The gains from variety in the European Union

Lukas Mohler*,[a], Michael Seitz[b,1]

[a] *Faculty of Business and Economics, University of Basel, Peter Merian-Weg 6, 4002 Basel, Switzerland*
[b] *Department of Economics, Ludwig-Maximilians-University of Munich, Ludwigsstrasse 28, 80539 Munich, Germany*

Abstract

In this paper, we apply the methodology developed by Feenstra (1994) and Broda and Weinstein (2006) to estimate the gains from imported variety for the 27 countries of the European Union using Eurostat data from the period of 1999 to 2008. Our results show that "newer" and smaller member states exhibit high gains from newly imported varieties.

Key words: Welfare gains from trade, Trade in variety, European Union
JEL: F12, F14

1. Introduction

The European Union with its 27 member states constitutes the largest single market in the world. Over the past decade the economic integration of these countries into the European Union and into the world economy has led to a surge in imports in these economies. From 1999 to 2008, the total value of imports for all member states has doubled where about one third of this increase can be attributed to the establishment of new trade linkages with new goods or new trading partners, increasing the number of available products for consumers. Since the seminal work of Krugman (1979, 1980) and the emergence of the "New Trade Theory", economists have tried to quantify the welfare gains from newly imported varieties for consumers. Based on the methodology first outlined by Feenstra (1994), Broda and Weinstein (2006) structurally estimate the gains from trade for the United States and find positive gains of the magnitude of 2.6 percent of GDP for the period from 1972 to 2001. In this contribution, we use highly disaggregated trade data at the HS-8 level for the period 1999 to 2008 to estimate the gains from variety for each member state of the European Union. We find that for "newer" and smaller member states the availability of new product varieties is an important source for consumer welfare.

*Corresponding author. Tel.: +41 61 267 0770; fax: +41 61 267 1316
Email addresses: lukas.mohler@unibas.ch (Lukas Mohler), michael.seitz@lrz.uni-muenchen.de (Michael Seitz)
[1] Tel.: +49 89 2180 6286; fax: +49 89 2180 6227

2. Empirical strategy

We outline the empirical strategy very concisely. For a more detailed discussion of the methodology, refer to Feenstra (1994) and Broda and Weinstein (2006).

We start with a simple CES utility function. A variety is defined as a good g imported from a country c as in Armington (1969):

$$M_{gt} = \left(\sum_{c \in C} d_{gct} M_{gct}^{1-\sigma_g} \right)^{\frac{1}{1-\sigma_g}}, \tag{1}$$

where C denotes the set of available countries and hence potentially available varieties in period t. M_{gct} is the subutility derived from the imported variety c of good g in period t and $d_{gct} > 0$ is the corresponding taste parameter. The elasticity of substitution among varieties is given by $\sigma_g > 1$. The unit-cost functions derived from this utility function can then be used to obtain an exact price index as shown in Diewert (1976). Sato (1976) and Vartia (1976) show that for the CES utility, this exact price index P_g can be written as

$$P_g = \prod_{c \in I_g} \left(\frac{p_{gct}}{p_{gct-1}} \right)^{w_{gct}}, \tag{2}$$

where w_{gct} is a log-change ideal weight. So far, the price index in equation (2) only accounts for a fixed set of available varieties I_g, independent of t. To allow for new and disappearing varieties over time we follow Feenstra (1994):

$$\Pi_g = P_g \left(\frac{\lambda_{gt}}{\lambda_{gt-1}} \right)^{\frac{1}{\sigma_g - 1}}, \tag{3}$$

where

$$\lambda_{gr} = \frac{\sum_{c \epsilon I_g} p_{gcr} x_{gcr}}{\sum_{c \epsilon I_{gr}} p_{gcr} x_{gcr}} \; ; \; r = t, t-1. \tag{4}$$

The idea of the index Π_g is to correct the conventional price index P_g by multiplying it with an additional term which measures the influence of new and disappearing varieties; this term is called the lambda ratio. The numerator of this ratio quantifies the impact of newly available varieties as λ_{gt} captures the ratio of expenditures on varieties available in both periods (i.e. $c \in I_g = (I_{gt} \cap I_{gt-1})$) relative to the entire set of varieties available in period t (i.e. $c \in I_{gt}$). Hence, λ_{gt} decreases when new varieties appear. On the other hand, the denominator of the lambda ratio captures the impact of disappearing varieties. These lower λ_{gt-1} and increase the ratio.

The exact price index also depends on the elasticity of substitution between varieties: If we observe a high elasticity of substitution, the additional term $(\frac{\lambda_t}{\lambda_t - 1})^{\frac{1}{\sigma - 1}}$ will approach unity and the influence of the lambda ratio on the price index is small. This is intuitive since a change in the varieties of homogeneous goods should not lower the price index.

To estimate the elasticities of substitution, the stochastic specification of Feenstra (1994) is used and Π_g is calculated for each good. To obtain the gains from variety, the price indices of equations (2) and (3) for the goods are then aggregated into aggregate import price indices. We then take the fraction of the corrected import price index and the conventional import price index. This ratio is called the endpoint ratio (EPR):

$$EPR = \prod_{g \in G} \left(\frac{\Pi_g}{P_g} \right)^{w_{gt}}, \tag{5}$$

where w_{gt} is again a log-change ideal weight. This ratio is used to express the upward (or downward) bias resulting from the change of variety over time: If the EPR is smaller than one, it means that the variety change has lowered the import price index. This will be the source of the gains from variety: Weighting the inverse of this fraction with the import share results in the gains from variety as a percentage of GDP.[2]

3. Data and results

We use the database from Eurostat which consists of highly disaggregated trade data for the EU-27 countries at the HS-8 level. We use quarterly data for the period of the first quarter of 1999 to the first quarter of 2008 to rule out potential seasonality effects.

Table 1 displays some descriptive statistics for each EU member state regarding the import of varieties.[3] The first four countries are the four largest "old" member states, the next eleven countries are the smaller "old" member states and the last ten countries are the "new" member states that joined the union in 2004 and 2007. From columns 1 and 2 we can see that the total number of imported goods is relatively constant over time for all countries: While for most of the "old" member states the number of imported goods decreases slightly, modest increases can be observed for some of the "new" member states. At the same time, the average number of worldwide suppliers has increased in most of the countries, except Hungary and Malta (columns 3 and 4). This translates into an overall increase of imported varieties for all countries except Cyprus, Hungary and Malta as shown in columns 5 and 6. Although there is a similar number of new and disappearing varieties in most countries (columns 7 and 8), from columns 9 and 10 we can see that the value of new varieties is much larger than the value of disappearing ones, especially for the "new" member states.

Next, we calculate the lambda ratios in equation (4). They illustrate the growth or decline in imported variety. Summary statistics of these ratios are shown in Table 2: For example, the median lambda ratio in Ireland is $0.96 < 1$,

[2] If we assume a Krugman (1980) economy as in Broda and Weinstein (2006).

[3] In Table 1, product categories are defined at the HS-6 level. At this level, the classification is harmonized and hence allows for a better comparison in the descriptive statistics. For all the later results however, we use HS-8 to make use of all available data.

expressing that the typical product category experienced a positive growth in variety of about 4%. Note that this measure of variety growth is more sophisticated than others: Instead of just counting new and disappearing varieties as in Table 1, this measure accounts for the importance of different varieties by using expenditure shares as weights. [4]

Finally, we estimate the elasticities of substitution for every imported product category of each country. Table 3 shows some descriptive statistics about the estimated elasticities.[5] The median elasticity lies between 3.4 and 4.9.[6] The elasticities are of a similar magnitude as in other contributions, for example in Broda and Weinstein (2006) or in Broda et al. (2006).

The elasticities and lambda ratios are then used to calculate the corrected import price indices as in equation (3). Aggregating those indices into an aggregate import price index and taking the fraction of the corrected to the conventional import price index, results in the EPR of (5). It is displayed in column 1 of Table 4. If this ratio is lower than 1, it means the change in variety has lowered the conventional import price index. The percentage in column 2 of table 4 expresses the upward (or downward) bias of the conventional import price index. Column 3 displays the fraction of imports to GDP. Weighting the inverse of column 1 with the import share gives us the gains from variety as a fraction of the GDP in column 4.

As an example, Table 4 shows that the EPR in the Netherlands is 0.9921. This accounts to an upward bias in the conventional price index of 0.79% over the whole period. Weighting this bias by the import share of 51%, this translates into a gain from variety of 0.41% of GDP. This gain must be interpreted as follows: Consumers in the Netherlands are willing to spend 0.41% of GDP in 2008 to have access to the larger set of imported varieties of 2008 instead of the set of 1999.

4. Interpretation of the results and concluding remarks

For most countries the biases and hence the gains from variety are positive. However, results differ across countries and three different groups can be identified. First, for the largest four countries in the EU in terms of GDP, the impact of traded variety is very small or even slightly negative for our period. This may be explained by the smaller import shares and by the fact that these countries have already been strongly integrated into the EU and the world economy

[4] Note that there are fewer lambda ratios than product groups: Some lambda ratios cannot be defined at the HS-8 level since there is no common variety at the beginning end the end of the chosen time period. Then, we define the lambda ratio at the SITC-5 level. This is handled exactly as in Broda and Weinstein (2006).

[5] 2,039 elasticities may seem like too few considering that Malta imported 2,093 goods in 1999 even at the HS-6 level. However, some product categories in small countries are imported from very few partner countries and for only a very short period. For these goods it is not possible to estimate an elasticity of substitution. See Feenstra (1994) for more information about this estimation technique.

[6] Note that the means are heavily influenced by some outlier elasticities.

before this period. Secondly, for all the smaller "old" member states we find modestly positive gains from imported variety, with the exception of Finland. Finally, for the "newer" member states of the European Union, with the exception of Malta, the gains are strongly positive, mostly larger than 1% of GDP. This result reflects the effects of the ongoing integration of these countries into the European single market and into the world economy as well as their higher growth rates and higher import shares. For example, the gains from variety for Estonia sum up to 2.74% of GDP, which is of the same magnitude as Broda and Weinstein (2006) find for the United States for their much longer period from 1972 to 2001. Our results show that especially for fast growing, less developed and smaller countries, the establishment of new trade linkages and the import of new varieties are an important source of welfare gains via trade.

References

Armington, P. S., 1969. A theory of demand for products distinguished by place of production. International Monetary Fund Staff Papers 16, 159–178.

Broda, C., Greenfield, J., Weinstein, D. E., 2006. From groundnuts to globalization: A structural estimate of trade and growth. NBER Working Paper 12512.

Broda, C., Weinstein, D. E., 2006. Globalization and the gains from trade. Quarterly Journal of Economics 121 (2), 541–585.

Diewert, W. E., 1976. Exact and superlative index numbers. Journal of Econometrics 4 (2), 115–145.

Feenstra, R. C., 1994. New product varieties and the measurement of international prices. American Economic Review 84 (1), 157–177.

Krugman, P. R., 1979. Increasing returns, monopolistic competition, and international trade. Journal of International Economics 9 (4), 469–479.

Krugman, P. R., 1980. Scale economies, product differentiation, and the pattern of trade. American Economic Review 70 (5), 950–959.

Sato, K., 1976. The ideal log-change index number. Review of Economics and Statistics 58 (2), 223–228.

Vartia, Y. O., 1976. Ideal log-change index numbers. Scandinavian Journal of Economics 3 (3), 121–126.

A. Tables

Table 1: Descriptive Statistics

	Total no. of goods		Mean no. of countries		Total no. of varieties		Varieties disapp.	Varieties new.	Value (mil. Eur) disapp.	Value (mil. Eur) new.
	1999	2008	1999	2008	1999	2008	1999	2008	1999	2008
France	5,079	4,995	15.25	17.08	77,448	85,327	7,778	7,922	8,002	15,181
Germany	5,010	4,888	18.68	20.31	93,574	99,251	9,449	9,082	12,121	22,934
Great Britain	4,979	4,914	15.53	17.47	77,325	85,831	8,124	7,950	8,839	15,713
Italy	5,032	4,934	14.19	16.28	71,387	80,346	7,363	7,528	5,574	9,394
Austria	4,909	4,809	10,16	13,01	49,871	62,577	5,138	5,606	1,750	3,776
Belgium	5,006	4,920	11,16	14,44	55,870	71,031	5,706	6,359	3,747	8,880
Denmark	4,624	4,721	8.54	11.41	39,496	53,852	3,983	5,092	1,352	2,809
Finland	4,661	4,557	8,54	10,29	39,791	46,874	4,146	4,197	945	2,569
Greece	4,685	4,628	7,54	9,26	35,306	42,863	3,720	4,003	796	1,344
Ireland	4,664	4,525	5.71	7.33	26,619	33,162	3,082	3,096	1,607	2,161
Luxemburg	4,279	4,339	4,47	5,00	19,147	21,694	2,154	2,381	502	797
Netherlands	4,910	4,849	13.38	15.61	65,714	75,681	6,857	7,607	4,624	16,092
Portugal	4,763	4,726	7,96	8,98	37,092	42,453	3,849	4,091	1,033	1,850
Spain	4,982	4,882	10,43	13,01	51,978	63,535	5,442	5,821	2,827	9,701
Sweden	4,812	4,758	11,13	12,74	53,548	60,625	5,286	5,530	1,875	4,155
Bulgaria	4,077	4,439	6,60	9,14	26,945	40,593	2,852	5,021	109	719
Cyprus	3,702	3,624	6,52	6,58	24,142	23,831	3,034	2,768	109	474
Czech Republic	4,834	4,806	11,12	12,02	53,766	57,785	5,344	5,393	627	2,907
Estonia	3,979	4,160	6,43	8,07	25,576	33,561	2,887	3,817	114	581
Hungary	4,140	4,013	11,63	11,46	48,168	46,003	6,163	5,498	763	3,312
Latvia	3,831	4,230	5,93	8,49	22,720	35,930	2,425	4,336	100	526
Lithuania	3,994	4,349	7,12	9,35	28,451	40,682	2,837	4,620	92	631
Malta	3,515	3,257	4,95	4,55	17,384	14,827	2,709	1,827	244	283
Poland	4,867	4,848	12,57	13,35	61,181	64,712	5,889	5,994	1292	3,904
Romania	4,288	4,672	8,46	11,84	36,281	55,317	3,524	6,056	256	1,593
Slovakia	4,445	4,570	7,69	8,85	34,184	40,447	3,484	4,276	234	1,231
Slovenia	4,489	4,595	8,59	8,89	38,578	40,836	3,896	4,240	252	884

Table 2: Lambda Ratios

	Nobs	Mean	**Median**	5% perc.	95% perc.
France	1,797	1.82	**0.99**	0.43	1.83
Germany	1,574	1.47	**0.99**	0.38	1.93
Great Britain	1,306	2.07	**0.98**	0.31	1.80
Italy	1,630	1.63	**0.98**	0.33	1.90
Austria	1,438	2.47	**0.99**	0.36	2.18
Belgium	1,622	4.33	**0.98**	0.30	2.06
Denmark	1,099	1.74	**0.97**	0.27	2.11
Finland	1,208	2.02	**0.97**	0.18	2.83
Greece	1,173	1.36	**0.95**	0.19	2.28
Ireland	1,321	2.27	**0.96**	0.23	3.14
Luxemburg	1,269	1.94	**1.00**	0.28	1.93
Netherlands	1,457	4.70	**0.98**	0.23	2.31
Portugal	1,243	2.90	**0.99**	0.27	2.45
Spain	1,416	1.69	**0.96**	0.21	2.06
Sweden	1,227	3.12	**0.97**	0.28	2.05
Bulgaria	682	1.31	**0.81**	0.11	2.30
Cyprus	506	1.77	**0.97**	0.17	3.75
Czech Republic	1,247	2.08	**0.98**	0.22	2.84
Estonia	720	7.01	**0.90**	0.13	3.12
Hungary	768	10.27	**1.00**	0.21	3.55
Latvia	656	1.59	**0.79**	0.09	3.11
Lithuania	814	1.35	**0.83**	0.08	2.29
Malta	542	2.31	**1.00**	0.17	6.27
Poland	1,232	11.59	**0.99**	0.21	3.34
Romania	874	7.86	**0.86**	0.13	3.05
Slovakia	853	3.83	**0.96**	0.17	2.73
Slovenia	993	1.96	**0.97**	0.24	2.92

Table 3: Estimated Elasticities of Substitution

	Nobs	Mean	StE	**Median**	Maximum	Minimum
France	10,491	11.29	0.83	**4.22**	5,504.26	1.02
Germany	10,193	14.19	2.63	**4.68**	21,469.27	1.04
Great Britain	9,930	10.46	1.47	**3.84**	11,977.77	1.00
Italy	9,797	14.28	1.42	**4.60**	8,177.53	1.01
Austria	8,317	9.60	1.41	**3.70**	11,062.26	1.02
Belgium	9,338	8.53	0.40	**4.10**	2,633.42	1.00
Denmark	7,631	7.94	0.55	**3.42**	3,033.52	1.03
Finland	6,765	14.23	2.00	**4.04**	12,064.90	1.01
Greece	6,728	9.04	0.72	**3.41**	2,928.15	1.00
Ireland	6,210	10.80	1.29	**3.47**	5,561.19	1.00
Luxemburg	5,173	13.70	1.40	**3.51**	4,055.22	1.00
Netherlands	8,698	16.90	3.81	**4.38**	29,244.75	1.03
Portugal	7,182	12.03	1.47	**3.65**	6,326.31	1.00
Spain	9,179	9.05	0.53	**3.89**	2,811.72	1.00
Sweden	7,723	289.95	280.12	**4.32**	2,163,410.00	1.00
Bulgaria	5,314	12.63	1.30	**4.57**	5,875.99	1.01
Cyprus	2,815	27.81	8.74	**4.56**	21,620.79	1.02
Czech Republic	7,526	13.54	1.84	**4.33**	10,539.79	1.00
Estonia	4,697	97.25	80.31	**4.18**	376,959.60	1.00
Hungary	6,914	13.61	0.94	**4.52**	3,224.69	1.01
Latvia	4,542	13.16	1.49	**4.33**	4,371.04	1.01
Lithuania	5,138	13.46	2.32	**4.50**	11,296.21	1.01
Malta	2,093	8.89	0.69	**3.59**	794.74	1.00
Poland	8,129	13.02	1.19	**4.31**	5,560.56	1.01
Romania	6,437	15.85	2.49	**4.89**	15,217.73	1.01
Slovakia	6,189	10.60	0.77	**3.98**	3,034.62	1.00
Slovenia	6,329	11.71	1.83	**4.07**	10,740.02	1.00

Table 4: Import Price Index Bias and the Gains from Variety

	EPR	**Bias**	Import Share	GFV
France	1.0167	**-1.67%**	0.24	**-0.41%**
Germany	1.0013	**-0.13%**	0.26	**-0.03%**
Great Britain	0.9959	**0.41%**	0.21	**0.09%**
Italy	0.9924	**0.76%**	0.21	**0.17%**
Austria	0.9917	**0.83%**	0.41	**0.33%**
Belgium	0.9940	**0.60%**	0.84	**0.51%**
Denmark	0.9753	**2.47%**	0.30	**0.75%**
Finland	1.0023	**-0.23%**	0.29	**-0.06%**
Greece	0.9846	**1.54%**	0.25	**0.38%**
Ireland	0.9957	**0.43%**	0.38	**0.15%**
Luxemburg	0.9980	**0.20%**	0.56	**0.11%**
Netherlands	0.9921	**0.79%**	0.51	**0.41%**
Portugal	0.9917	**0.83%**	0.34	**0.27%**
Spain	0.9781	**2.19%**	0.26	**0.59%**
Sweden	0.9925	**0.75%**	0.30	**0.21%**
Bulgaria	0.9706	**2.94%**	0.53	**1.57%**
Cyprus	0.9847	**1.53%**	0.38	**0.57%**
Czech Republic	0.9856	**1.44%**	0.65	**0.92%**
Estonia	0.9646	**3.54%**	0.76	**2.74%**
Hungary	0.9817	**1.83%**	0.62	**1.13%**
Latvia	0.9694	**3.06%**	0.52	**1.66%**
Lithuania	0.9772	**2.28%**	0.60	**1.41%**
Malta	1.0232	**-2.32%**	0.69	**-1.55%**
Poland	0.9903	**0.97%**	0.35	**0.35%**
Romania	0.9726	**2.74%**	0.43	**1.19%**
Slovakia	0.9707	**2.93%**	0.79	**2.34%**
Slovenia	0.9800	**2.00%**	0.60	**1.21%**