Economics Letters 117 (2012) 243–246

Contents lists available at SciVerse ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Trade, variety, and immigration

Chen Bo [a], David S. Jacks [b,*]

[a] Trade Division, SIBA, Shanghai University of Finance and Economics, 777 Guo Ding Road, Shanghai 200433, PR China

[b] Department of Economics, 8888 University Drive, Simon Fraser University, Burnaby, British Columbia, V5A 1S6, Canada

ARTICLE INFO

Article history:
Received 2 February 2012
Received in revised form
3 April 2012
Accepted 6 April 2012
Available online 11 May 2012

JEL classification:
F1
F4

Keywords:
International trade
Variety effects
Immigration

ABSTRACT

What are the gains from international trade? And how do immigrants influence this process? We consider the case of Canada, document its experience with import variety growth in the period from 1988 to 2007, and relate this variety growth to the process of immigration. We find that import varieties grew 76%, that this growth is associated with a welfare gain to Canadian consumers as large as 28%, and that enhanced immigration flows may be responsible for 25% of this variety growth and its attendant welfare gains for native-born Canadians.

1. Introduction

Recently, Broda and Weinstein (2006) have reconsidered the role of variety in enhancing consumer welfare. Building on Feenstra's (1994) insight that trade data could readily be used to trace the impact of new varieties on an exact price index of a single good, they extend this work to compute an aggregate price index for imported goods. Their results were dramatic: the bias introduced by not considering new import varieties in a standard import price index for the United States is on the order of 1.2% per year, implying an unmeasured welfare gain to US consumers from international trade in the period from 1972 to 2001 representing 2.6% of gross domestic product (GDP).

In this paper, we contribute to this literature on two fronts. First, we exploit highly disaggregated Canadian trade data. Second, we identify potential sources of import variety growth. In sum, our results are that Canadian import varieties grew 76% from 1988 to 2007, that this growth is associated with a welfare gain as large as 28%, and that enhanced immigration flows may be responsible for 25% of this variety growth and its attendant welfare gains.

2. Material and methods: documenting variety growth

Researchers typically define a variety as a country–good pair. For example, beer produced in France and that produced in Britain are treated as two varieties of the good "beer". In this paper, we follow this precedent with one important exception. Using Canadian statistics, it becomes possible to define a variety as a state–good pair. We can justify this choice of treating state–good pairs as a variety in the following ways. First, if we were to treat the US as a single country, it would significantly reduce the count of import varieties and would be equivalent to throwing away good data. Second, and more importantly, it is very likely that large countries – such as the United States – do actually produce multiple varieties of single goods. Thus, treating individual states as separate exporting areas in Canadian imports is not only possible but also desirable.

Based on our definition of varieties, Table 1 reports summary statistics on Canadian import varieties between 1988 and 2007. In column (2), we document that the number of goods under HS definitions increased from 12,072 in 1988 to 16,282 in 2007. At the same time, import varieties (exporting area–good pairs) increased from 290,726 in 1988 to 512,697 in 2007. Clearly, imported varieties have increased much faster than imported goods.

Table 2 reports the exporting areas' ranking in both 1988 and 2007 with respect to the number of goods imported into Canada. The United States as a whole was the single largest source of import varieties for Canada in both 1988 and 2007. Unsurprisingly, China

* Corresponding author. Tel.: +1 778 782 5392; fax: +1 778 782 5944.
E-mail addresses: chenbo1947@gmail.com (B. Chen), dsjacks@gmail.com (D.S. Jacks).

0165-1765/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
doi:10.1016/j.econlet.2012.04.007

Table 1
Varieties in Canadian imports (1988–2007).
Source: Authors' calculation based on WORLD TRADE ANALYSER.

	Reference year (1)	Total number of HS categories (goods) (2)	Median number of exporting areas per good (3)	Average number of exporting areas per good (4)	Total number of varieties (exporting area–good pairs) (5)	Share of total Canadian imports (%) (6)
All goods, 1988	1988	12,072	20	24.1	290,726	100
All goods, 2007	2007	16,282	23	31.5	512,697	100
Common goods, 1988–2007	1988	4207	20	24.4	102,666	25.34
Common goods, 1988–2007	2007	4207	29	36.4	153,157	24.65
Goods present in 1988 but not in 2007	1988	7865	19	23.9	188,060	74.66
Goods present in 2007 but not in 1988	2007	12,075	21	29.8	359,540	75.35

Table 2
Exporting area's rankings by number of goods imported into Canada.

Ranking in 2007	Exporting area	Number of goods in 2007	Number of goods in 1988
–	United States	15,799	11,815
1	China	11,946	2,894
2	US-New York	11,009	9,300
3	US-California	10,792	7,982
4	US-Illinois	10,288	7,689
5	Germany	10,159	7,122
6	US-Pennsylvania	9,770	7,502
7	US-Ohio	9,669	7,226
8	US-Michigan	9,363	7,296
9	US-New Jersey	9,203	7,728
10	United Kingdom	8,846	6,989

Table 3
Exporting area's contribution to the growth in Canadian import varieties and values, 1988–2007.

Exporting Area	Percentage contribution to the growth in Canadian import varieties from 1988 to 2007	Average share in Canadian imports during 1988 to 2007
China	4.08	3.87
Mexico	2.36	2.46
India	2.34	0.31
Taiwan	1.58	1.45
Italy	1.43	1.56
Thailand	1.42	0.44
South Korea	1.4	1.81
Germany	1.37	3.35
Indonesia	1.36	0.19
Japan	1.35	6.14

vaulted in the rankings, jumping from fortieth to first, when US states are treated as separate exporting areas.

Table 3 ranks the importance of countries according to their contribution to Canadian import variety growth. Emerging markets contribute the most in this respect.

2.1. Material and methods: modeling the effects of changes in variety

Feenstra (1994) derives an exact price index for a constant elasticity of substitution (CES) aggregate good allowing for changes in both the variety and quality of existing goods. Broda and Weinstein (2006) extend Feenstra's price index to the case of several CES aggregates. They show that the bias imparted by ignoring new varieties depends on their relative share of consumption in those goods, the goods' weights in total consumption, and the elasticity of substitution between the varieties of these goods. The first two factors measure the importance of the new varieties in the consumption bundle, while the last factor captures the contribution of a particular variety on welfare.

3. Results

We closely follow Broda and Weinstein (2006), documenting details of the estimation in the working version of this paper (Chen and Jacks, 2010). We proceed in three steps to estimate the impact of import varieties on Canadian welfare. In the first step, we estimate the elasticity of substitution among varieties for tens of thousands of HS 10-digit goods. Next, we calculate the change in variety for each good. In the final step, we apply log ideal weights to the change in price due to the change in variety for each good and aggregate them to estimate the total effect of variety on the Canadian import price index. Once the aggregate impact is obtained, we calculate the effect of variety on welfare.

3.1. Results: elasticities of substitution between varieties

In Table 4, we report the average estimated elasticity of substitution between varieties (sigma) for 15 HS-2 categories. In column (3), we find that the most important imports are in "Machinery/electrical" and "Transportation". Column (4) reports

Table 4
Average sigmas for HS-2 aggregation levels.

HS-2 code	Industry	Average import share (%)	Number of HS-10 goods per industry	Median number of varieties per HS-10 good	Average sigma	Standard error
(1)	(2)	(3)	(4)	(5)	(6)	(7)
01–05	Animal and animal products	1.36	603	9.16	4.19	0.83
06–15	Vegetable products	2.61	884	13.93	3.34	0.5
16–24	Foodstuffs	2.44	674	13.81	3.86	0.63
25–27	Mineral products	0.12	24	23.83	3.56	0.34
28–38	Chemicals and allied industries	7.91	1722	13.85	3.66	0.36
39–40	Plastics/rubbers,	6.33	787	17.45	2.07	0.46
41–43	Raw hides, skins, leather, furs	0.54	305	14.36	3.82	0.6
44–49	Wood and wood products	3.72	566	19.55	2.36	0.12
50–63	Textiles	3.25	2875	15.92	2.8	0.84
64–67	Footwear/headgear	0.64	300	15.32	3.88	1.51
68–71	Stone/glass	2.42	491	14.95	2.81	0.58
72–83	Metals	6.18	2160	13.07	3.41	0.75
84–85	Machinery/electrical	30.17	3639	14.85	2.09	0.06
86–89	Transportation	22.93	387	12.96	2.35	0.06
90–97	Miscellaneous	7.01	680	24.05	1.64	0.12

Table 5
Descriptive statistics on lambdas.

Variable	Statistic	HS-2	HS-4	HS-6	HS-8	HS-10
	5th percentile	0.19	0.04	0.02	0.02	1.00
Lambda in 1988	Mean	0.53	0.56	0.67	0.50	1.00
	95th percentile	0.94	1.00	1.00	0.99	1.00
	5th percentile	0.10	0.02	0.00	0.01	1.00
Lambda in 2007	Mean	0.46	0.55	0.55	0.46	1.00
	95th percentile	0.99	1.00	1.00	1.00	1.00
Lambda ratio	5th percentile	0.38	0.19	0.00	0.10	1.00
$\lambda_{07}/\lambda_{88}$	Mean	0.91	1.32	0.96	2.75	1.00
	95th percentile	1.44	3.45	1.86	6.84	1.00
Log-ideal weight (%)		86.00	8.69	1.78	1.24	2.29
Number of observations		52	100	67	56	348

the number of HS-10 goods in each industry for which we have estimated sigmas. As might be expected, the highest number of differentiated goods comes from "Machinery/electrical" and "Textiles".

A lower value of sigma implies less substitutability and, thus, a larger effect for the change in variety on the exact price index. The weighted average sigmas of HS-2 categories are reported in column (6). We find that the level of substitutability is high in agricultural and mineral products, followed by light manufacturing goods, whereas it is usually low in heavy manufacturing and electrical products.

3.2. Results: variety growth

After obtaining the sigmas, the second step is to calculate the change in variety for each good (lambda). Table 5 reports descriptive statistics for the 623 lambdas we are able to calculate. Of the 623 different HS level categories, 52 are aggregated to the HS-2 level, 100 to the HS-4 level, 67 to the HS-6 level, and 56 to the HS-8 level. 348 lambdas remain at the HS-10 level.

3.3. Results: import prices and welfare

The final step is to combine the estimates of import goods' lambdas, their corresponding weights, and elasticities of substitution in order to calculate the effect of a good's change in variety on the exact price index of imports. Excluding outliers, the aggregate effect of changes in variety on the exact price index of imports between 1988 and 2007 is 0.35. That is, when adjusted for changes in variety, the exact price index of imports fell 65% faster than the unadjusted price during the period from 1988 to 2007, representing very rapid annual declines of 5.11%.

The log ideal weight of imports in Canadian GDP for the period from 1988 to 2007 is 23.91%. Therefore, the effect of changes in variety on the general exact price index is 0.78, or 1.24% annually. By definition, the exact price index is derived as the minimum cost of a unit of welfare. Therefore, if the general exact price index falls by x%, this is equivalent to welfare increasing by $x/(1-x)$. Since the growth in import varieties results in the Canadian general exact price dropping by 22% (=1.00–0.78), we can conclude that the welfare gain is 28.2% (=0.22/0.78) from 1988 to 2007, or 1.25% annually. Alternatively, our results suggest that a representative Canadian consumer would be willing to give up 22% of their real income from 1988 to 2007 in order to gain access to new imported varieties.

3.4. Results: on the sources of variety growth

In explaining the dramatic growth in import variety into the US, Broda and Weinstein (2006) note that "reductions of trade costs may have made it cheaper to source new varieties from different countries" while "the growth of economies like China, Korea, and India has meant that they now produce more varieties that the United States would like to import" (p. 553).

In what follows, we draw from a long-standing literature linking immigration with enhanced international trade flows via the reduction of trade costs. Here, we extend this literature by considering the effects of immigration on the variety of imports. Additionally, we heed the suggestion that economic growth may

Table 6
Summary statistics.

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Varieties (logged)	152	7.04	1.86	0	12.59
Immigrants (logged)	152	10.97	0.94	9.65	13.39
Product of GDPs (logged)	152	39.5	1.85	34.48	44.08

Table 7
Regression results.

Dependent variable in all regressions: varieties (logged)						
	(1)			(2)		
	Coefficient	S.E.	*p*-value	Coefficient	S.E.	*p*-value
Immigration (logged)	0.4203	0.2163	0.06	0.2053	0.0877	0.02
Product of GDPs (logged)	0.625	0.3975	0.12	0.1243	0.0244	0.00
Observations		152			152	
R-squared		0.95			0.93	

also be responsible for the growth in import varieties. Thus, our baseline regression is

$$\ln(V_{jt}) = \phi_j + \theta_t + \alpha \ln\left(IMM_{jt}\right) + \beta \ln\left(Y_{ct} Y_{jt}\right) + \varepsilon_{jt},$$

where V_{jt} is the number of varieties from country j in time t, ϕ_j represents a set of exporting country fixed effects, θ_t represents a set of time fixed effects, IMM_{jt} is the stock of immigrants to Canada from country j in time t, and $Y_{ct}Y_{jt}$ is the product of Canada's GDP and country j's GDP in time t.

Table 6 reports the summary statistics for our three variables of interest, while column (1) of Table 7 gives the results from estimating the equation. The specification in column (2) accounts for any spurious correlation which may arise if the variables of interest are trending over time. Estimation takes place by means of SUR, where observations on import varieties, immigrant stocks, and joint output in a given year are treated as a single equation. The coefficients on immigrant stocks and joint output are restricted to be equal across equations. The estimated coefficients still suggest a powerful role for immigrants on import variety.

In combination, what these results suggest is that a 1% increase in immigration would lead to an increase in import varieties of roughly 0.30%. Table 1 documented that the growth of Canadian import varieties ran at 3.03% per year from 1988 to 2007. At the same time, the stock of immigrants to Canada rose by 2.39% per year. Pushing our results very hard, this would imply that immigrants to Canada are responsible for as much as 24% ($=2.39 * 0.003/0.0303$) of the growth in Canadian import varieties in any given year. We earlier suggested that the aggregate growth in import varieties over the period from 1988 to 2007 may have increased Canadian welfare by as much as 28%. Taken at face value, our results imply that the average Canadian consumer was roughly 7% better off in 2007 than in 1988 simply due to the enhanced varieties of import goods associated with immigration.

4. Conclusion

In this paper, we have considered the issue of import variety growth, its implications for the broader economy, and some of its potential sources. In the case of Canada, we document that import varieties grew 76%, that this growth is associated with a welfare gain as large as 28%, and that enhanced immigration flows may be responsible for 25% of this variety growth and its attendant welfare gains. One of the keys to these results has been the use of highly disaggregated Canadian trade data. This allows us to employ a new working definition of variety which moves beyond the traditional taxonomy of a particular good from a particular country by considering subnational accounts and which suggests avenues for future research.

Acknowledgments

Chen gratefully acknowledges funding for this project from the Ministry of Education of PR China (Grant No.: 09YJC790180) and of the Natural Science Foundation of China (Grant No.: 71103116). Jacks gratefully acknowledges funding for this project from Metropolis British Columbia.

References

Broda, C., Weinstein, D., 2006. Globalization and the gains from variety. Quarterly Journal of Economics 121 (2), 541–585.
Chen, B., Jacks, D., 2010. Trade, variety and immigration. Metropolis Working Paper 10-09.
Feenstra, R.C., 1994. New product varieties and the measurement of international prices. American Economic Review 84 (1), 157–177.