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Does the Home Bias Explain Missing Trade in Factors?

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Abstract

It is now widely accepted that when controlling for international differences in production techniques, the predictions from the Heckscher-Ohlin-Vanek (HOV) theorem are largely satisfied. However, a large amount of 'missing trade' remains. This paper makes two main contributions: Firstly, the HOV is tested for various production factors including labour by educational attainment levels (high, medium, low) and capital. Secondly, the paper allows for a more general structure of final consumption in the HOV framework with technology differences, which reduces the amount of missing trade. We test for the effects of non-homothetic preferences, home bias of consumption and the role of distance at the country and industry level. We discuss how this can be tackled in the analytical framework both for a country's total exports but also in a bilateral way. Results are shown both for total trade and bilateral trade. Empirically we draw on the recently released World Input-Output Database (WIOD) and show the extent of reductions in 'missing trade' caused by the various assumptions and restrictions on demand structures.

Keywords: factor content of trade, Heckscher-Ohlin-Vanek, home bias, non-homothetic tastes, technology

JEL classification: F1, F15, F19

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1. Introduction

It is now widely accepted that when controlling for international differences in production techniques the predictions of the Heckscher-Ohlin-Vanek (HOV) theorem are largely satisfied (Trefler, 1993, 1995; Davis and Weinstein, 2001; Reimer, 2006; Trefler and Zhu, 2010; Nishioka, 2012). However, there still remains a large amount of 'missing trade', i.e. predicted flows of factors are much larger than the measured ones. Further, most of the recent papers tested the HOV with only one factor, an exception being Nishioka (2012) which included both capital and labor. There is of course an older literature including many more factors (for an overview see Foster and Stehrer, 2010).

The contribution of this paper is therefore twofold: Firstly, the HOV is tested for various production factors including labor by educational attainment levels (high, medium, low) and capital. Secondly, since technology differences are accounted for, 'missing trade' is caused by an imperfect modeling of demand structures. This paper thus allows for a more general structure of final consumption in the HOV framework with technology differences and shows the extent to which various assumptions on demand structures reduce the difference between actual and predicted flows of factor services. In particular, we test for the effects of non-homothetic preferences, home-bias of consumption, and the relevance of distance at the country and industry level. We discuss how this can be tackled in the analytical framework both for a country's total exports but also in a bilateral way as suggested by Hakura (2001). Empirically we draw on the recently released World Input-Output Database (WIOD) and show the extent of the reduction in missing trade due the various assumptions on demand structures.

The analysis requires data on output and the use of intermediates and production factors by industry. In this section we provide information on a recently constructed database, the World Input-Output Database (WIOD), that is used to study the value added and factor content of trade (see www.wiod.org). This is derived from national supply and use or input-output tables which are combined with detailed trade data resulting in a World Input-Output Table (WIOT). At the industry level the data are combined with further information obtained from Socio-Economic Accounts (SEAs) data. The WIOTs are therefore a combination of national input-output tables in which the use of products is broken down according to their country of origin, national supply and use tables and detailed trade data. The information is collected on an annual basis from 1995 to 2009 for 59 products and 35 industries. The industry classification follows the ISIC Rev. 3 classification for non-EU countries, which is compatible with NACE Rev. 1.1 used for EU countries. The data cover 40 countries (the 27 EU member states, Turkey, Canada, USA and Mexico, Japan, Korea, Taiwan, Australia, Brazil, Russia, India, Indonesia, and China) which account for about 85 percent of world GDP. The variables from the SEAs include gross output and value added, final demand expenditures, as well as employment by educational attainment, and capital compensation. A detailed description of the data is provided by Timmer (2012).

The paper proceeds as follows. Section 2 introduces the framework as suggested by Trefler and Zhu (2010) to test the HOV model with technology differences and traded intermediates. This framework is extended to allow for non-homothetic preferences and for non-proportional expenditure structures of final demand across countries. In a second step the extension to a bilateral test of the HOV model following Hakura (2001) is discussed. In Secion 4, the theory is tested for various inputs (capital, high, medium and low-skilled labor) using various tests. Particular emphasis is given to a regression based test showing which assumption on expenditure structures reduces the amount of missing trade. Section 5 concludes.

2. The factor content of trade with traded intermediates

In the calculations of the factor content of trade we follow the recent literature that includes the international flows of intermediates in the factor content calculations. There has been a long debate on how to incorporate traded intermediates into the Heckscher-Ohlin-Vanek framework starting with Staiger (1986) and Deardorff (1982). Recently this was discussed particularly by Reimer (2006) and was more recently tackled by Trefler and Zhu (2010) and Nishioka (2012). We outline the latter approach in this section and also discuss our approach to allow for different consumption patterns. This was emphasized in Linder (1961) and more recently in Markusen (1986), Maskus (1985), Maskus and Nishioka (2009), and Nishioka (2010). Staiger et al. (1987) tested for effects of trade barriers but found no significant improvements in terms of model predictions.

2.1. Methodological aspects

The calculation of the factor content of trade starts from the international input-output table and the corresponding coefficient matrix denoted by $\mathbf{A}$ which is of dimension $NG \times NG$ where N denotes the number of countries and G is the number of industries. As the WIOD data include $N = 41$ countries and $G = 35$ industries the dimension of this matrix is 1435×1435. Using the corresponding data on inputs (i.e. capital, low, medium and high educated workers) one obtains a direct input coefficient matrix for each of these four factors by country and industry denoted by $\mathbf{D}$. $\mathbf{D}$ is of dimension $F \times NG$ with F being the number of factors considered. We denote a specific row of this matrix by $\mathbf{d}_f$ which is of dimension $1 \times NG$.

The direct plus indirect input coefficients matrix is given by pre-multiplying the Leontief inverse $(\mathbf{I}-\mathbf{A})^{-1}$ by the direct input coefficients matrix, i.e. $\mathbf{b}_f = \mathbf{d}_f(\mathbf{I}-\mathbf{A})^{-1}$ which is again of dimension $1 \times NG$. Following Trefler and Zhu (2010) the trade vector for country r, $\mathbf{t}^r$, which is of dimension $NG \times 1$, has negative entries for bilateral imports and positive entries for country r's total exports. Thus, for each country the trade vector is of dimension $NG \times 1$. As argued in Trefler and Zhu (2010) and Deardorff (1982) the proper measure of the factor content of trade when intermediates are traded is given by $t_f^r = \mathbf{d}_f \mathbf{t}^r$ which is the the 'Vanek-consistent' definition of the factor content of country r's trade, i.e. $t_f^r = V_f^r - s^r V_f$ where V_f^r is the country specific endowment of country r with factor f and $V_f = \sum_r V_f^r$ denotes world endowments of factor f. The share s_r is measured as gross domestic product less the value of the trade balance, divided by world gross domestic product. Trefler and Zhu (2010) argue that former contributions (with the exception of Reimer, 2006) suffer from being either incompatible with the Vanek-relevant definition of the factor content of trade or are not economically meaningful.

For notational convenience we now skip the subscript f denoting the factor of production under consideration. Country r's consumption vector is denoted by $\mathbf{f}^r$ is which is of dimension $NG \times 1$. Each element of this vector shows final demand of country r for product i from country s, i.e. $\mathbf{f}^r = [f_i^{sr}]_{i=1,\dots,N}^{s=1,\dots,C}$. Summing up over all countries r gives world demand for product i from country s; formally, $\mathbf{f} = \sum_p \mathbf{f}^p$ with a typical element being $f_i^s = \sum_{p=1,\dots,C} f_i^{sp}$. A necessary and sufficient condition for a Vanek prediction is $\mathbf{bf}^r = s^r\mathbf{bf}$, which is referred to as 'strong consumption similarity' (SCS) and implies (i) homothetic preferences across countries and (ii) that a country consumes a proportion s^r of the final goods produced by every country (as in monopolistic competition models with taste for varieties or models with homothetic preferences and complete specialization in production for example). In particular, the Vanek prediction holds when allowing for technology differences across countries as is assumed throughout this paper. This can be compared to the standard HOV model, which assumes the same techniques across countries. In this case the sufficient condition implies homothetic preferences and that country r's consumption of goods is proportional to world consumption of that good without specifying where the good is produced. A more restrictive assumption on technology therefore allows for a weaker form of consumption similarity.[1]

[1]When restricting technology (e.g. to US technology) only 'weak consumption similarity' has to hold to assure Vanek consistency. Restricting technology in such a way however results in a poor performance of the HOV model as documented in the other contributions (see e.g. Davis and Weinstein, 2001; Nishioka, 2012).

2.2. Imposing stronger restrictions on consumption

As shown in Trefler and Zhu (2010) the HOV model works well when allowing for technology differences though there remains a significant amount of "missing trade", i.e. that actual trade flows are much lower than the predicted flows. Various explanations have been put forward to explain this 'missing trade', examples including a home bias of consumption, trade barriers, transport costs and so on. Of the various tests for missing trade the simplest one would be to regress the measured factor content of trade (FCT) on the predicted one. A coefficient close to one would indicate that there is little missing trade and that trade flows in factor services are well explained. Since technology differences are already taken into account in this framework, the missing trade that exists results from an improper specification of consumption patterns. Trefler and Zhu (2010) account for missing trade by imposing consumption similarity for various industries (Agriculture, Food, Government, Construction). They show that this improves the predictive power of the model significantly showing up in a slope coefficient of 0.94 when imposing consumption similarity for all four sectors. Other papers like Cassing and Nishioka (2010) introduce a vector of deviations of predicted from actual patterns of trade flows in final goods to account for missing trade.

In this paper a different route is taken by imposing some more structure on the SCS condition. The equation (for each individual factor) to be tested can be written as

$$t^{r,\text{Measured}} = \mathbf{bt}^r = \mathbf{bf}^r - s^r\mathbf{bf} = V^r - s^r V = t^{r,\text{Predicted}}$$

The predicted factor content of trade can be rewritten as

$$t^{r,\text{Predicted}} = V^r - s^r\mathbf{bf} = V^r - \mathbf{b}s^r\mathbf{f} = V^r - \mathbf{bS}^r\mathbf{f}$$

with $\mathbf{S}^r = s^r\mathbf{I}_{NC}$, i.e. a matrix with $s^r = \sum_{p,i} f_i^{pr} / \sum_{p,r,i} f_i^{pr}$, or in words country r's share in total world consumption, as diagonal elements and zeros otherwise. This reformulation is used to impose different structures on the consumption patterns by specifying the share matrix $\mathbf{S}$ accordingly. Here one has to make sure that the full employment constraint at the world level holds, i.e. $V = \sum_r \mathbf{bS}^r\mathbf{f} = \mathbf{b}\sum_r \mathbf{S}^r\mathbf{f}$. This can be violated if the sum of all countries hypothetical demand for good i of a specific country does not equal the empirical sum of expenditures. We refer to this as a violation of the WFEC ('world full employment condition'). For these cases we also calculate results when row-normalizing the hypothetical expenditures, thus $\tilde{\hat{f}}_i^{pr} = \hat{f}_i^{pr}\frac{\sum_r f_i^{pr}}{\sum_r \hat{f}_i^{pr}}$ where $\hat{f}_i^{pr}$ denotes hypothetical final demand.

Let us denote total world expenditures on final goods by $E = \sum_{i,p,r} f_i^{pr}$. In the SCS case a typical element of matrix $\mathbf{S}^r$ can be written as

$$s_i^{rp} = \frac{\sum_{i,s} f_i^{s1}}{E} \frac{\sum_{t,s} f_i^{ts}}{E} \frac{\sum_s f_i^{ps}}{\sum_{t,s} f_i^{ts}} = s^r \alpha_i \gamma_i^p \tag{1}$$

where s_i^{rp} denotes the share of country r's expenditures on good i in country p. The first term denotes country r's share in total consumption, s^r. The second term, α_i is the ratio of total expenditures on product i to total expenditures and thus imposes homothetic preferences (which are a weighted average over all countries' final demand patterns). The third term is the expenditure share country p attracts from all spending on good i. To show that this formulation is equivalent to the SCS formulation the expression can be simplified to $s_i^{rp} = s^r \frac{\sum_s f_i^{ps}}{E}$. Multiplying this expression with total expenditures E yields $\hat{f}_i^{pr} = s^r \sum_s f_i^{ps} = s^r f_i^{p*}$ which is a typical element of $\mathbf{S}^r\mathbf{f}$.

This formulation is now used to impose some structure on consumption patterns deviating from the "strong consumption similarity assumption". First, the assumption of homothetic preferences across countries is relaxed while still keeping the assumption of proportional consumption across countries. Non-homothetic preferences arise due to differences in income per capita for example (Linder, 1961; Maskus, 1985, as emphasized by). Figure 1 shows a box-plot of expenditure shares on final goods by country and industry. As one can see, these shares differ widely across countries. Particularly strong differences are found for agriculture (AtB) with countries like India, China, Romania and Bulgaria showing large shares, food and beverages (15t16), construction (F) which also includes investment categories, and education (L) with high shares for US, Canada, Taiwan and Brazil.

Formally, allowing for non-homogenous preferences the share matrix for each country has typical elements

$$s_i^{rp} = \frac{\sum_{i,s} f_i^{sr}}{E} \frac{\sum_t f_i^{tr}}{\sum_{t,i} f_i^{tr}} \frac{\sum_s f_i^{ps}}{\sum_{t,s} f_i^{ts}} = s^r \alpha_i^r \gamma_i^p \tag{2}$$

Compared to the SCS formulation, the second term is replaced by country specific expenditure shares across products. Simplifying and multiplying with world expenditures E gives $\hat{f}_i^{pr} = \frac{\sum_t f_i^{tr}}{\sum_{t,s} f_i^{ts}} \sum_s f_i^{ps}$, i.e. the share of country r's expenditures in world expenditure on good i multiplied by expenditures demand for good i in country r. This still satisfies the requirement that it sums up to actual expenditures on final goods i of country p as $\sum_r \hat{f}_i^{pr} = \sum_r \left(\frac{\sum_t f_i^{tr}}{\sum_{t,s} f_i^{ts}} \sum_s f_i^{ps} \right) = \sum_s f_i^{ps}$, i.e. the WFEC is satisfied. As a second step, assumption (ii) above - the assumption that a country spends the same share on each country - can be relaxed by imposing the empirical expenditure patterns at the country level. This would allow for the role of geographical proximity for example (that distance matters with countries being geographically closer to each other trading more). This formulation still imposes the assumption that expenditure shares across

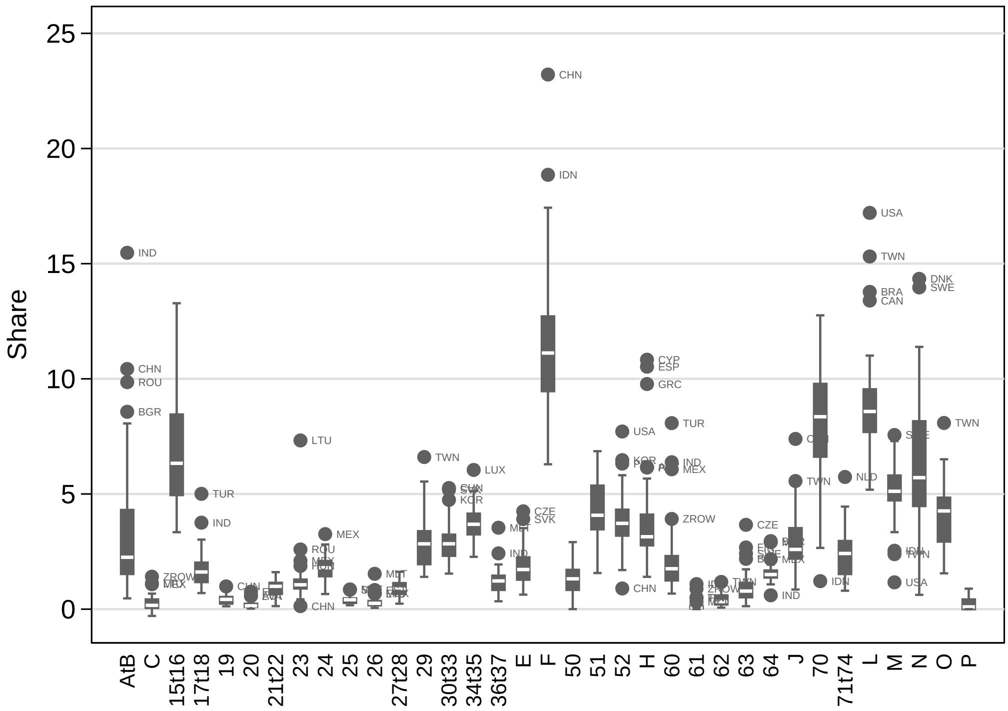

Figure 1: Expenditure shares by country and industry (average over years)

countries are identical for each product (these country-industry specific sourcing patterns are discussed below). Assuming again homothetic preferences the typical share becomes

$$s_i^{rp} = \frac{\sum_{i,s} f_i^{sr}}{E} \frac{\sum_{t,s} f_i^{ts}}{E} \frac{\sum_i f_i^{pr}}{\sum_{i,t} f_i^{tr}} = s^r \alpha_i \gamma^{rp} \tag{3}$$

Simplifying and multiplying with E gives

$$\hat{f}_i^{pr} = \alpha_i \sum_i f_i^{pr}$$

i.e. the expenditure share on product i times total expenditures of country r in p. Adding up over all countries r shows that the WFEC is not met, $\sum_r \hat{f}_i^{pr} = \alpha_i \sum_{i,r} f_i^{pr} \neq \sum_r f_i^{pr}$.

Relaxing in this case the assumption of homothetic preferences and introducing country-specific final demand patterns yields

$$s_i^{rp} = \frac{\sum_{i,s} f_i^{sr}}{E} \frac{\sum_t f_i^{tr}}{\sum_{t,i} f_i^{tr}} \frac{\sum_i f_i^{pr}}{\sum_{i,t} f_i^{tr}} = s^r \alpha_i^r \gamma^{rp} \tag{4}$$

Simplifying and multiplying with E gives

$$\hat{f}_i^{pr} = \alpha_i^r \sum_i f_i^{pr}$$

i.e. the expenditure share on product i times total expenditures of country r in p. Adding up over all countries r shows that again the WFEC is violated as $\sum_r \hat{f}_i^{pr} = \alpha_i^r \sum_{i,r} f_i^{pr} \neq \sum_r f_i^{pr}$.

Similarly, sticking again to assumption (i) of homothetic preferences but now allowing for country and country-industry specific trade patterns results in the following demand structures:

$$s_i^{rp} = \frac{\sum_{i,s} f_i^{sr}}{E} \frac{\sum_{t,s} f_i^{ts}}{E} \frac{f_i^{pr}}{\sum_t f_i^{tr}} = s^r \alpha_i \gamma_i^{rp} \tag{5}$$

This cannot be simplified, thus

$$\hat{f}_i^{rp} = \frac{\sum_{i,s} f_i^{sr}}{E} \sum_{t,s} f_i^{ts} \frac{f_i^{pr}}{\sum_t f_i^{tr}}$$

Again the WFEC condition is violated.

Finally, one can additionally allow for non-homothetic preferences which results in

$$s_i^{rp} = \frac{\sum_{i,s} f_i^{sr}}{E} \frac{\sum_t f_i^{tr}}{\sum_{t,i} f_i^{tr}} \frac{f_i^{pr}}{\sum_t f_i^{tr}} = s^r \alpha_i^r \gamma_i^{rp} \tag{6}$$

This simplifies to $s_i^{rp} = f_i^{pr}/E$ and thus $\hat{f}_i^{pr} = f_i^{pr}$, i.e. the empirical expenditures.

Further, for each of cases (2)-(5) above a 'home-bias' effect can be modeled which allows for the fact that a country might spend relatively more on its own goods than on goods for other countries. These expenditure shares on domestic products are large and range from about 70% for very small countries up to about 95% for larger countries (see Table 7). We model this for each of the four cases (2)-(5) above by calculating the share of expenditures on the home country and normalize the shares of expenditure on other countries' goods accordingly. Formally, at the country level we calculate the share $h^r = \sum_i f_i^{rr} / \sum_{i,p} f_i^{pr} = \sum_i f_i^{rr}/E^r$ and normalize the sourcing patterns as $\tilde{\gamma}^{rp} = \gamma^{rp}/(1 - h^r)$ such that $\sum_{p \neq r} \tilde{\gamma}^{rp} = 1$. Similarly, this can also be done at the level of industries, i.e. $h_i^r = f_i^{rr} / \sum_p f_i^{pr}$ and $\tilde{\gamma}_i^{rp} = \gamma_i^{rp}/(1-h_i^r)$ such that $\sum_{p \neq r} \tilde{\gamma}_i^{rp} = 1$ for all i. Therefore, for each of the five cases distinguished above we can distinguish three sub-cases; (i) no home-bias, (ii) home-bias at the country level, and (iii) home-bias at the country-industry level.

Summarizing, these cases are listed in Table 1. It is important to note however that not all of these sixteen cases are different. First, imposing country specific sourcing structures automatically implies a home bias at the country level, therefore (3a)=(3b), (4a)=(4b), and (5a)=(5c). Case (5b) is further not useful since a home bias at the country level is modeled whereas country-industry specific patterns would

Table 1 Overview

	Preferences	Home bias	Geographic consumption patterns	
SCS	Homothetic	No	Proportional	$s_i^{rp} = s^r \alpha_i \gamma_i^p$
(2a)	Non-homothetic	No	Proportional	$s_i^{rp} = s^r \alpha_i^r \gamma_i^p$
(2b)	Non-homothetic	Country specific	Proportional	$s_i^{rp} = s^r \alpha_i^r h^r \tilde{\gamma}_i^p$
(2c)	Non-homothetic	Country-industry specific	Proportional	$s_i^{rp} = s^r \alpha_i^r h_i^r \tilde{\gamma}_i^p$
(3a)	Homothetic	No	Country specific	$s_i^{rp} = s^r \alpha_i \gamma^{rp}$
(3b)	Homothetic	Country specific	Country specific	$s_i^{rp} = s^r \alpha_i h^r \tilde{\gamma}^{rp}$
(3c)	Homothetic	Country-industry specific	Country specific	$s_i^{rp} = s^r \alpha_i h_i^r \tilde{\gamma}^{rp}$
(4a)	Non-homothetic	No	Country specific	$s_i^{rp} = s^r \alpha_i^r \gamma^{rp}$
(4b)	Non-homothetic	Country level	Country specific	$s_i^{rp} = s^r \alpha_i^r h^r \tilde{\gamma}^{rp}$
(4c)	Non-homothetic	Country-industry specific	Country specific	$s_i^{rp} = s^r \alpha_i^r h_i^r \tilde{\gamma}^{rp}$
(5a)	Homothetic	No	Country-industry specific	$s_i^{rp} = s^r \alpha_i \gamma_i^{rp}$
(5b)	Homothetic	Country level	Country-industry specific	$s_i^{rp} = s^r \alpha_i h^r \tilde{\gamma}_i^{rp}$
(5c)	Homothetic	Country-industry specific	Country-industry specific	$s_i^{rp} = s^r \alpha_i h_i^r \tilde{\gamma}_i^{rp}$
(6a)	Non-homothetic	No	Country-industry specific	$s_i^{rp} = s^r \alpha_i^r \gamma_i^{rp}$
(6b)	Non-homothetic	Country level	Country-industry specific	$s_i^{rp} = s^r \alpha_i^r h^r \tilde{\gamma}_i^{rp}$
(6c)	Non-homothetic	Country-industry specific	Country-industry specific	$s_i^{rp} = s^r \alpha_i^r h_i^r \tilde{\gamma}_i^{rp}$

be assumed simultaneously. This is similarly the case for (6b). Finally, cases (6a) and (6c) are equal to the empirical patterns of consumption which by definition result in an exact prediction of the factor content of trade. Therefore, for the further empirical application we are left with nine cases only: SCS, (2a), (2b), (2c), (3a)=(3b), (3c), (4a)=(4b), (4c), (5a)=(5c).

One of the caveats of this approach is that the WFEC is not met in many cases as already outlined above. To see whether this is a severe problem we calculate the deviation of the row sum of hypothetical expenditures from the empirical ones and express these as a percentage of total expenditures. Severe deviations are found for case (2b), i.e. non-homothetic preferences, country-specific home bias and proportional sourcing patterns with deviations ranging between minus and plus 20%. Larger values in all cases are found for very small countries. In all other cases the deviation is on average much smaller. Only India shows larger differences (-12%) in cases (3c) and (5a)=(5c), and some smaller countries like Estonia and Malta with differences of up to 8% in these cases. Further checks suggest that these differences are mostly country-specific.[2] We therefore report results using the non-normalized hypothetical structures in the main text and provide some additional tables reporting results using the normalized data in the Appendix.[3]

To further see how close the hypothetical final demands are from the empirical ones we calculate the absolute deviation, $D_i^{pr} = |\hat{f}_i^{pr} - f_i^{pr}|$ and express these in terms of the corresponding total at the country level. In Table 2 we report the results as an average by year. Tables (8) and (9 in the Appendix show the results by country and industry (in all cases as averages over years), respectively.[4] The deviation is rather strong when assuming strong consumption similarity (SCS) and for case (2a) when non-homothetic preferences are allowed for. Introducing a home bias effect but still assuming proportionality over the trading partners (as in case (2b)) markedly reduces the deviation which is further improved when allowing for a country-industry specific home-bias. In cases (3a) and (3c) with homothetic preferences and country specific sourcing structures the deviation is larger when compared with cases (2b) and (2c), i.e. when proportionality and non-homothetic preferences are assumed. When introducing non-homothetic preferences again however (as in cases (4a) and (4c)) the deviation is rather similar to the cases (2b) and (2c). Thus, when allowing for non-homothetic preferences together with country and country-industry specific home bias, the assumption on sourcing structures lead to similar results. The reason for this is that the relative size of trading partners plays a significant role as documented in gravity results. Finally, in case (5a) which differs from (4c) only with respect to preferences the deviation is again much larger.

Thus, allowing for non-homothetic preferences in conjunction with a country or country-industry specific home bias reduces the deviations significantly. It is interesting to note that when allowing for home-bias it is not too important whether to assume proportionality (2b and 2c) or country-specific foreign consumption patterns (4a=4b and 4c). Sticking to the assumption of homothetic preferences results in larger deviations even when modeling country-industry specific foreign sourcing patterns.

3. Testing the Vanek prediction with different consumption patterns

Based on these considerations we show the results of the various empirical tests as used in the literature. Such tests include a sign test, a rank correlation test, and a regression based test, results of which are reported below.

[2] These results are available upon request.

[3] Additionally, as the row-normalization might result in a deviation in the column sums, we also applied a RAS procedure. Results are not significantly different however.

[4] More detailed results are available upon request.

Table 2 - Deviation of final demand by year

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country & industry	Country	Country & industry	Country	Country & industry	Country & industry
Sourcing:	Prop.	Proportional			Country		Country		Country & industry
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
1995	163.0	159.2	19.0	5.0	43.1	34.2	19.7	4.5	31.1
1996	163.4	159.8	19.5	5.1	43.1	34.0	20.2	4.6	30.8
1997	162.5	158.8	19.5	5.2	43.2	33.9	20.3	4.6	30.6
1998	160.6	156.9	20.7	5.4	43.1	33.2	21.5	4.7	29.9
1999	159.2	155.3	20.9	5.5	42.9	33.1	21.7	4.8	29.7
2000	157.3	153.4	21.8	5.7	43.2	32.7	22.6	5.0	29.2
2001	156.5	152.4	21.9	5.6	43.7	33.1	22.8	5.0	29.7
2002	157.0	152.8	22.4	5.7	44.7	33.9	23.3	5.2	30.3
2003	159.2	155.3	23.1	5.7	45.0	33.9	24.0	5.3	30.3
2004	160.5	156.7	23.4	5.9	45.3	34.1	24.3	5.5	30.4
2005	160.6	156.9	23.9	5.9	46.0	34.7	24.8	5.6	31.0
2006	160.9	157.1	24.6	6.1	47.3	35.6	25.6	5.9	31.6
2007	162.3	158.5	25.2	6.2	48.8	36.8	26.3	6.1	32.9
2008	163.1	158.8	25.8	6.2	50.2	38.3	26.9	6.4	34.4
2009	164.2	159.4	22.8	5.4	49.7	41.8	23.8	5.6	38.4

3.1. Sign and rank correlation tests

The sign test calculates the number of cases for which the predicted and the measured factor content have the same sign; i.e. a country abundant in a particular factor - taking into account productivity differences - is expected to be a net exporter of this factor. Results of this simple test are reported in Table 3 for the nine cases outlined above and for each individual production factor. In the SCS case the sign test performs

Table 3 - Sign test (in %), N=41, average over years

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country & industry	Country	Country & industry	Country	Country & industry	Country & industry
Sourcing:	Prop.	Proportional			Country		Country		Country & industry
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Employment	94.8	93.8	95.4	97.1	94.5	93.7	99.0	98.5	93.5
.. High	92.0	92.0	94.0	98.0	82.1	77.9	95.1	99.5	77.4
.. Medium	92.8	92.4	94.8	97.6	92.5	92.4	98.0	99.0	91.7
.. Low	97.7	96.7	98.2	98.7	94.1	93.8	99.3	99.3	93.8
Capital	83.7	84.9	94.8	98.5	87.6	86.2	95.8	99.0	86.3

rather well with values above 90% for the employment categories. The performance is slightly less good for

Table 4 - Correlation, average over years

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country & industry	Country	Country & industry	Country	Country & industry	Country & industry
Sourcing:	Prop.	Proportional			Country		Country		Country & industry
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Correlation coefficients									
Employment	0.979	0.982	0.992	0.998	0.953	0.956	0.995	0.999	0.959
.. High	0.960	0.952	0.985	0.999	0.734	0.579	0.986	1.000	0.581
.. Medium	0.978	0.977	0.996	0.998	0.847	0.804	0.996	1.000	0.806
.. Low	0.974	0.978	0.987	0.997	0.923	0.935	0.991	0.999	0.942
Capital	0.888	0.914	0.986	0.998	0.919	0.908	0.989	1.000	0.909
Rank correlation coefficients									
Employment	0.956	0.947	0.982	0.988	0.967	0.960	0.994	0.994	0.961
.. High	0.952	0.955	0.976	0.994	0.621	0.520	0.983	0.999	0.521
.. Medium	0.960	0.950	0.981	0.994	0.852	0.849	0.993	0.999	0.850
.. Low	0.974	0.941	0.987	0.991	0.956	0.951	0.997	0.998	0.952
Capital	0.831	0.865	0.976	0.995	0.831	0.819	0.983	1.000	0.821

capital showing about 84% of correct signs on average. These shares tend to be higher for the other cases however, with cases (2c) and (4c) ranking top.

Similarly, the correlations and rank correlation tests provides highly significant results as reported in Table 4. The model performs slightly less good with respect to capital inputs (though results are still highly significant). The Spearman rank correlation coefficients are above 0.90 in general and again highest in cases (2c) and (4c). Again these results are in line with those reported in Trefler and Zhu (2010) reporting a rank correlation coefficient of 0.89 for employment in their sample.

3.2. Regression analysis

Thus, the sign and rank correlation tests are not able to distinguish between the success and failures of the differences in modeling demand patterns. As outlined above, a matter of concern is the ”missing trade”, i.e. the predicted factor flows are much larger when compared to the measured ones.

We present the deviations of the predicted from the measured employment content in Figure 2 for four selected strategies (averages over years). The upper left panel shows the case when imposing strong consumption similarity for which the predicted patterns strongly deviate from the measured ones in line with results in other studies like Trefler and Zhu (2010). This is much improved when allowing for non-homothetic preferences and a country-specific home bias but still sticking to the proportionality assumption with respect to foreign sourcing as shown in the upper right panel. The differences can still be reduced when introducing country-industry specific home bias as in the lower left panel.[5] When sticking to the assumption of homothetic preferences but allowing for country-industry specific home bias and foreign sourcing structures differences between actual and predicted trade again increase as shown in the lower right panel.

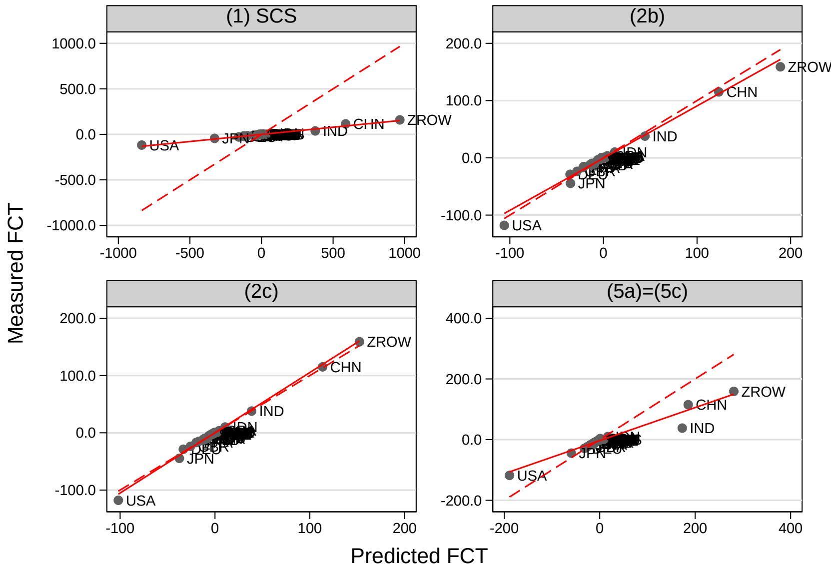

Figure 2: Measured (solid line) versus predicted (dotted line) employment content

A convenient way to test for this missing trade is to run a regression of the measured factor content of trade on the predicted one, i.e.

$$\mathrm{FCT}^{measured,r} = \alpha + \beta\,\mathrm{FCT}^{predicted,r} + \varepsilon^{r}$$

for which a positive slope coefficient on β is expected. The closer this coefficient is to one, the lower is the amount of missing trade.

Table 5 presents the results of ordinary least squares which is the preferred specification as no systematic deviations dependent on country specific effects is expected. The coefficients for all endowment measures are positive and highly significant. The magnitude of the slope coefficients in the model with strong consumption similarity (SCS) is 0.156 for total employment which is similar to those for medium educated

[5] Graphs for cases (4a)=(4b) and (4c) respectively look similar.

Table 5 - (Pooled) OLS results

Preferences:	Homothetic		Non-homothetic		Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country-Ind.	Country	Country-Ind.	Country	Country-Ind.	Country-Ind.
Sourcing:	Proportional		Proportional		Country		Country		Country-ind.
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Employment	0.156***	0.193***	0.915***	1.052***	0.521***	0.554***	0.865***	1.014***	0.546***
s.e.	0.002	0.002	0.005	0.003	0.007	0.007	0.004	0.002	0.007
Const.	-0.002	-0.002	-524.969***	83.717	-4483.148***	-3916.183***	-1360.738***	-729.227***	-3261.637***
s.e.	375.296	362.410	197.729	105.506	479.321	462.854	163.090	61.194	443.186
R^2	0.942	0.946	0.984	0.995	0.907	0.913	0.989	0.998	0.920
High skilled	0.099***	0.104***	0.680***	1.076***	0.340***	0.320***	0.632***	1.005***	0.318***
s.e.	0.001	0.002	0.005	0.002	0.012	0.016	0.005	0.001	0.016
Const.	-0.000	-0.000	61.595***	22.304***	310.928***	300.968***	45.505***	-4.168***	305.558***
s.e.	25.787	27.874	13.965	4.229	51.834	63.456	14.140	1.584	63.412
R^2	0.892	0.874	0.968	0.997	0.582	0.384	0.968	1.000	0.386
Low skilled	0.162***	0.217***	0.947***	1.046***	0.403***	0.416***	0.906***	1.014***	0.414***
s.e.	0.002	0.002	0.006	0.003	0.007	0.007	0.005	0.002	0.006
Const.	-0.001	-0.001	-927.407***	30.922	-4018.341***	-3616.565***	-1439.388***	-532.824***	-3296.781***
s.e.	247.994	235.618	152.226	72.453	380.974	351.976	126.598	45.611	331.179
R^2	0.932	0.938	0.974	0.994	0.844	0.866	0.982	0.998	0.881
Medium skilled	0.154***	0.171***	0.894***	1.059***	0.630***	0.683***	0.834***	1.013***	0.665***
s.e.	0.002	0.002	0.003	0.003	0.015	0.018	0.003	0.001	0.018
Const.	-0.001	-0.001	281.330***	31.011	286.338	475.740	-46.130	-192.347***	679.213**
s.e.	134.098	139.903	50.025	32.927	269.860	300.003	47.494	17.182	298.711
R^2	0.939	0.934	0.992	0.996	0.754	0.696	0.992	0.999	0.699
Capital	0.144***	0.162***	0.925***	0.987***	0.528***	0.527***	0.897***	0.996***	0.531***
s.e.	0.004	0.004	0.007	0.003	0.008	0.009	0.006	0.000	0.009
Const.	-0.043	-0.044	-10289.257***	3064.580***	29629.092***	29195.689***	4249.855**	2052.038***	27787.227***
s.e.	6311.808	5707.205	2086.502	767.304	4232.826	4523.979	1771.509	134.116	4497.910
R^2	0.696	0.752	0.967	0.996	0.865	0.846	0.976	1.000	0.848

Table 6 - Fixed and random effects results

Preferences:	Homothetic		Non-homothetic		Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country-Ind.	Country	Country-Ind.	Country	Country-Ind.	Country-Ind.
Sourcing:	Proportional		Proportional		Country		Country		Country-ind.
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Fixed effects									
Employment	0.104***	0.127***	1.006***	1.052***	0.590***	0.578***	0.960***	1.006***	0.589***
s.e.	0.008	0.009	0.008	0.003	0.022	0.022	0.006	0.003	0.022
R^2	0.942	0.946	0.984	0.995	0.907	0.913	0.989	0.998	0.920
High skilled	0.127***	0.134***	0.810***	1.031***	0.461***	0.450***	0.831***	0.998***	0.453***
s.e.	0.005	0.006	0.010	0.002	0.014	0.015	0.008	0.001	0.015
R^2	0.892	0.874	0.968	0.997	0.582	0.384	0.968	1.000	0.386
Low skilled	0.088***	0.129***	1.068***	1.063***	0.268***	0.278***	0.976***	1.002***	0.284***
s.e.	0.009	0.011	0.008	0.003	0.029	0.029	0.008	0.004	0.029
R^2	0.932	0.938	0.974	0.994	0.844	0.866	0.982	0.998	0.881
Medium skilled	0.114***	0.114***	0.938***	1.041***	0.557***	0.534***	0.944***	1.011***	0.539***
s.e.	0.008	0.008	0.009	0.003	0.012	0.012	0.006	0.003	0.012
R^2	0.939	0.934	0.992	0.996	0.754	0.696	0.992	0.999	0.699
Capital	0.113***	0.117***	0.822***	0.959***	0.625***	0.626***	0.869***	0.997***	0.627***
s.e.	0.003	0.003	0.008	0.004	0.010	0.012	0.007	0.001	0.012
R^2	0.696	0.752	0.967	0.996	0.865	0.846	0.976	1.000	0.848
Random effects									
Employment	0.148***	0.181***	0.989***	1.052***	0.557***	0.568***	0.943***	1.007***	0.568***
s.e.	0.004	0.004	0.008	0.003	0.016	0.016	0.006	0.003	0.016
R^2	0.942	0.946	0.984	0.995	0.907	0.913	0.989	0.998	0.920
High skilled	0.107***	0.115***	0.769***	1.034***	0.450***	0.443***	0.788***	1.000***	0.445***
s.e.	0.003	0.004	0.009	0.002	0.013	0.014	0.008	0.001	0.014
R^2	0.892	0.874	0.968	0.997	0.582	0.384	0.968	1.000	0.386
Low skilled	0.147***	0.198***	1.055***	1.062***	0.348***	0.364***	0.965***	1.004***	0.371***
s.e.	0.004	0.005	0.008	0.003	0.019	0.018	0.007	0.003	0.017
R^2	0.932	0.938	0.974	0.994	0.844	0.866	0.982	0.998	0.881
Medium skilled	0.145***	0.157***	0.922***	1.042***	0.560***	0.538***	0.919***	1.012***	0.543***
s.e.	0.004	0.004	0.007	0.003	0.012	0.012	0.005	0.003	0.011
R^2	0.939	0.934	0.992	0.996	0.754	0.696	0.992	0.999	0.699
Capital	0.115***	0.121***	0.840***	0.964***	0.612***	0.612***	0.872***	0.997***	0.613***
s.e.	0.003	0.003	0.008	0.003	0.010	0.011	0.006	0.001	0.011
R^2	0.696	0.752	0.967	0.996	0.865	0.846	0.976	1.000	0.848

(0.154) and low educated labour (0.162) and also for capital (0.144). The fit of the regressions are rather high with the overall R^2 being around 0.90 or even higher with the exception of capital where the R^2 drops to 0.70. The coefficients for high educated labour are somewhat lower at around 0.099. These coefficients are also smaller compared to those reported in Trefler and Zhu (2010) where a value of 0.32 is reported.[6] Thus, as in other contributions, there is a considerable amount of missing trade ranging between 85 and 90% (for capital). As pointed out above this is probably driven by the way consumption patterns are modeled. The other columns in the table show results for the various demand structures as discussed above. As expected, in those cases where the deviations from the actual patterns are also low (see above) the coefficients approach one, particularly in the cases of (2b), (2c) and (4c). This is also the case for endowment with capital. The coefficients are closest to one in case (4c), i.e. non-homothetic preferences, country-industry specific home bias but country specific patterns of demand on foreign final products. However, this only slightly outperforms case (2c) where instead proportionality on foreign final demand is modeled.

In Table 6 we report a robustness test by including country fixed and random effects. Results are close to those when using pooled OLS. Only in the case (4a)=(4b) do the coefficients go up significantly. In Table 5 also the constant is reported which in some cases is significantly different from zero. The reason for this is that in these cases the WFEC fails which is captured by the constant. In the appendix we report the OLS results with row normalized data (see Table 12) where the constant becomes zero and insignificant. The slope coefficients are mostly unchanged.

4. Summary and conclusions

In this paper we considered the role of final demand patterns in factor-content predictions with traded intermediates. Specifically, we built on the insights of Trefler and Zhu (2010) who show the proper measure of the factor content of trade in this case (see also Deardorff, 1982). In this contribution it is argued that when properly calculating the factor content of trade (with technology differences across countries and traded intermediates) a 'strong consumption similarity' (SCS) assumption has to be made to arrive at a 'Vanek-consistent' prediction. In this paper we relax this assumption by considering different ways of modeling consumption (or more exactly final demand) structures. These alternatives range from introducing non-homothetic preferences, home bias effects and observed country and country-industry specific sourcing

[6]The reason for this is the different data used. The sample in our case is restricted to 40 countries. There might also be differences in the underlying figures with respect to factor endowments.

patterns (thus accounting for gravity forces to be at work).

Testing the model for various production factors - capital, high, medium and low skilled employment - which adds to the existing literature we first show that the predicted factor content of trade is in line with the measured value when considering the sign and rank correlation tests in the case when country-industry specific technology differences are allowed for. However, using the SCS assumption results in a significant amount of missing trade. Both these results are in line with the existing literature though this paper tests for different production factors.

Accounting for more realistic final demand structures, the results of this exercise point towards an explanation for this so-called 'missing trade'. Allowing for non-homothetic preferences across countries together with a country-level or country-industry level home bias yields slope coefficients around one, which mean that by this the missing trade has vanished. Thus, when allowing for differences in expenditures shares across countries and home-bias effects the amount of missing trade vanishes irrespective of modeling the international demand structures (e.g. proportional versus country specific). When sticking to the assumption of homothetic preferences but allowing for country-industry specific sourcing structures, the share of missing trade is reduced but is still significant. Thus it is not not only the assumption of homogeneity of preferences (although this is violated by empirical data), but this assumption together with neglecting the important home-bias of final demand which explains the 'missing trade'.

References

Cassing, J. and S. Nishioka (2010). Per capita income and the mystery of missing trade. *Manuscript*.

Davis, D. R. and D. Weinstein (2001). An account of global factor trade. *American Economic Review 91*(5), 1423–1453.

Deardorff, A. V. (1982). The general validity of the Heckscher-Ohlin theorem. *American Economic Review 72*(4), 197–209.

Foster, N. and R. Stehrer (2010). The factor content of trade. A survey of the literature. *Deliverable 8.1, WIOD project*.

Hakura, D. S. (2001). Why does HOV fail? The role of technological differences within the EU. *Journal of International Economics 54*, 361–382.

Linder, S. (1961). *An Essay in Trade and Transformation*. New York: John Wiley & Sons.

Markusen, J. R. (1986). Explaining the volume of trade: An eclectic approach. *American Economic Review 76*(5), 1002–1011.

Maskus, K. (1985). A test of the Hecksher-Ohlin-Vanek theorem: The Leontief commonplace. *Journal of International Economics 19*, 201–212.

Maskus, K. E. and S. Nishioka (2009). Development-related biases in factor productivities and the HOV model of trade. *Canadian Journal of Economics 42*(2), 519–553.

Nishioka, S. (2010). The origin of variation in production techniques and the empirical predictions of the HOV model. *Manuscript*.

Nishioka, S. (2012). International technology differences in production techniques: Implications for the factor content of trade. *Journal of International Economics 87*, 98–104.

Reimer, J. (2006). Global production sharing and trade in services of factors. *Journal of International Economics 68*, 384–408.

Staiger, R., A. Deardorff, and M. Stern (1987). An evaluation of factor endowments and protection as determinants of Japanese and American foreign trade. *Canadian Journal of Economics 20*, 449–463.

Staiger, R. W. (1986). Measurement of the factor content of trade with traded intermediate goods. *Journal of International Economics 21*, 361–368.

Timmer, M. (ed., 2012). The World Input-Output Database (WIOD): Contents, sources and methods. *WIOD Background document available at www.wiod.org*.

Trefler, D. (1993). International factor price differences: Leontief was right! *Journal of Political Economy 101*(6), 961–987.

Trefler, D. (1995). The case of missing trade and other HOV mysteries. *American Economic Review 85*, 1029–1046. Reprinted in: Leamer, E.E. (ed.) (2001), International Economics, New York: Worth.

Trefler, D. and S. Zhu (2010). The structure of factor content predictions. *The Journal of International Economics 82*, 195–207.

A Appendix Tables

Table 7 - Home bias (in %)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AUS	92.7	92.9	91.5	91.2	90.6	90.1	90.5	90.1	90.6	90.4	90.1	90.3	90.1	90.3	91.3
AUT	86.5	86.1	84.9	84.3	83.7	83.2	82.3	83.0	83.2	82.7	82.2	82.0	81.6	81.7	83.3
BEL	79.0	78.9	78.2	78.4	78.6	77.0	77.1	78.2	79.1	78.8	79.4	79.1	78.8	78.2	79.4
BGR	88.9	88.0	88.1	87.9	83.3	84.1	82.5	82.5	81.3	79.9	80.2	76.8	76.2	74.7	81.0
BRA	96.6	97.0	96.5	96.5	96.2	96.3	95.6	96.3	96.5	96.6	96.6	96.5	96.3	95.9	96.3
CAN	85.9	85.6	85.1	84.1	83.6	83.8	83.9	84.5	85.3	85.8	86.0	86.1	86.1	86.2	87.3
CHN	93.9	94.9	96.1	95.4	95.4	94.9	94.5	93.9	93.0	93.9	94.2	94.4	95.1	95.0	95.6
CYP	82.0	81.5	81.7	82.3	82.3	81.0	80.6	80.4	82.7	82.1	82.3	81.7	80.6	81.8	84.4
CZE	82.7	82.3	83.5	82.8	81.6	81.0	81.1	82.3	81.9	79.8	80.3	80.5	79.4	80.8	82.0
DEU	90.5	90.2	89.3	88.6	88.4	86.5	86.4	86.6	86.6	86.6	85.8	84.4	84.3	84.2	85.7
DNK	85.7	86.0	85.7	85.5	84.8	84.3	85.2	84.5	85.5	85.0	84.9	83.4	83.7	83.5	85.7
ESP	91.9	91.4	90.5	89.5	88.7	88.8	88.6	89.1	89.1	88.7	88.5	88.3	88.2	89.3	91.2
EST	75.9	75.8	72.4	72.9	77.0	76.4	74.2	76.7	75.4	75.8	76.3	75.9	77.0	78.3	81.9
FIN	89.6	88.8	88.6	88.2	88.9	89.5	88.8	89.9	88.2	88.8	88.6	87.5	87.7	87.3	88.4
FRA	91.6	91.7	91.3	90.7	90.4	89.8	89.6	89.9	90.3	90.1	89.9	89.8	89.7	89.8	90.5
GBR	89.2	88.7	88.6	88.6	88.5	88.3	87.8	87.9	88.3	88.8	88.5	88.4	88.2	87.9	88.3
GRC	91.9	91.4	91.0	90.2	88.5	88.4	87.8	87.4	87.5	87.2	88.2	88.5	87.8	87.9	88.9
HUN	87.8	87.6	87.1	85.2	83.6	83.6	83.5	83.9	83.1	81.6	81.0	79.3	78.9	78.7	79.7
IDN	94.0	94.4	94.7	89.2	93.4	93.4	92.9	93.8	94.4	93.5	92.6	93.9	93.5	92.5	94.6
IND	96.8	96.8	97.2	96.9	97.3	97.3	97.3	97.0	96.6	95.5	94.5	94.5	94.6	93.9	94.3
IRL	80.7	80.4	80.4	78.9	78.5	77.8	79.1	80.4	81.9	82.2	81.3	81.0	78.8	79.6	80.9
ITA	92.3	92.7	92.2	91.6	91.0	90.5	90.4	90.3	91.0	91.0	90.9	90.6	90.3	90.4	91.7
JPN	97.2	96.7	96.7	96.8	96.8	96.7	96.4	96.3	96.2	96.0	95.7	95.4	95.3	95.5	96.0
KOR	92.1	91.6	92.1	93.0	92.9	91.4	92.0	92.1	91.8	91.2	91.9	91.6	91.2	89.7	90.6
LTU	81.2	80.9	78.4	80.4	82.1	83.0	81.2	81.7	82.0	81.5	79.9	77.6	75.2	77.6	79.4
LUX	70.6	71.0	69.1	69.1	67.7	69.0	69.1	69.6	72.7	71.3	72.4	72.7	72.2	73.4	75.7
LVA	84.4	82.6	80.2	77.8	80.1	81.0	80.1	80.3	80.3	80.7	78.9	78.4	79.1	80.8	83.2
MEX	93.8	93.4	93.3	92.0	92.2	91.9	92.2	92.5	92.3	92.1	91.8	91.6	91.3	91.4	91.0
MLT	73.2	72.1	71.9	73.0	71.7	72.1	70.9	72.0	71.1	71.5	71.4	70.4	69.7	70.9	72.2
NLD	82.8	82.8	83.2	83.0	82.5	82.7	84.0	84.2	84.7	85.0	85.3	84.8	84.3	83.2	84.4
POL	91.8	90.8	88.4	87.3	87.6	88.7	89.3	88.7	87.5	86.5	87.3	86.7	85.4	85.4	86.4
PRT	87.9	87.6	86.8	85.5	84.6	84.4	84.8	85.8	86.4	85.5	85.7	85.0	84.7	84.7	86.1
ROU	91.5	91.4	90.6	90.7	89.7	88.5	88.2	87.4	86.8	85.9	86.0	84.9	84.2	84.9	88.1
RUS	87.5	89.8	90.0	88.6	87.8	88.2	88.8	86.9	87.6	87.6	87.6	87.3	87.1	86.6	86.4
SVK	81.8	81.9	80.0	77.4	78.0	78.6	76.6	77.7	78.3	77.6	76.3	76.1	75.8	76.6	78.3
SVN	81.1	81.0	80.7	80.3	80.0	78.8	79.2	80.1	79.9	78.6	78.0	76.8	76.8	76.5	79.3
SWE	88.3	88.4	88.0	87.3	87.6	86.5	87.0	87.2	87.2	86.7	85.9	85.2	84.8	84.5	85.5
TUR	94.5	93.2	93.0	92.9	93.6	92.6	93.7	93.6	93.3	92.0	92.4	92.1	92.6	88.1	88.4
TWN	86.7	86.8	86.2	85.5	85.1	82.7	85.2	85.7	85.2	83.3	83.9	84.4	84.0	84.7	85.9
USA	95.0	95.0	94.8	94.8	94.4	94.0	94.3	94.2	94.1	94.2	94.1	93.9	93.8	93.9	94.7
ZROW	89.7	90.0	91.5	90.5	90.6	90.0	89.7	89.2	88.8	88.7	88.2	88.1	87.4	87.4	89.1

Table 8 - Deviation in % by country

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country & industry	Country	Country & industry	Country	Country & industry	Country & industry
Sourcing:	Prop.	Proportional			Country		Country		Country & industry
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
AUS	188.1	187.8	36.9	4.0	36.9	26.9	19.3	4.7	23.6
AUT	176.8	176.2	52.2	11.7	50.4	30.3	41.2	8.6	24.8
BEL	169.9	168.9	68.5	22.1	65.9	38.8	59.7	15.3	27.7
BGR	180.3	178.6	78.1	19.8	72.4	63.9	45.7	19.1	53.1
BRA	188.5	188.0	10.5	3.2	33.0	30.3	10.0	3.4	28.0
CAN	177.6	178.0	44.7	18.1	53.7	35.0	41.4	11.0	27.0
CHN	165.1	159.5	22.3	7.1	74.7	66.1	27.4	10.2	59.0
CYP	189.9	189.6	58.0	9.7	54.4	41.8	40.6	12.3	33.0
CZE	175.7	174.8	71.6	21.1	58.0	43.2	49.3	13.3	34.6
DEU	163.4	162.7	32.7	8.7	45.7	28.7	38.8	7.5	23.9
DNK	174.9	173.2	41.1	12.0	69.7	43.4	49.9	15.6	32.1
ESP	181.1	180.5	25.1	8.0	47.4	36.0	28.4	6.2	32.2
EST	200.5	199.8	75.4	27.5	71.5	60.2	60.9	20.8	44.4
FIN	180.8	180.3	31.4	9.5	57.9	39.8	35.5	10.2	32.2
FRA	173.4	172.3	25.4	6.7	42.2	26.6	29.2	5.2	23.4
GBR	175.1	174.0	29.9	5.1	45.5	29.1	29.6	4.7	25.9
GRC	195.1	193.9	30.0	3.5	40.5	34.2	22.6	5.5	30.6
HUN	171.1	171.0	62.5	19.0	52.8	43.6	48.0	16.8	31.8
IDN	184.3	183.7	21.6	6.1	76.2	74.7	20.8	7.7	68.5
IND	185.0	181.7	13.9	4.0	65.1	64.2	14.6	6.9	60.0
IRL	156.0	155.7	55.1	23.9	83.4	57.2	73.5	36.8	27.7
ITA	171.7	170.6	25.3	6.3	38.2	29.6	27.2	7.0	25.6
JPN	167.8	165.5	10.7	2.9	31.1	23.7	13.3	3.2	20.9
KOR	173.4	171.9	29.9	9.0	51.2	41.6	30.7	9.4	34.1
LTU	182.9	182.2	66.8	18.8	62.2	55.9	47.5	18.7	42.1
LUX	174.8	176.0	112.1	31.8	88.5	63.3	84.3	48.0	22.9
LVA	188.1	187.4	67.2	14.5	54.6	43.9	41.1	12.9	34.5
MEX	182.3	181.7	22.0	12.7	55.4	44.5	26.7	6.6	38.6
MLT	179.1	178.7	80.5	22.7	68.5	64.5	64.7	25.0	44.4
NLD	172.1	171.8	57.1	17.0	62.2	36.6	48.3	15.9	30.0
POL	182.5	181.7	45.9	12.4	50.3	37.5	31.9	8.9	31.9
PRT	184.3	184.2	32.4	10.5	46.1	34.0	36.3	9.1	26.9
ROU	187.5	186.6	33.5	11.5	63.2	57.3	32.0	12.5	47.3
RUS	191.1	190.9	30.5	5.0	47.0	46.0	23.3	6.5	41.1
SVK	178.6	177.5	75.6	27.5	61.7	46.4	57.0	19.2	32.7
SVN	176.8	175.7	63.2	24.2	60.5	42.0	58.8	18.5	28.7
SWE	171.9	171.3	42.2	9.9	65.5	45.4	42.6	10.7	38.5
TUR	184.3	182.9	18.2	6.8	61.7	55.7	23.8	9.0	49.1
TWN	168.9	168.2	37.7	11.3	66.1	50.9	47.3	13.6	40.7
USA	135.7	127.2	12.2	2.4	40.5	31.8	13.0	1.3	30.9
ZROW	160.5	155.9	25.5	4.4	45.5	37.0	25.1	5.2	34.1

Table 9 - Deviation in % by industry

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country & industry	Country	Country & industry	Country	Country & industry	Country & industry
Sourcing:	Prop.	Proportional			Country		Country		Country & industry
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
AtB	171.8	159.7	15.5	5.9	96.9	91.5	17.3	6.7	88.7
C	167.6	143.3	21.2	5.2	91.7	104.7	24.1	8.8	98.3
15t16	152.3	154.0	19.3	11.0	43.3	35.9	18.5	8.9	30.3
17t18	109.0	111.4	83.4	31.0	103.9	59.6	83.1	37.4	33.0
19	106.7	103.4	88.3	27.8	122.1	82.7	89.5	47.6	51.6
20	159.7	160.0	14.7	6.5	53.0	54.4	16.5	9.5	48.1
21t22	151.0	144.8	12.7	8.9	45.6	44.8	13.5	9.7	38.7
23	145.9	146.8	28.8	16.6	44.5	40.7	28.4	17.6	28.1
24	118.6	117.0	56.6	16.5	66.4	42.5	55.7	19.3	31.2
25	132.6	133.7	44.5	21.3	57.8	43.6	41.9	15.2	35.3
26	155.8	154.6	20.6	8.3	72.0	65.1	21.2	11.5	59.3
27t28	150.0	149.7	25.6	13.3	57.7	79.2	23.8	10.1	74.2
29	110.8	110.8	66.9	21.4	76.9	41.0	65.7	17.9	32.0
30t33	90.9	89.9	90.2	28.3	91.3	35.2	88.9	24.2	18.1
34t35	120.4	119.1	64.1	28.8	66.6	39.3	63.7	26.8	18.1
36t37	119.1	116.6	58.8	22.8	65.8	42.4	57.3	18.4	31.0
E	173.1	173.4	14.3	1.3	31.6	25.1	15.5	1.1	24.3
F	176.5	177.1	15.0	0.7	34.7	27.7	15.9	0.2	27.5
50	172.9	169.7	16.0	1.0	55.0	45.3	17.1	0.7	44.7
51	168.1	168.1	11.9	2.6	29.1	25.8	13.3	2.8	23.8
52	164.6	153.0	12.3	1.6	38.4	33.7	13.6	1.5	32.4
H	171.3	170.7	14.1	2.0	30.1	23.8	15.3	1.9	22.2
60	175.2	173.0	11.2	2.2	56.1	52.5	12.6	2.3	51.2
61	151.7	110.0	66.6	11.5	104.6	99.5	67.5	29.5	93.4
62	137.6	129.1	25.9	11.2	50.6	45.2	25.6	13.4	37.8
63	175.1	174.3	13.4	4.3	71.4	68.2	14.8	4.7	66.1
64	169.0	167.0	12.5	1.8	24.1	16.5	13.9	1.4	15.4
J	163.4	154.0	11.3	2.2	42.3	36.6	13.7	2.8	34.3
70	170.9	167.3	14.6	0.7	32.3	22.8	15.8	0.2	22.6
71t74	162.8	158.7	8.8	3.1	28.5	25.0	10.9	3.6	22.4
L	166.2	154.0	13.6	0.7	38.0	33.1	15.1	0.2	32.9
M	183.3	183.6	17.1	0.7	55.9	43.6	18.2	0.3	43.4
N	170.2	164.6	15.3	0.6	38.3	29.1	16.4	0.1	29.0
O	171.4	171.2	13.2	1.8	28.2	21.8	14.5	1.6	20.5
P	182.2	176.2	21.0	0.7	98.0	92.1	20.2	0.3	91.9

Table 10 - Sign test (in %), row normalized, N=41, average over years

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country & industry	Country	Country & industry	Country	Country & industry	Country & industry
Sourcing:	Prop.	Proportional			Country		Country		Country & industry
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Employment	94.8	93.8	96.1	97.1	99.0	94.0	98.9	98.7	94.1
.. High	92.0	92.0	94.3	97.9	96.7	96.9	95.4	98.5	97.1
.. Medium	92.8	92.4	94.8	97.6	97.7	96.9	97.4	98.7	96.3
.. Low	97.7	96.7	97.2	98.7	99.3	97.4	98.4	99.3	97.7
Capital	83.7	84.9	87.2	98.5	93.7	91.5	95.1	97.2	92.4

Table 11 - Correlation, row normalized, average over years

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country & industry	Country	Country & industry	Country	Country & industry	Country & industry
Sourcing:	Prop.	Proportional			Country		Country		Country & industry
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Correlation coefficients									
Employment	0.979	0.982	0.993	0.998	0.999	0.991	0.999	0.999	0.986
.. High	0.960	0.952	0.974	0.999	0.995	0.996	0.994	0.999	0.993
.. Medium	0.978	0.977	0.994	0.998	0.999	0.995	0.999	0.999	0.990
.. Low	0.974	0.978	0.993	0.997	0.997	0.987	0.998	0.998	0.984
Capital	0.888	0.914	0.923	0.999	0.985	0.964	0.990	0.999	0.963
Rank correlation coefficients									
Employment	0.956	0.947	0.968	0.988	0.994	0.975	0.992	0.992	0.974
.. High	0.952	0.955	0.949	0.994	0.987	0.983	0.976	0.997	0.986
.. Medium	0.960	0.950	0.975	0.994	0.992	0.990	0.991	0.997	0.986
.. Low	0.974	0.941	0.972	0.991	0.997	0.981	0.989	0.996	0.983
Capital	0.831	0.865	0.881	0.994	0.970	0.933	0.977	0.997	0.930

Table 12 - OLS results, row normalized

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country-Ind.	Country	Country-Ind.	Country	Country-Ind.	Country-Ind.
Sourcing:	Proportional	Proportional			Country		Country		Country-ind.
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Employment	0.16***	0.19***	1.05***	1.03***	0.91***	0.74***	1.02***	1.05***	0.67***
s.e.	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Const.	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
s.e.	375.30	362.41	193.20	108.49	71.80	218.17	78.71	89.76	263.84
R^2	0.94	0.95	0.98	1.00	1.00	0.98	1.00	1.00	0.97
High skilled	0.10***	0.10***	0.69***	1.02***	0.67***	0.85***	0.66***	1.02***	0.81***
s.e.	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Const.	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
s.e.	25.79	27.87	18.68	3.17	8.95	8.01	9.16	2.56	9.00
R^2	0.89	0.87	0.94	1.00	0.99	0.99	0.99	1.00	0.99
Low skilled	0.16***	0.22***	1.17***	1.03***	0.94***	0.68***	1.16***	1.05***	0.62***
s.e.	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Const.	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
s.e.	247.99	235.62	116.35	73.59	79.78	158.11	63.16	72.64	181.35
R^2	0.93	0.94	0.98	0.99	0.99	0.97	1.00	0.99	0.96
Medium skilled	0.15***	0.17***	0.94***	1.04***	0.89***	0.84***	0.90***	1.05***	0.75***
s.e.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Const.	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
s.e.	134.10	139.90	63.88	33.57	20.92	56.15	30.58	19.66	77.47
R^2	0.94	0.93	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Capital	0.14***	0.16***	1.05***	0.99***	0.83***	0.91***	0.88***	1.00***	0.91***
s.e.	0.00	0.00	0.02	0.00	0.01	0.01	0.01	0.00	0.01
Const.	-0.04	-0.05	-0.04	-0.05	-0.04	-0.04	-0.06	-0.05	-0.04
s.e.	6311.81	5707.20	3947.92	715.74	1925.63	2797.00	1644.35	413.87	2736.32
R^2	0.70	0.75	0.88	1.00	0.97	0.94	0.98	1.00	0.94

Table 13 - FE and RE results, row normalized

Preferences:	Homothetic	Non-homothetic			Homothetic		Non-homothetic		Homothetic
Home bias:	No	No	Country	Country-Ind.	Country	Country-Ind.	Country	Country-Ind.	Country-Ind.
Sourcing:	Proportional	Proportional			Country		Country		Country-ind.
	SCS	2a	2b	2c	3a=3b	3c	4a=4b	4c	5a=5c
Fixed effects									
Employment	0.104^{***}	0.127^{***}	1.014^{***}	1.020^{***}	0.885^{***}	0.795^{***}	0.922^{***}	0.926^{***}	0.838^{***}
s.e.	0.008	0.009	0.012	0.003	0.005	0.012	0.006	0.005	0.015
R^2	0.942	0.946	0.985	0.995	0.998	0.980	0.997	0.997	0.971
High skilled	0.127^{***}	0.134^{***}	0.685^{***}	1.004^{***}	0.721^{***}	0.891^{***}	0.733^{***}	0.986^{***}	0.928^{***}
s.e.	0.005	0.006	0.015	0.002	0.006	0.008	0.005	0.003	0.008
R^2	0.892	0.874	0.943	0.998	0.987	0.990	0.986	0.999	0.987
Low skilled	0.088^{***}	0.129^{***}	1.128^{***}	1.030^{***}	0.924^{***}	0.748^{***}	0.947^{***}	0.890^{***}	0.719^{***}
s.e.	0.009	0.011	0.010	0.004	0.007	0.013	0.008	0.006	0.019
R^2	0.932	0.938	0.985	0.994	0.993	0.972	0.996	0.994	0.963
Medium skilled	0.114^{***}	0.114^{***}	0.895^{***}	1.011^{***}	0.875^{***}	0.857^{***}	0.914^{***}	0.982^{***}	0.899^{***}
s.e.	0.008	0.008	0.011	0.003	0.005	0.011	0.007	0.005	0.009
R^2	0.939	0.934	0.986	0.996	0.999	0.989	0.997	0.999	0.980
Capital	0.113^{***}	0.117^{***}	0.929^{***}	0.944^{***}	0.834^{***}	0.915^{***}	0.868^{***}	1.004^{***}	0.923^{***}
s.e.	0.003	0.003	0.010	0.004	0.007	0.008	0.006	0.001	0.007
R^2	0.696	0.752	0.881	0.996	0.972	0.940	0.979	0.999	0.943
Random effects									
Employment	0.148^{***}	0.181^{***}	1.024^{***}	1.021^{***}	0.898^{***}	0.771^{***}	0.977^{***}	0.971^{***}	0.752^{***}
s.e.	0.004	0.004	0.010	0.003	0.004	0.009	0.005	0.005	0.012
R^2	0.942	0.946	0.985	0.995	0.998	0.980	0.997	0.997	0.971
High skilled	0.107^{***}	0.115^{***}	0.685^{***}	1.006^{***}	0.709^{***}	0.875^{***}	0.718^{***}	1.000^{***}	0.889^{***}
s.e.	0.003	0.004	0.012	0.002	0.005	0.006	0.005	0.002	0.007
R^2	0.892	0.874	0.943	0.998	0.987	0.990	0.986	0.999	0.987
Low skilled	0.147^{***}	0.198^{***}	1.136^{***}	1.030^{***}	0.929^{***}	0.719^{***}	1.083^{***}	0.935^{***}	0.658^{***}
s.e.	0.004	0.005	0.009	0.003	0.006	0.010	0.007	0.006	0.012
R^2	0.932	0.938	0.985	0.994	0.993	0.972	0.996	0.994	0.963
Medium skilled	0.145^{***}	0.157^{***}	0.910^{***}	1.013^{***}	0.888^{***}	0.849^{***}	0.909^{***}	1.022^{***}	0.860^{***}
s.e.	0.004	0.004	0.009	0.003	0.003	0.008	0.005	0.003	0.008
R^2	0.939	0.934	0.986	0.996	0.999	0.989	0.997	0.999	0.980
Capital	0.115^{***}	0.121^{***}	0.933^{***}	0.966^{***}	0.834^{***}	0.915^{***}	0.870^{***}	1.004^{***}	0.922^{***}
s.e.	0.003	0.003	0.010	0.003	0.006	0.007	0.006	0.001	0.007
R^2	0.696	0.752	0.881	0.996	0.972	0.940	0.979	0.999	0.943

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