter in %
Austria	0.000	2.274	0.059	-0.055	-28.819	9.982	-4.518	-9.472
Belgium-Luxembourg	0.051	1.485	0.110	-0.296	-23.375	14.616	-27.567	-32.829
Czech Republic	-0.283	2.426	0.031	-0.048	-27.222	8.820	-4.415	-7.448
Denmark	-0.239	1.885	0.047	-0.053	-26.025	10.174	-4.615	-8.132
Finland	-0.634	1.877	0.015	-0.016	-24.503	9.468	-1.972	-2.592
France	-1.530	1.255	-0.032	0.011	-24.256	10.961	-1.386	4.647
Hungary	-0.475	2.229	0.012	-0.012	-27.658	8.245	-1.789	-2.971
Ireland	0.328	1.994	0.096	-0.903	-25.862	11.116	-90.041	-90.838
Italy	-2.001	0.897	-0.026	0.013	-16.558	14.835	-1.678	7.426
Netherlands	-0.693	1.757	0.017	-0.010	-26.337	10.428	-1.652	-1.710
Poland	-1.759	1.282	-0.032	0.020	-19.473	12.416	-1.240	6.879
Portugal	-0.642	1.599	0.027	-0.022	-23.513	10.897	-2.289	-3.192
Slovak Republic	0.240	1.831	0.087	-0.401	-27.807	11.038	-38.463	-43.339
Spain	-1.767	1.023	-0.014	0.009	-16.963	14.414	-1.547	5.693
Sweden	-0.938	1.692	-0.001	0.001	-23.972	9.971	-1.207	0.577
United Kingdom	-2.116	0.982	-0.046	0.022	-18.084	13.383	-1.606	9.024
Average	-0.779	1.656	0.022	-0.109	-23.777	11.298	-11.624	-10.517

Table 26: Heterogeneity of comparative static effects in percent of incepting goods preferences across countries on their bilateral trade flows, $\phi = \varphi = 1$

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	4.434	4.434	7.180	9.321	13.434	15.903	15.903
Belgium-Luxembourg	8.579	8.579	11.775	14.150	18.444	21.022	21.022
Czech Republic	3.091	3.091	6.125	8.380	12.458	14.905	14.905
Denmark	4.399	4.399	7.472	9.756	13.885	16.363	16.363
Finland	3.903	3.903	6.961	7.555	13.343	15.809	15.809
France	5.252	5.252	8.350	8.952	14.815	17.314	17.314
Hungary	2.542	2.542	5.568	7.803	11.858	14.293	14.293
Ireland	5.251	5.251	8.483	10.651	14.813	17.312	17.312
Italy	9.365	9.365	12.584	13.209	16.289	21.763	21.763
Netherlands	4.598	4.598	7.811	9.965	14.101	16.584	16.584
Poland	6.961	6.961	10.109	10.721	13.733	19.218	19.218
Portugal	5.259	5.259	8.358	8.959	14.823	17.322	17.322
Slovak Republic	5.013	5.013	8.238	10.401	14.554	17.047	17.047
Spain	8.955	8.955	12.162	12.785	15.854	21.441	21.441
Sweden	4.396	4.396	7.469	8.066	13.820	16.360	16.360
United Kingdom	7.941	7.941	11.119	11.735	14.776	20.311	20.311
Average	5.621	5.621	8.735	10.150	14.437	17.685	17.685

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	-17.517	-17.517	-14.788	-8.621	-6.027	-1.788	-1.788
Belgium-Luxembourg	-38.708	-38.708	-36.681	-32.098	-30.170	-27.020	-27.020
Czech Republic	-15.788	-15.788	-13.002	-6.705	-2.871	0.271	0.271
Denmark	-16.382	-16.382	-13.616	-7.364	-3.675	-0.437	-0.437
Finland	-11.516	-11.516	-8.588	-1.702	2.056	5.358	5.358
France	-5.320	-5.320	-1.207	5.182	9.202	12.735	12.735
Hungary	-11.828	-11.828	-8.911	-2.318	1.696	4.986	4.986
Ireland	-91.636	-91.636	-91.359	-90.734	-90.471	-90.049	-90.049
Italy	-2.972	-2.972	2.065	7.791	11.911	15.532	15.532
Netherlands	-10.747	-10.747	-7.794	-0.847	2.943	6.274	6.274
Poland	-3.412	-3.412	1.602	7.302	11.403	15.007	15.007
Portugal	-12.044	-12.044	-9.134	-2.558	1.447	4.729	4.729
Slovak Republic	-48.273	-48.273	-46.562	-42.694	-41.068	-38.409	-38.409
Spain	-4.439	-4.439	0.521	6.160	10.219	13.784	13.784
Sweden	-8.775	-8.775	-5.757	1.343	5.218	8.622	8.622
United Kingdom	-0.294	-0.294	3.501	9.307	13.486	17.157	17.157
Average	-18.728	-18.728	-15.607	-9.910	-6.544	-3.328	-3.328

Table 27: Comparative static effects in percent of incepting services preferences, $\phi = \varphi = 1$

Country	GDP in %	EV in %	Net labor flow between sectors into (+)/out(-) Goods in %	Serivces in %	Goods trade Intra in %	Inter in %	Services trade Intra in %	Inter in %
Austria	0.000	4.421	0.113	-0.096	3.373	10.829	-32.699	155.668
Belgium-Luxembourg	0.378	3.638	0.680	-0.632	60.334	62.529	-70.649	1.659
Czech Republic	-0.017	2.544	0.191	-0.214	12.865	18.545	-34.707	121.139
Denmark	0.119	2.399	0.264	-0.206	20.718	24.510	-31.986	121.305
Finland	-0.075	2.061	0.129	-0.111	8.525	12.703	-23.127	149.958
France	0.649	1.972	-0.183	0.077	-15.666	-22.932	-5.718	192.295
Hungary	-0.099	3.295	0.072	-0.064	0.365	7.443	-25.606	165.072
Ireland	0.520	2.123	0.766	-0.979	68.532	69.158	-98.127	-94.191
Italy	0.681	1.152	-0.075	0.042	-4.677	-12.926	-4.424	181.352
Netherlands	0.253	3.040	-0.020	0.012	-5.748	-4.387	-16.885	181.093
Poland	0.032	1.676	-0.098	0.070	-10.115	-10.801	-6.216	199.172
Portugal	0.440	1.453	0.129	-0.087	10.379	8.583	-16.645	149.402
Slovak Republic	-0.137	4.691	0.657	-0.768	56.280	66.423	-82.867	-33.996
Spain	0.584	1.163	-0.032	0.021	-1.863	-8.112	-6.330	177.001
Sweden	-0.011	2.241	0.008	-0.006	-1.918	0.118	-15.189	179.059
United Kingdom	0.610	1.543	-0.138	0.077	-11.571	-18.352	-4.015	192.397
Average	0.245	2.463	0.154	-0.179	11.863	12.708	-29.699	127.399

Table 28: Heterogeneity of comparative static effects in percent of incepting services preferences across countries on their bilateral trade flows, $\phi = \varphi = 1$

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	3.518	3.518	6.691	8.964	16.045	20.107	20.107
Belgium-Luxembourg	52.106	52.106	55.490	60.224	70.753	76.729	76.729
Czech Republic	10.704	10.704	14.258	16.692	24.276	28.625	28.625
Denmark	16.401	16.401	18.991	22.698	30.671	35.245	35.245
Finland	5.319	5.319	7.837	11.016	18.231	22.369	22.369
France	-27.388	-27.388	-25.772	-23.513	-21.437	-15.633	-15.633
Hungary	0.223	0.223	3.441	5.645	12.510	16.448	16.448
Ireland	58.407	58.407	61.931	66.861	77.827	84.050	84.050
Italy	-17.958	-17.958	-16.133	-13.580	-11.235	-4.714	-4.714
Netherlands	-10.523	-10.523	-8.533	-5.683	0.446	3.962	3.962
Poland	-16.411	-16.411	-14.551	-11.949	-6.163	-2.879	-2.879
Portugal	1.810	1.810	4.075	7.244	14.066	18.291	18.291
Slovak Republic	55.288	55.288	60.272	63.688	74.325	80.426	80.426
Spain	-13.566	-13.566	-11.643	-8.953	-6.483	0.426	0.426
Sweden	-6.343	-6.343	-4.259	-1.277	5.139	8.819	8.819
United Kingdom	-23.127	-23.127	-21.417	-19.024	-16.827	-10.683	-10.683
Average	5.529	5.529	8.167	11.191	17.634	22.599	22.599

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	116.914	116.914	145.016	154.488	169.394	179.263	179.263
Belgium-Luxembourg	-13.298	-13.298	-2.066	1.721	7.679	11.623	11.623
Czech Republic	88.856	88.856	109.987	121.570	134.546	143.140	143.140
Denmark	89.465	89.465	110.593	122.283	135.302	143.926	143.926
Finland	114.005	114.005	137.868	150.906	165.780	175.515	175.515
France	151.016	151.016	179.010	194.306	211.728	223.170	223.170
Hungary	125.700	125.700	154.939	164.796	180.304	190.570	190.570
Ireland	-95.011	-95.011	-94.455	-94.151	-93.804	-93.578	-93.578
Italy	142.465	142.465	169.501	184.279	197.415	210.835	210.835
Netherlands	140.078	140.078	166.851	181.663	198.161	209.084	209.084
Poland	156.449	156.449	185.048	200.671	218.493	230.162	230.162
Portugal	114.697	114.697	138.628	151.711	163.347	176.406	176.406
Slovak Republic	-43.296	-43.296	-36.794	-34.350	-30.506	-27.959	-27.959
Spain	138.634	138.634	165.253	179.793	192.724	207.234	207.234
Sweden	138.741	138.741	165.368	180.098	196.501	207.358	207.358
United Kingdom	151.396	151.396	179.433	194.750	208.375	223.656	223.656
Average	94.801	94.801	117.136	128.408	140.965	150.650	150.650

Table 29: Comparative static effects in percent of incepting goods and services preferences, $\phi = \varphi = 1$

			Net labor flow between sectors into (+)/out(-)		Goods trade		Services trade	
Country	GDP in %	EV in %	Goods in %	Serivces in %	Intra in %	Inter in %	Intra in %	Inter in %
Austria	0.000	6.858	0.135	-0.111	-28.667	17.428	-33.584	140.668
Belgium-Luxembourg	0.474	5.643	0.750	-0.646	12.383	74.828	-71.470	-6.716
Czech Republic	-0.297	5.119	0.203	-0.222	-19.804	26.573	-35.472	112.188
Denmark	-0.121	4.480	0.283	-0.215	-14.188	33.283	-32.754	111.741
Finland	-0.735	4.026	0.133	-0.114	-19.255	22.514	-23.861	146.231
France	-0.684	3.122	-0.188	0.080	-33.896	-13.338	-6.963	199.382
Hungary	-0.580	5.534	0.077	-0.067	-27.398	15.578	-26.287	158.723
Ireland	0.869	4.587	0.840	-0.980	14.554	79.115	-98.201	-94.808
Italy	-1.193	1.994	-0.082	0.046	-19.238	1.029	-6.121	196.639
Netherlands	-0.402	4.789	-0.015	0.009	-30.621	4.088	-17.675	176.877
Poland	-1.637	2.815	-0.105	0.076	-25.397	2.179	-7.663	212.828
Portugal	-0.243	3.163	0.137	-0.092	-17.716	18.566	-17.492	145.572
Slovak Republic	0.138	6.952	0.723	-0.778	6.595	76.666	-83.442	-40.371
Spain	-1.125	2.158	-0.037	0.024	-17.913	5.801	-7.855	189.300
Sweden	-0.939	3.919	0.007	-0.005	-25.137	10.228	-16.042	179.643
United Kingdom	-1.347	2.378	-0.147	0.084	-24.760	-5.076	-5.764	210.192
Average	-0.489	4.221	0.170	-0.182	-16.904	23.091	-30.665	127.380

Table 30: Heterogeneity of comparative static effects in percent of incepting goods and services preferences across countries on their bilateral trade flows, $\phi = \varphi = 1$

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	3.546	3.700	3.546	9.523	13.726	27.721	34.755
Belgium-Luxembourg	54.661	54.664	54.661	62.316	69.868	90.771	101.277
Czech Republic	11.878	11.917	11.878	18.336	22.878	37.999	45.599
Denmark	17.920	17.372	17.920	23.756	29.513	45.451	53.461
Finland	8.543	-22.062	8.543	13.915	19.215	33.885	41.258
France	-22.491	1.556	-22.491	-18.655	-15.768	-8.364	0.870
Hungary	2.108	-9.232	2.108	8.002	12.148	25.948	32.884
Ireland	58.406	-7.902	58.406	66.448	73.981	95.390	106.151
Italy	-9.342	-8.847	-9.342	-4.855	-1.478	7.182	17.057
Netherlands	-7.719	5.032	-7.719	-3.151	0.287	13.827	20.096
Poland	-8.884	57.130	-8.884	-4.374	-0.980	11.127	18.579
Portugal	5.381	-5.179	5.381	10.597	14.522	29.985	37.143
Slovak Republic	56.719	-2.592	56.719	64.711	71.033	92.079	102.658
Spain	-5.262	7.934	-5.262	-0.573	2.956	12.006	23.293
Sweden	-2.163	-14.584	-2.163	2.680	6.325	20.680	27.326
United Kingdom	-14.873	57.943	-14.873	-10.660	-7.488	0.643	10.785
Average	9.277	9.178	9.277	14.876	19.421	33.521	42.075

	Heterogeneity of international services trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	118.186	118.186	133.225	138.938	147.314	168.396	168.396
Belgium-Luxembourg	-15.405	-15.405	-9.719	-7.315	-3.552	4.668	4.668
Czech Republic	92.355	92.355	105.284	111.879	119.310	138.001	138.001
Denmark	92.478	92.478	105.415	110.888	117.987	138.156	138.156
Finland	123.449	123.449	138.467	144.820	154.758	176.477	176.477
France	171.770	171.770	190.036	197.760	209.852	236.261	236.261
Hungary	133.621	133.621	151.184	157.335	166.356	189.057	189.057
Ireland	-95.252	-95.252	-94.933	-94.798	-94.623	-94.290	-94.290
Italy	169.593	169.593	187.714	195.379	206.077	233.558	233.558
Netherlands	150.650	150.650	168.112	176.094	185.771	210.127	210.127
Poland	183.070	183.070	204.347	211.807	222.735	250.248	250.248
Portugal	124.062	124.062	139.133	145.491	153.764	177.236	177.236
Slovak Republic	-46.236	-46.236	-42.195	-40.779	-38.702	-33.477	-33.477
Spain	163.034	163.034	180.708	188.191	197.888	225.447	225.447
Sweden	153.308	153.308	170.330	179.020	188.797	213.420	213.420
United Kingdom	181.184	181.184	200.082	209.724	220.581	247.905	247.905
Average	106.242	106.242	120.449	126.527	134.644	155.074	155.074

Appendix E: Comparative statics assuming a one-sector (goods-only) economy

Table 31: Comparative static effects in percent of incepting goods preferences in the one-sector economy accounting for trade imbalances

Country	GDP in %	EV in %	Intra in %	Inter in %
Austria	0.000	-0.061	0.406	296.062
Belgium-Luxembourg	16.665	6.565	-22.029	37.658
Czech Republic	18.754	0.172	18.550	17.497
Denmark	14.432	1.968	0.822	55.398
Finland	14.111	1.371	4.206	58.192
France	13.598	0.578	8.972	62.867
Hungary	18.243	0.119	18.077	21.308
Ireland	16.849	6.820	-23.980	36.327
Italy	13.602	0.418	10.666	62.655
Netherlands	14.455	1.981	1.263	55.137
Poland	10.949	-0.002	10.920	92.226
Portugal	8.287	-0.064	8.184	128.170
Slovak Republic	22.494	0.189	22.491	-6.986
Spain	13.022	0.196	11.089	68.636
Sweden	14.305	1.739	2.121	56.501
United Kingdom	13.623	0.415	10.590	62.454
Average	13.962	1.400	5.147	69.006

Table 32: Heterogeneity of comparative static effects in percent of incepting goods preferences across countries on their bilateral trade flows in the one-sector economy accounting for trade imbalances

	Heterogeneity of international goods trade changes in % by country						
Country	Minimum	2.50%	25%	50%	75%	97.50%	Maximum
Austria	168.699	168.699	233.381	267.005	278.459	592.017	592.017
Belgium-Luxembourg	-47.503	-47.503	19.318	31.353	35.452	147.675	147.675
Czech Republic	-53.361	-53.361	1.643	15.695	19.821	120.036	120.036
Denmark	-40.287	-40.287	30.138	49.408	54.071	181.720	181.720
Finland	-39.158	-39.158	32.598	50.929	56.983	187.046	187.046
France	-37.301	-37.301	36.646	55.537	61.776	195.809	195.809
Hungary	-52.001	-52.001	4.609	19.071	23.317	126.456	126.456
Ireland	-48.053	-48.053	18.068	29.977	34.033	145.082	145.082
Italy	-37.318	-37.318	36.609	55.494	61.102	195.728	195.728
Netherlands	-40.366	-40.366	29.966	49.210	53.867	181.347	181.347
Poland	-26.621	-26.621	64.660	83.601	89.331	246.194	246.194
Portugal	-13.726	-13.726	96.087	115.864	122.601	307.029	307.029
Slovak Republic	-62.071	-62.071	-17.339	-5.911	-2.556	40.843	40.843
Spain	-35.141	-35.141	41.353	60.894	67.348	205.998	205.998
Sweden	-39.843	-39.843	31.106	50.520	55.217	183.816	183.816
United Kingdom	-37.393	-37.393	36.445	55.307	60.846	195.373	195.373
Average	-27.590	-27.590	43.455	61.497	66.979	203.260	203.260