NAFTA@10

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Editors

Foreword

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The Variety Effects of Trade Liberalization

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Introduction

This paper assesses the variety effects of trade liberalization in the context of the Free Trade Agreement between Canada and the United States. Since the Canada-U.S. FTA was implemented 15 years ago, a large body of ex post empirical analyses has emerged to study the resulting economic impact. Most of these analyses follow the standard welfare interpretations of trade, seeking the expected relative price and quantity changes following upon the Canada-U.S. FTA. While relative price and quantity changes are likely the primary benefits of trade liberalization, liberalization also yields gains by enhancing consumers' and producers' access to new varieties in each country, which is also important to a nation's welfare. Unfortunately, there are few available studies that allow the strength of such an argument to be evaluated on empirical grounds in the Canada-U.S. FTA context. This paper attempts to fill this research gap by presenting the latest empirical evidence on the variety gains that accrue from trade liberalization under the Canada-U.S. FTA.

There has been well-established literature on the role of "variety" or "product differentiation" in international trade. Much of this literature is motivated by the observation that large volumes of intra-industry trade take place between countries with similar factor endowments, while the traditional factor-endowment-based explanation of trade predicts large inter-industry trade between countries with different factor endowments. The monopolistic competition trade model, or the so-called "love of variety" approach, which was introduced in Krugman (1979, 1980) and Helpman (1981), and consolidated in Helpman and Krugman (1985), represents one of many intellectual efforts to address this empirical puzzle by emphasising product differentiation and economies of scale as alternative sources of trade. They have successfully shown how product differentiation and increasing returns to scale in production could give rise to trade between similar countries in the absence of comparative advantage.

The product differentiation explanation of trade claims that many varieties of a product exist because producers attempt to distinguish their varieties from rivals' in the minds of consumers in order to achieve brand loyalty, or because consumers demand a wide spectrum of varieties. Although countries without substantial cost differences are not specialized at the industry level in international trade, they are, nevertheless, specialized in the different varieties of a product within the same industry, resulting in intra-industry trade. Product differentiation, reinforced by brand-specific economies of scale, gives rise to large volumes of trade between similar countries.

The product differentiation explanation of trade suggests a completely different empirical framework for assessing the impacts of trade liberalization. In the world of comparative advantage, gains from trade would be evaluated in terms of increases in allocative efficiency arising from the reallocation of resources across industries, while in the product differentiation framework, gains from trade would be reflected in the availability of new varieties following upon trade liberalization. With the opening of trade, each country increases its exports of varieties to other countries, at the same time, it faces competition from foreign varieties produced by foreign firms. As a result, a country under free trade is expected to produce fewer domestic varieties due to foreign competition, but it would have a wider range of available varieties through imports. In addition, there is a price effect associated with trade liberalization and increases in competition, which lowers the price for each variety, thereby increasing consumers' and producers' affordability and access to new varieties. Consequently, the sum of varieties under freer trade would exceed the number of varieties available before the opening of trade (Feenstra, 2001)[1].

Product differentiation typically involves brand-specific economies of scale. However, Helpman (1998) downplays the significance of economics of scale, because product differentiation might limit the scope for economics of scale. As the number of varieties increases, the output of each individual variety necessarily falls. He stresses that what matters is that there exists economies of scale, not their size[2]. Feenstra also finds that several country empirical studies fail to find any significant scale effects following upon trade liberalization (Feenstra, 2001)[3]. Feenstra argues that if the elasticity of demand for product varieties is constant, consumption of each variety is likely to fall under free trade because individuals are spreading their expenditures over more product varieties. Under such a circumstance, firms' scale will not change at all, though the number of varieties consumed will increase due to increasing imports.

In the context of the Canada-U.S. FTA, extensive policy discussions in the half-century or more leading up to the Canada-U.S. FTA argued that Canadian firms would benefit from unrestricted access to the U.S. market. It was believed that the Canadian market was too small to allow manufacturing industries to operate at a minimum efficient scale. Indeed, this was the principal reason that Canada entered into a free trade agreement with the U.S. in 1989. However, with more than a decade since the Canada-U.S. FTA has been in effect, the expected scale effect has not been borne out empirically. Head and Ries (1999) examined the impact on the plant scale in the six years following the Canada-U.S. FTA, using plant level data for a sample of 230 Canadian industries. They found that tariff reduction in the U.S. increased the Canadian plant scale by 10% on average, but this was largely offset by an 8.5% reduction in plant scale due to the reductions in Canadian tariffs. On balance, the Canada-U.S. FTA had only a marginal impact on scale[4]. This disappointing result suggests that economists

[1] Feenstra, Robert C. (2001) "Advanced International Trade: Theory and Evidence", Princeton University Press, forthcoming. Chapter 5.
[2] Helpman, Elhanan (1998) "The Structure of Foreign Trade", NBER Working Paper 6752.
[3] See Head, Keith and John Ries, (1999) on Canada, Tybout and Westbrook (1995) on Mexico, and Tybout, de Melo and Corbo (1991) on Chile.
[4] Head, Keith and John Ries, (1999) "Rationalization Effects of Tariff Reductions", *Journal of International Economics*, 47(2), April, 295-320.

might have misunderstood the nature and dynamism of North American trade. Given the fact that bilateral trade between Canada and the U.S. has been dominated by trade in differentiated products within the same industry (this will be explained below), access to new varieties is perhaps a more important source of gains from trade than the scale effect.

There have been some empirical studies emerging in the past decade which attempt to establish the link between changes in trade policy and an increase in the availability of new varieties from the perspective of consumer welfare. Many of these studies argue that growth in the availability of new varieties is more valuable to economic welfare than growth in quantity. Romer (1994) shows that lower tariffs increase demand for foreign varieties, allowing more of them to enter the local market, and sell enough units to cover local fixed costs; as a result, welfare gains would be 10% of GDP, compared to 1% of GDP in more standard models, in response to a 10% tariff reduction on all imports[5].

Russel Hillberry and Christine McDaniel (2002), using very detailed U.S. trade data, identified the extent to which the increase in NAFTA trade was associated with trade in new varieties. They decomposed the growth in the value of U.S. trade with its NAFTA partners from 1992 to 2002 into price, volume, and variety effects. The latter effect was measured by the change in trade values due to trading more or fewer goods as classified in the Harmonized Tariff Schedule. They measured the increase in US exports to Canada as 35% and the increase in Canadian exports to the US as 69% between 1993 and 2001. Of the 35% increased US exports to Canada, only 3.4 percentage points of these represented trade in new varieties. They concluded that most of the post-NAFTA changes in U.S. trade patterns were increases in the quantity of goods traded in HS lines that were already traded in 1993. They found only a marginal variety effect[6].

While most of available empirical studies of what variety gains might follow from trade liberalization uses growth in the number of the HS lines with positive trade as an indicator of increases in variety. a paper by Haveman and Hummels is an important exception to this. They calculated the number of exporters from whom the importer purchased that good for each importer and good, and then expressed this as a ratio over the total number of exporters in that good. If an importer did not purchase a good from any exporter, the ratio is zero. Their calculations showed that importers purchased a very small fraction of available varieties. The zero values represented fully 22% of the distribution. Conditional on importing the good from at least one exporter, they found that, in nearly half of these cases, importers bought from fewer than 10% of available exporters. Indeed, the most common situation was that countries traded a particular 4-digit HS good with only one partner. Haveman and Hummels suspected that the fraction of available varieties that were actually imported was even lower than their figures suggested, because they did not have direct evidence

[5] Romer, Paul (1995) “New Goods, Old Theory, and the Welfare Costs of Trade Restrictions,” *Journal of Development Economics*, vol. 43, 1995, pp. 5-38.
[6] Hillberry, H. Russell and Christine A. McDaniel (2002) “A Decomposition of North American Trade Growth since NAFTA”, International Economic Review, Many/June 2002, U.S. International Trade Commission.

on the full set of varieties produced. Based on their findings, they concluded that the existing trade models such as the monopolistic competition model might considerably overstate either the extent of product differentiation (incomplete specialization) or the degree to which consumers value that differentiation[7].

Caves (1981) has made an important observation about product differentiation. According to him, product differentiation does not necessarily lead to greater intra-industry trade. If product differentiation is due to the complexity of the characteristics of the product, it should stimulate intra-industry trade. On the other hand, if product differentiation has a strong information component, requiring substantial advertising by the firm in order to inform customers of its product's uniqueness, language and cultural barriers to advertising in a foreign country might make product differentiation a hindrance to intra-industry trade[8].

Most of what is available in the literature to date involving the measurement of the variety effects of trade liberalization suffers a fundamental weakness: HS lines considerably underestimate the number of varieties traded across countries. For instance, there are many car models produced in North America and imported from abroad, but only one HS code that covers them all. A full examination of the variety of trade requires evidence on the full breadth of varieties produced.

This study contributes to recent empirical literature on trade in varieties in the following two areas. First, it uses the World Intellectual Property Office (WIPO)'s cross-country trademark registration statistics to measure recent trends in global trade in variety. It confirms Haveman and Hummels' suspicion that nations are trading far fewer varieties than commonly supposed, and there is a strong "home bias' in the global production and consumption of differentiated products. It also finds evidence that supports Caves' hypothesis that languages and culture constitute important barriers to trade in differentiated products, while at the same time trade liberalization helps to facilitate trade in varieties. Second, this study uses the Canadian Intellectual Property Office's and U.S. Intellectual Patent Office's trademark databases to track bilateral trade in varieties between Canada and the U.S. at detailed industrial levels to determine whether the Canada-U.S. FTA has enhanced each country's access to varieties.

The paper is organized as follows: the following section will set the stage for the analysis by outlining the economics of trademarks, section three will describe global trade in varieties from the early 1980s through 2002 using WIPO's cross-country trademark registration statistics. Section four will present the econometric results, while the theoretical framework that underpins the econometric estimation is included in the appendix. Section five will outline the changes in North American trade pattern, the variety gains under the Canada-U.S. FTA, and the industry-level regression analysis detailing the variety-enhancing effect of the Canada-U.S. FTA. The final section will summarize the results.

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[7] Jon Haveman and David Hummels (1999) "Alternative Hypotheses and the Volume of Trade: Evidence on the Extent of Specialization".

[8] Caves, Richard E. (1981), " Intra-Industry Trade and Market Structure in the Industrialized Countries", Oxford Economic Papers, 33 (July):203-223.

Why trademarks?

Before presenting the detailed trademark statistics, one needs to know what trademarks are. Why are trademarks being used in this context in the first place? And, do the trademark statistics match what the differentiated product trade model describes?

According to the Canadian Intellectual Property Office's definition, a trademark is a word, a symbol, a design, or a combination of these features to distinguish the goods or services of one person or organization from those of others in the marketplace. Trademarks come to represent not only actual goods and services, but also the reputation of the producer. As such, they are considered as valuable intellectual property. A registered trademark can be protected through legal proceedings from misuse and imitation[9].

In general, a trademark performs the following four main economic functions:

1) A trademark is one means of achieving product differentiation. As Chamberlin (1947) explained a half century ago, a product is differentiated if any significant basis exists that helps a consumer to distinguish the goods or services of one seller from those of another, leading to a preference for one variety of the product over another. Such a basis could be found in certain characteristics of the product itself, such as exclusive patented features; trademarks, trade names; peculiarities of the package or container; or singularity in quality, design, colour or style[10].

2) By distinguishing the source, origin, and quality of particular products from other similar products, the trademark protects the public against confusion and deception, as well as the trademark owner's trade and business and the goodwill that is attached to the trademark. The rationale for patent protection is quite different from that of a trademark. Patents are granted to encourage inventions by private enterprises or individuals, and to encourage prompt and adequate public disclosure of a new technology. Unlike patents and other intellectual properties, the trademark is the only instrument in the differentiation process that receives specific legal protection for unlimited time. Registrations are usually valid for a limited time period, but trademark holders have the option of renewing their registrations.

3) A trademark gives market power to the businesses that own them. In the case of patents, a grant of a monopoly for a certain period of time is in itself an indicator of market power, while in the case of trademarks, the market power of a specific product is achieved through the development of brand loyalty. Brand loyalty constitutes a barrier to the entry of new competitors into the market, making more difficult not only actual but also potential competition.

4) A trademark is a prime instrument in advertising and selling differentiated products. Although advertising need not be brand specific, the advertising effort is chiefly concentrated on the promotion of a particular trademark. Trademarks tend to proliferate among those products such as apparel,

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[9] Canadian Intellectual Property Office (2002), "A Guide to Trade-Marks".

[10] E. H. Chamberlin, *The Theory of Monopolistic Competition: A re-orientation of the Theory of Value*, 5th ed. (Cambridge, Mass., Harvard University Press, 1947, p.56

cosmetics, and toilet preparation products for which the advertising effort is highest and most persuasive. They are a basic element in the persuasive content of advertising messages aimed at influencing consumers' purchase behaviour. In addition, brand specific advertising is an important factor in the creation of market power. High levels of advertising create an additional cost on any new entrant into the industry. If, at the same time, economies of scale exist in advertising, new entrants not only have to reach the average level of advertising existing in the industry, but they also have to achieve a high volume of sales to enjoy all the benefits from the advertising expenditure.

Overall, the economic rationale of having trademark protection is to help the business achieve product differentiation, to protect the trademark owner's business from unfair competition as well as the public against confusion in the market place. In reporting the bill that became the United States Federal Trademark Act of 1946 (Lanham Act), the Senate Committee on Patents pointed out the fundamental basis for trademark protection:

> *Trademarks, indeed, are the essence of competition, because they make possible a choice between competing articles by enabling the buyer to distinguish one from the other. Trademarks encourage the maintenance of quality by securing to the producer the benefit of the good reputation which excellence creates. To protect trademarks, therefore, is to protect the public from deceit, to foster fair competition, and to secure to the business community the advantages of reputation and good will by preventing their diversion from those who have created them to those who have not. This is the end to which this is directed.*[11]

Because of the nature of trademarks, the trademark registration statistics offer more information on the availability of varieties than any other statistics that have been used in empirical studies to date. Each trademark represents a unique variety, which distinguishes itself from others by its own designs, technologies, concepts, or ideas. In addition, the registration statistics contain other useful information for research and analysis such as the registration number, industrial classes, the name and address of the applicant, the owner of the trademark, the nationality of the owner, the date of registration, etc...

However, several problems are encountered in interpreting the trademark registration statistics published by the WIPO:

1) The registration statistics adequately capture the number of new products being introduced into the market, but they fail to reflect the number of trademarks withdrawn from the market. Since the cost of registration is relatively low, many firms prefer to renew the existing registrations to prevent others from using them, even though these trademarks are no longer being used. Therefore, using the stock number of registrations would significantly inflate the actual number of varieties in the market.

[11] J.T. McCarthy, op.cit., vol. 1, p. 54.

2) Some countries' registration statistics include both new registrations and renewals; as a result, their figures are higher than those that separate new registrations from renewals.

3) Some countries such as Canada, the U.S. and many other English-speaking countries allow multiple-class applications in the sense that one registration can be applied to several industrial classes, (for instance, a Disney trademark can be used for a T-shirt as well as for a cup, while a T-shirt and a cup belong to different classes of industries), while other countries, such as Mexico, allow only single-class applications. Consequently, the number of trademark registrations in Mexico could be higher than those in Canada, but in reality, new products introduced in Canada are not fewer than those in Mexico.

4) The standards for accepting trademark applications vary by country. In Canada and other advanced industrialized countries, the ratio of registrations over applications is about 50 percent; while in many less developed countries, that ratio is more than 90 percent. As a result, registrations in some less developed countries are substantially higher than in many industrialized countries.

5) With respect to cross-country registrations of trademarks, a problem might arise in so far as there are cases where corporations that are actually controlled by foreigners might appear as national entities. Under these circumstances, the trademarks registered by these corporations appear in the statistics as nationally owned. However, the underestimation of the ownership of trademarks by foreigners is not likely to be a serious distortive factor because the current international legislation is not biased against foreign registrations and generally the owners of trademarks prefer to have them registered in their own names.

Because of these reasons, the trademark registration statistics should be used with caution. Nevertheless, the cross-country trademark registration statistics still provide rich and useful information on global trade in varieties. The following will present some stylized facts of trade in varieties in the global and North American context using the WIPO's cross-country trademark registration statistics.

North American trade in variety in a global context

Table 1 reports average annual new trademarks for selected source countries (including the U.S., Canada, the U.K., Japan, German, Spain, Switzerland, China, and India) in a list of host countries for the period between 1990 and 2000. Wherever the cell points to, the source countries refers to average annual domestic registrations in these countries. For instance, the average annual new trademark registrations by U.S residents in Canada between 1990 and 2000 were 4,647, while the corresponding figure for U.S. residents in the U.S. was 73,686. Similarly, the average annual new trademark registrations by Canadians in the U.S. were 2,535, while the corresponding figure for Canadian domestic registration was 8,416.

The second to last row sets out the average annual trademark registrations summing over all host countries by source country. For instance, the average annual trademark registrations by U.S. firms in all host countries were 3,051 between 1990 and 2000, while the similar figures for Canada and the U.K.

were 205, and 688, respectively. The last row is the ratio of the average annual registrations in all host countries over the average annual domestic registrations. This ratio indicates the extent of "home bias" in the production of varieties. For instance, the average annual trademark registrations in foreign countries by U.S. firms accounted for only 4 percent of domestic registrations in the U.S. between 1990s and 2000, while the corresponding figure for Switzerland was 12.8 percent, and for China was 0.1 percent.

Table 1. Annual Average Cross-Country Trademark Registration, 1990-2000.

	U.S.	Canada	U.K.	Japan	Germany	Spain	Swiss	China	India
China	3625	125	685	1952	1905	255	956	77102	30
India	307	5	108	91	140	12	62	5	4565
Japan	6193	188	1077	131073	1430	171	755	97	7
Korea	3145	84	496	1840	710	56	425	38	7
Canada	4647	8416	311	336	379	64	200	37	7
Austria	874	28	253	134	2127	154	873	30	3
Finland	968	23	287	129	1279	107	433	25	2
France	5092	209	1069	810	4504	879	2039	92	7
Germany	2592	99	826	567	22958	276	1091	69	8
Ireland	1235	20	952	115	755	124	240	14	3
Italy	3415	91	1120	692	2258	385	1203	93	9
Norway	1297	30	399	158	1624	151	492	32	3
Portugal	1884	39	770	287	2198	1101	920	62	4
Spain	2748	61	943	472	1291	53172	598	60	5
Sweden	1264	36	393	185	1392	123	479	27	4
Swiss	1561	53	414	235	2231	188	5301	44	3
UK	5266	278	23142	1028	3083	385	1167	77	32
Australia	4008	171	1028	582	724	74	417	47	12
N.Z.	2604	82	717	304	435	38	296	36	13
Brazil	1985	45	295	252	466	85	272	16	6
Argentina	5957	133	968	558	1118	564	810	32	9
Mexico	6448	174	464	356	757	360	462	30	5
USA	73686	2535	1556	1285	1887	296	722	110	39
Av. For Reg.	**3051**	**205**	**688**	**562**	**1486**	**266**	**678**	**49**	**10**
Ratio of For. Over Dom. Reg. (%)	4.1	2.4	3.0	0.4	6.5	0.5	12.8	0.1	0.2

Source: Author's calculation based on WIPO's Industrial Property Annual Statistics

Examining Table 1, several interesting trends stand out, and each is discussed in turn below:

1) The data strongly confirms Haveman and Hummel's suspicion that nations are trading far fewer varieties than is commonly supposed. Importers purchase only a very small fraction of available varieties from foreign countries. There is a strong "home bias' effect in the production of varieties. This is even after taking account of natural and policy barriers to trade such as language, distance, and regional preferential trade arrangements. For instance, between 1990 and 2000, the annual average domestic registrations in the U.S. were 73,686, implying about 73,686 new products, concepts, and ideas were introduced into the U.S. market annually during that period. However, over the same period, the annual average registrations by US residents in Canada, the U.K. and other English speaking countries (assuming English-speaking industrializing countries are more likely to accept U.S. varieties than other countries) were around 4-5000, which was 5-6% of average domestic registrations in the U.S.

This trend is not unique to the U.S. It applies to other advanced industrialized countries as well. By way of illustration, the annual average domestic registrations in Japan between 1990 and 2000 were 131,073, but the average Japanese registrations in foreign countries over the same period were only 1,285 in the U.S., 1,028 in the U.K., and 567 in Germany. In Germany, the annual average domestic registrations were 22,958, but the registrations by German residents in the U.S. were 1,887; and 3,083 in the U.K., and 4,504 in France.

Switzerland, however, is an exception. Relative to other countries, Switzerland's varieties are widely accepted in many parts of the world, particularly in its neighbouring countries. As indicated at the last row of Table 1, Switzerland was leading the industrial countries in terms of exports of varieties; its foreign registrations accounted for 12.8 percent of domestic registrations, compared to 6.5 percent for Germany and 4.1 percent for the U.S.

2) Nations that share the same language exchange more varieties between them. For instance, English-speaking countries traded more varieties among themselves than with non-English-speaking countries. The same is the case for Spanish and German speaking countries. This lends support to Caves' hypothesis that if product differentiation has a strong information component, requiring substantial advertising, countries that speak the same language and share the same culture would be more likely to trade their varieties among themselves. On the other hand, for the countries that are not part of language and cultural traditions, language and culture constitute a barrier to trade in differentiated products.

3) Trade in varieties is more likely to take place in less distant economies. The distance effect of bilateral trade is one of the clearest and most robust findings in empirical trade literature. With respect to trade in varieties, distance matters perhaps even more than trade in quantity. Table 1 shows that nations that shared the common border were trading far more varieties than those located far apart.

4) Higher income countries tend to trade more varieties between themselves than with lower income countries. A possible explanation is that higher income countries are the producers of most of the varieties in the world,

and their rich consumers can afford, and are willing to pay more, than poor consumers for the first unit of each variety.

Low-income countries export far fewer varieties than high-income countries. As indicated in Table 1, trademark registrations between low-income and wealthy industrialized countries were very asymmetric. For instance, the annual average trademark registrations by U.S. residents in China and India were 3,625 and 307, respectively, while the corresponding registrations by Chinese and India residents in the U.S. were only 110 and 39, respectively. This implies that despite rapid export growth from China and India to industrialized countries, and rising skill levels in these two countries, their exports were driven more by the increases in the quantity of trade, than by the increases in the variety of trade. The bulk of their exports to rich countries represented "process trade", outsourced by industrialized countries that own the intellectual properties of the products. China and India manufactured these products without developing their own products, concepts, and ideas, or creating their own brand royalties in rich countries.

5) Nations that have formed regional trading arrangements tend to trade more varieties among themselves. Trade liberalization is playing a facilitating role in global trade in varieties. Lowering tariff barriers increase demand for foreign varieties, allowing more of them to enter the local market, thereby increasing the range of products supplied in the domestic market and enhancing consumers' access to foreign varieties.

6) Canada is not a heavyweight in global trade in varieties. Between 1990 and 2000, the annual average registrations by Canadian residents in all foreign countries were 205, compared to 3,051 for the U.S., and 1,486 for Germany, and 688 for the U.K. Further, Canadian foreign registrations are almost exclusively concentrated in the U.S. market with U.S. registrations totalling 2,535, compared to only 278 registrations in the U.K., and 209 registrations in France. The U.S. is the single largest supplier of differentiated products in the world. Its annual average trademark registrations in foreign countries totalled 3,051.

The picture painted above suggests that the product differentiation model, which is based on the very strict assumptions of complete specialization and identical consumer's preferences, is not what one observes in a real world. Consumers' preferences for different varieties are far from identical. Product differentiation is strongly influenced by language, distance, culture, and historical ties. A theoretical framework that is developed by incorporating some of these elements discussed above is included as an appendix. The empirical investigation on the determinants of global trade in variety is presented below.

Estimation results

The gravity-type equation that is presented below is derived from the theoretical model explained in the Appendix. The equation attempts to investigate the determinants of global trade in variety, and it is specified as follows:

$$\ln v_{ij} = \eta_1 \ln y_i + \eta_2 \ln y_j + \eta_3 \ln py_i + \eta_4 \ln py_j + \eta_5 \ln Dis_{ij} + \eta_6 t_{ij} + \eta_7 Lan_{ij} + \eta_8 \phi_i + \eta_9 \phi_j + \varepsilon_{ij} \quad (1)$$

The variables are defined next. Subscripts *i* and *j* represent the source and target country, respectively.

v_{ij} is the number of trademarks registered by country *i* in country *j*,

y_i represents source country *i*'s GDP,

y_j represents the target country *j*'s GDP,

py_i is source country *i*'s per capita GDP,

py_j is target country *j*'s per capita GDP,

Dis_{ij} is the distance between the source country *i* and the target country *j*, using Haveman's bilateral distance calculation[12],

t_{ij} is a binary dummy variable, which is unity if both source and target countries belong to the same regional trade agreement and zero otherwise,

Lan_{ij} is a binary dummy variable that is unity if two countries have a common language and zero otherwise,

ϕ_i is the source country fixed effect, representing a country's propensity to export its varieties abroad. It equals to one if the country is exporting and 0 otherwise,

ϕ_j is the target country fixed effect, representing a country's propensity to import the varieties from its trading partners. It equals to one if the country is importing and 0 otherwise,

ε_{ij} is the stochastic error term, representing other influences on cross-country trademark registrations.

The dependent variable, trademark registrations by non-residents in the regression analysis, are taken from the WIPO's Industrial Property Annual Statistics for the following 33 countries: Argentina, Australia, Bulgaria, Brazil, Canada, Switzerland, China, Czechoslovak, Germany, Denmark, Spain, Finland, France, the U.K., Greece, Hungary, Ireland, Israel, India, Italy, Japan, Korea, Mexico, Norway, New Zealand, Poland, Portugal, Romania, Sweden, Russia, Turkey, the U.S., and South Africa. This is the cross-section regression. The numbers in the registrations are annual averages for the entire period of 1990-2000 so as to eliminate the yearly fluctuations, as registrations often fluctuate with business cycles and merger and acquisition activities. GDP and population data are taken from the Penn World Tables.

Table 2 reports the estimation results of (1). The estimation results confirm several observations mentioned earlier. First, the estimated coefficients for both source- and target-country GDP are significant and positive, with the

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[12] http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html

source-country GDP effect dominating. The statistical significance of both source- and target-country GDP effects suggest that the size of the economy matters: "larger" economies supply and demand more varieties than "smaller" ones. "Larger" economies specialize in everything, while "smaller" countries specialize in a few things.

Second, source-country per capita GDP is estimated to have a significant and positive effect on the cross-country registrations of trademarks. This is consistent with the conventional wisdom that wealthy industrialized economies have a comparative advantage in producing brand-name differentiated products; as such, they are the main suppliers of differentiated products in the global market. On the other hand, it is surprising to see that per capita GDP for target country is negatively correlated with registrations as wealthy industrialized countries are expected to have a high propensity to import the differentiated products from abroad due to the income effect. The possible explanation for this result is that several low-income countries started to introduce new trademark registration systems into their countries during the 1990s in compliance with the new Trade-related Intellectual Property Agreement concluded at the Uruguay Round trade negotiations, resulting in a surge in foreign trademark registrations in these countries.

Third, the estimated coefficient for distance has the expected negative sign, which indicates that trade in variety is more likely to take place between less distant economies. The estimated coefficient for the "language" dummy is significant with a positive sign. This confirms Caves' hypothesis that product differentiation has a strong information component; countries that share the same language and culture are more likely to appreciate the uniqueness of their own products, and more likely to develop the brand-name loyalty for their own products. Regional trade agreements are estimated to have a significant and positive impact on cross-country trademark registrations, suggesting that trade liberalization is contributing positively to global trade in variety. However, the estimated effect of "regional trade liberalization" appears far smaller than that of "language". The estimated coefficient for "language" is 0.8 compared to only 0.22 for "regional trade liberalization". This raises a question as to how effective trade liberalization is in facilitating global trade in variety. However, caution should be taken in interpreting these regression results since many regional trading partners share the same border and language; as such, the distance and language effects might dilute the effect of trade liberalization.

Fourth, with respect to the source-country fixed effects, several source countries are estimated to have a relatively high propensity to export their varieties, most notably the U.S., Germany, France, the U.K., Switzerland, and Italy. The estimated fixed country effects range from 2.529 for the U.S., 1.913 for Germany, to 1.5061 for Italy. On the other hand, India, China, and Mexico have fewer varieties available for their foreign customers. The source-country effects for Australia, Canada, and Finland are statistically insignificant.

The overall target-country effects appear weaker than the source-country effect. The economies of the U.S., Australia, China, and the U.K. are relatively open to foreign varieties, while India and Brazil are relatively restrictive with respect to foreign varieties. The target-country effects for Canada, Switzerland, Germany, Spain, Finland, Korea, and Mexico are statistically insignificant.

Table 2. The Determinants of Global Trade in Variety

Variables	Parameter Estimates	t-statistics
Constant	-14.03528	-9.832357
v	0.365454	8.532996
v	0.245630	5.788625
pv	0.706213	20.05190
pv	-0.105936	-3.013511
Dis^i	-0.541819	-16.90024
Lan^i	0.802707	7.921156
t^i	0.217310	2.736747
ϕ Australia	0.144272	0.953675
ϕ Brazil	0.293154	1.757711
ϕ Canada	0.124041	0.803184
ϕ Switzerland	1.574166	10.54413
ϕ China	0.485852	12.42470
ϕ Germany	1.913054	10.30381
ϕ Spain	1.096261	7.122069
ϕ Finland	-0.217976	-1.533044
ϕ France	1.847351	10.61162
ϕ UK	1.532777	9.135715
ϕ India	0.087257	5.580154
ϕ Italy	1.506131	9.066492
ϕ Japan	0.682604	3.296985
ϕ Korea	0.610631	4.030031
ϕ Mexico	0.405210	2.617597
ϕ USA	2.528950	11.54231
ϕ Australia	0.722609	4.786037
ϕ Brazil	-0.549002	-3.240389
ϕ Canada	-0.237624	-1.543223
ϕ Switzerland	0.025581	0.171540
ϕ China	0.700212	3.514917
ϕ Germany	0.035565	0.192720
ϕ Spain	0.178654	1.164607
ϕ Finland	-0.224229	-1.576640
ϕ France	0.531485	3.038636
ϕ UK	0.422334	2.528291
ϕ India	-1.985353	-9.890453
ϕ Italy	0.302856	1.831600
ϕ Japan	0.356332	1.734706
ϕ Korea	0.177119	1.172584
ϕ Mexico	0.233299	1.511967
ϕ US	0.638620	2.938193
$R^2 = 0.85$	N = 1105	

The variety gains under the Canada-U.S. FTA

To have a better picture of the variety-enhancing effect of trade liberalization, the following uses the Canadian Intellectual Property Office's and U.S. Intellectual Patent Office's trademark databases to track bilateral trade in variety between these two countries at the detailed industrial level over the past several decades. The advantages of using these two countries' trademark data are twofold: 1) these two countries have better-quality trademark registration statistics, and they have very similar trademark registration and enforcement systems; 2) by focusing on these two countries' registrations statistics, one could further isolate the trade liberalization effect by removing the language and distance effects from the regression analysis, as these two countries share the same border, culture, and language.

Changes in Canada's merchandise trade pattern

Prior to examining the variety effects of the Canada-U.S. FTA, it might be helpful to highlight the changes in the bilateral trade pattern between Canada and the U.S. in past decades. During this time, the bilateral merchandise trade pattern between Canada and the U.S. experienced profound changes. The most significant was the rapid expansion of Canada's exports of differentiated products, resulting in a steady rise in the share of differentiated products in Canada's total merchandise exports to the U.S[13]. As illustrated in Figure 1, the share of differentiated products in Canada's merchandise exports reached 70 percent in the late 1990s, up from 50 percent in the early 1980s; while the corresponding share of homogenous products fell to 14 percent from more than 20 percent over the same period. The increases in Canada's exports of differentiated products to the U.S. were partly attributed to the 1965 Auto Pact between Canada and the United States. However, from the mid-1980s onward, a noticeable trend emerged; the significant expansion of Canada's exports of non-auto differentiated products to the U.S. The share of non-auto differentiated products in Canada's total exports of differentiated products to the U.S. increased to nearly 60 percent in the late 1990s from just above 40 percent in the mid-1980s, while the corresponding share for auto products went down to nearly 40 percent from 57 over the same period. The rising exports of machinery and equipment were largely responsible for the shift in the composition of Canada's exports of differentiated products to the U.S. (See Figure 2).

On the imports side, the U.S. has always been Canada's main supplier of differentiated products. Imports of various types of differentiated products from the U.S. consistently dominated Canada's merchandise import pattern, accounting for 85 percent of total Canada's merchandise imports from the U.S. This trend has changed little over the past several decades.

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[13] Merchandise trade data are grouped into three categories according to the classification by Rauch (1999). These groups are: (1) homogeneous, which refers to products traded on organized exchanges; (2) differentiated, which refers to products that are "branded"; and (3) referenced, which refers to those that are "in-between", whose prices are often quoted in trade publications.

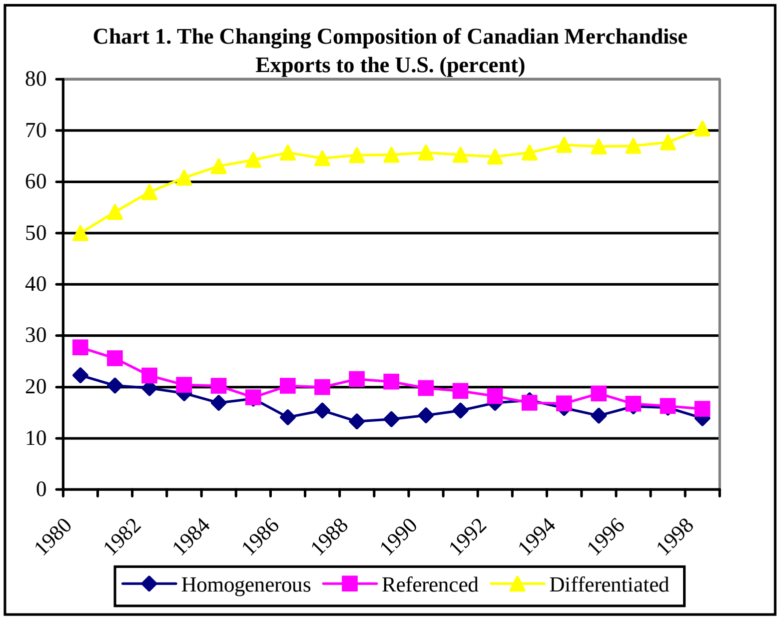

Chart 1. The Changing Composition of Canadian Merchandise Exports to the U.S. (percent)

Source: Authors' calculations based on Statistics Canada data

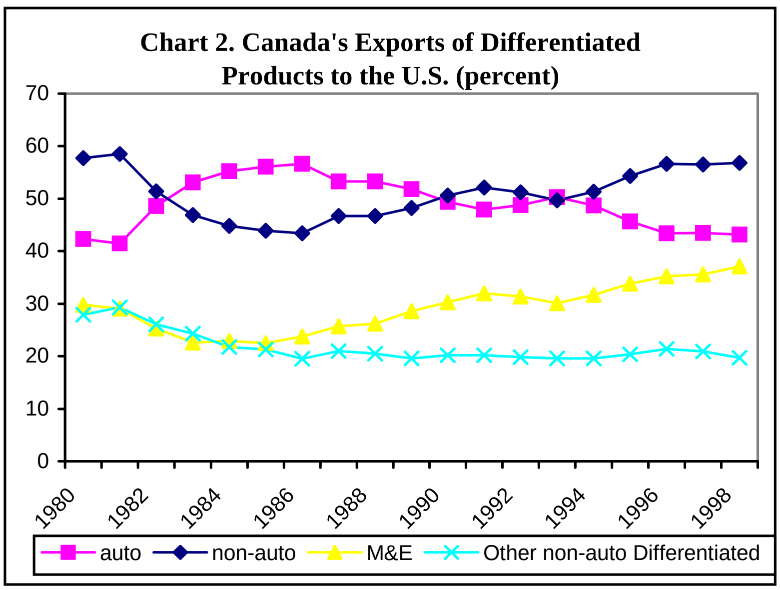

Chart 2. Canada's Exports of Differentiated Products to the U.S. (percent)

Source: Authors' calculations based on Statistics Canada data

The changes in the bilateral merchandise trade pattern described above indicate that while homogeneous products remained significant in Canada's total exports to the U.S., the recent surge of Canada's exports to the U.S. was almost exclusively explained by increased exports of differentiated products, particularly non-auto differentiated products. This fact underlies the need to use the product differentiation framework to explain and understand the nature and dynamism of bilateral trade between Canada and the U.S. Access to more varieties and enhancing the levels of product differentiation are the key benefits of the Canada-U.S. FTA. The following will use Canadian and U.S. trademark statistics to verify this hypothesis.

The variety gains under the Canada-U.S. FTA

Tables 3 and 4 present average annual new trademark registrations by U.S. residents in Canada and corresponding registrations by Canadians in the U.S. by product over the periods of 1980s-90s. As shown in Tables 3 and 4, the increased access to different varieties of differentiated products following upon trade liberalization was a distinguishing feature during the Canada-U.S. FTA period[14]. By way of illustration, the average annual new trademark registrations for differentiated products by U.S. residents in Canada rose from 4,342 in the 1980-89 period to 7,018 in the 1990-02 period, an increase of 2,676 annually. This can be compared to an increase in annual registrations of 61 for homogeneous products and 581 for referenced products over the same period. Similarly, the average annual new trademarks registered by Canadians in the U.S. for differentiated products increased by 1,432 between the 1980s and 1990s, compared to only 46 for homogeneous products and 316 for referenced products. The figures based on the number of registrations per billion dollars of imports show a similar picture: one billion dollars of Canadian imports of differentiated products from the U.S. contained 97 new trademarks (if the auto products were excluded, that figure increased to 126), compared to 25 for homogenous products; similarly, there were 38 varieties embedded in every billion dollars of Canadian exports of differentiated products to the U.S. (if the auto products were excluded, that figure rises to the 55), compared to only 5 varieties for homogenous products. These figures confirm that trade in homogeneous products is driven by changes in quantity within a narrow set of varieties; while trade in differentiated products is determined by changes in the number of varieties. The actual traded quantities for each variety could be relatively small. Given the fact that the recent surge of Canada's exports to the U.S. was driven mainly by exports of differentiated products, examining the gains from variety--the increased numbers of Canadian varieties sold in the U.S. and the availability of U.S. varieties sold in Canada will feature prominently in the remaining analysis of this chapter.

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[14] Trademarks are registered based on the product classification. When the product classification is converted into the industry-based classification such as North American Industry Classification System (NAICS), the total number of registrations summing over all industries might be larger than that of original registrations as both Canadian and the U.S. allow multiple-class registrations, which means that one trademark could be registered under different industries.

Table 3. The Annual Average Trademark Registrations by U.S. Residents in Canada and Canada's Imports from the U.S. by Product, 1980-02

	1980-89	90-02	Change	Growth (%)	Imports (Can$ Billion) (90-02)	Number of Trademark per Billion of Imports
Homogeneous Products	185	246	61	33.5	10	25
Referenced Products	974	1555	581	59.7	9.8	158
Differentiated Product	4342	7018	2676	61.6	72.5	97
Differentiated Product without Auto Products	4041	6550	2509	62.1	51.9	126
Goods	5501	8820	3319	60.3	92.3	96
Services	930	2402	1472	158.4	31.5	76
Total	6431	11222	4791	74.5	123.8	90.6

Source: Author's calculation from the data listed at the CIPO trademark database, and the U.S. Bureau of Economics Analysis.

Table 4. The Annual Average Trademark Registrations by Canadian Residents in the U.S. and the U.S. Imports from Canada by Product, 1980-01

	1980-89	90-01	Change	Growth (%)	Imports (U.S$ Billion)	Number of trademark per billion of imports
Homogeneous Products	48	94	46	97.2	17.3	5.4
Referenced Products	210	526	316	151	16.5	31.9
Differentiated Product	864	2296	1432	165.6	60.3	38.1
Differentiated Product without Auto Products	804	2142	1338	166.5	38.8	55.2
Goods	1122	2916	1794	166.5	94	31
Services	265	902	637	240.6	13.2	68.3
Total	1387	3818	2431	175.3	107.2	35.6

Source: Author's calculation from the data listed at the U.S IPO trademark database, and the U.S. Bureau of Economics Analysis.

Tables 3 and 4 also show that Canada's access to U.S. varieties was almost three times more than what the U.S. obtained from Canada. During the 1990s, the average annual trademark registrations by U.S. residents in Canada amounted to 11,222, compared to 3,818 by Canadian residents in the U.S. The number of varieties embedded in every billion dollars of imports was also much higher in the case of Canada's imports from the U.S. versus U.S. imports from Canada. For instance, Canada's imported 91 varieties for every billion imports from the U.S., compared to 36 for every billion U.S. imports from Canada. This asymmetric pattern of registrations was particularly pronounced in the case of differentiated products. Canada obtained 126 varieties for every billion dollars of imports of differentiated products from the U.S.; on the other hand, Canada provided only 38 varieties in every billion dollars of exports of differentiated products to the U.S. The asymmetric pattern of registrations suggests that the size of the market matters with respect to the availability of varieties. The number of varieties is likely greater in large economies, both for consumer and intermediate goods, as larger markets allow more units for each variety to be sold in the local market to cover fixed costs. Large economies specialize in everything, while smaller countries specialize in a few things. As such, when trade is liberalized, a medium-size country like Canada would gain more by expanding its trading relationship with the U.S., not only because trade liberalization gives Canada an opportunity to expand the volume of trade, but also because it enhances its access to varieties that are more available in large economies.

Across industries, those in which Canada has had the most increase in variety from the U.S. were those that experienced the most rapid technology changes, and those in which many new ideas, new concepts, and new products proliferated. These industries, including computer and electronic products, chemical products, as well as machinery, topped the new trademark registrations by U.S. residents in Canada. Food, apparel, and toilet preparation products that were subject to heavy advertisements to influence consumers' purchase behaviour also saw heavy new registrations (See Table56).

Table 5. Annual Average Registrations of Trademarks by U.S. Residents in Canada, 1980-02

NAICS	Industries	1980-89	1990-02	Growth (%)
334	Computer & Elec. Products	463	981	111.8
339	Miscellaneous Manu.	587	868	47.8
325	Chemical Products	641	864	34.7
311	Food	364	572	57.2
333	Machinery	392	571	45.6
332	Fabricated Metal Product	391	571	46.0
323	Printing	275	561	103.8
336	Transportation Equipment	301	469	55.5
315	Apparel	282	465	64.9
326	Plastics & Rubber Products	288	444	54.5

Source: Author's calculation from the data listed at the CIPO trademark database.

Canada's leading exports of varieties to the U.S. were also found in the same category of industries as in the case of the U.S., though the number of Canadian registrations in each category was fewer than the corresponding U.S. registrations in Canada (See Table 6). This result is consistent with what the product differentiation model predicts, trade in differentiated products between similar countries often takes places in the same industry, which results in intensive intra-industry trade. However, it is important to note that although the number of Canadian registrations in the U.S. was trailing U.S. registrations in Canada, average annual Canadian registrations in the U.S. reported stronger growth in the 1990s, increasing by 175 percent over the 1980s, outstripping U.S. registrations in Canada that grew by 75 percent over the same period. The growth of Canadian registrations in the U.S. was particularly pronounced in the computer and electronic product industry, which increased by 239.6 percent over the 1980s. This was followed by the apparel industry that increased by 193 percent, and by the plastics and rubber product industry that increased by 170.5 percent.

Table 6. Annual Average Registrations of Trademarks by Canadians in the US, 1980-02

NAICS	Industries	1980-89	1990-02	Growth (%)
334	Computer & Electronic Products	116	394	239.6
339	Miscellaneous Manufacturing	112	266	137.9
325	Chemical Products	85	207	144.7
311	Food	78	198	152.5
332	Fabricated Metals	81	196	140.6
333	Machinery	78	191	146.7
323	Printing	69	175	152.5
326	Plastics & Rubber Products	58	158	170.5
315	Apparel	53	156	193.8
336	Transportation Equipment	61	153	153.1
335	Electrical Equipment	52	131	151.4

Source: Author's calculation from the data listed at the U.S IPO trademark database.

To examine the variety effects of the Canada-U.S. FTA, Table 7 presents the Canadian *ad valorem* duty rates for its imports from the U.S. and the corresponding U.S. rates for U.S. imports from Canada by product during the Canada-U.S. FTA period. Overall, the Canadian rates were higher than the U.S. rates before the Canada-U.S. FTA. Throughout the 1990s, the overall duty rates for Canadian merchandise imports from the U.S. fell by 2.92 percentage points, while the U.S. duty rates fell by a one-percentage point. Across products, duty rates for resource-based homogeneous goods were low even before the Canada-U.S. FTA in both countries. Thus, progressively reducing or eliminating tariffs for differentiated and referenced products was the focus of trade liberalization under the Canada-U.S. FTA. Between 1989 and 2001, the Canadian tariff rates for imported U.S. differentiated products fell by 2.88 percentage points (If auto products were excluded, the rate fell by 3.92 percentage points). Similarly, the U.S. tariff rates for imported Canadian differentiated products declined by 1.26 percentage points (if auto products were excluded, the rates fell by 2.19 percentage points) over the same period. Overall, these tariff changes occurred in parallel with the broad changes in the bilateral trade pattern between Canada and the U.S. since the Canada-U.S. FTA came into effect--the rising share of differentiated products, particularly of the non-auto differentiated products in total Canada's exports to the U.S. The tariff reductions at the both sides of the border stimulated greater trade in differentiated products between the two countries, reflected in the increases in the volume and varieties of trade of differentiated products.

Table 7. Canadian and the U.S. tariff ratios by Products, in selected years

	Homogeneous		**Referenced**		**Differentiated**		**Differentiated without Auto**		**Total**	
	Can	**US**	**Can**	**US**	**Can**	**US**	**Can**	**US**	**Can**	**US**
1989	1.66	0.72	4.99	0.92	3.01	1.34	4.08	2.26	3.03	1.10
1995	0.57	0.27	1.18	0.37	0.70	0.43	0.93	0.57	0.74	0.39
2001	0.01	0.02	0.06	0.04	0.13	0.08	0.16	0.07	0.11	0.06
89-01	-1.65	-0.70	-4.93	-0.88	-2.88	-1.26	-3.92	-2.19	-2.92	-1.04

Source: Authors' calculations from the data listed in Statistics Canada

Tables 8 and 9 presents the links between Canada-U.S. FTA tariff reductions and changes in trademark registrations between the two countries at the detailed industry level. Table 8 reports that the industries that had the deepest Canadian tariff reductions during the Canada-U.S. FTA period had the strongest growth of imported U.S. varieties. For instance, compared to the 1980s, industries such as beverage and tobacco, apparel and textile products that had the Canadian tariff reductions by a range of 10-25 percent reported, a 69.7 percent increase of average annual U.S. registrations in Canada during the Canada-U.S. FTA period. This was compared to a 59.2 percent increase for the industries with 1-10 percent tariff cuts, and a 57.2 percent increase for the industries with 0-1 percent tariff cuts.

A similar but more pronounced trend can be found in Canadian registrations in the U.S. During the Canada-U.S. FTA period, in the industries that had 1-10 percent U.S. tariff reductions, the average annual registrations of Canadian trademarks in the U.S. increased by 160.6 percent over the 1980s. This was followed by a 144.2 percent increase for the industries with the U.S. tariff reductions of 0.1-0.99 percent, and a 56.4 percent increase for the industries with no tariff changes (See Table 9). It appeared that Canadian registrations were more sensitive to the tariff reductions in the U.S. than U.S. registrations to the tariff reductions in Canada.

Services trade is considerably more restricted than goods trade. As a result, bilateral registrations of service trademarks were far smaller than those of goods. For instance, the average annual goods registrations by U.S. residents in Canada during the 1990s was 8,820, more than triple their service trademark registrations. The Canadian registrations of service trademarks in the U.S. relative to their registrations in goods were of a similar order.

Table 8. Changes in the Annual Average Registrations of U.S. Trademark in Canada and in the Canadian Tariffs on Imports from the U.S. by industry

		Trademark			Tariffs		
NAICS	Industry	1980-89	1990-02	Growth (%)	1989	2001	Change
312	Beverage & Tobacco	84	146	73.4	38.97	14.08	-24.89
315	Apparel	282	465	64.9	19.09	1.17	-17.92
313	Textile Mills	119	190	59.2	14.25	0.25	-14.00
314	Textile Products	98	176	80.5	13.93	0.73	-13.20
337	Furniture	74	138	86.4	11.99	0.26	-11.73
	Subtotal	**658**	**1116**	**69.7**			
316	Leather Products	183	317	73.7	9.82	2.42	-7.40
323	Printing	275	561	103.8	7.37	0.09	-7.28
335	Elect. Equipment & Appliance	265	412	55.2	6.55	0.20	-6.35
326	Plastics & Rubber	288	444	54.5	5.94	0.13	-5.81
339	Miscellaneous Manufacturing	587	868	47.8	4.97	0.21	-4.76
322	Paper Products	216	364	68.1	4.48	0.01	-4.46
325	Chemical Products	641	864	34.7	4.54	0.10	-4.44
332	Fabricated Metal Products	391	571	46.0	4.45	0.14	-4.31
327	Non-metallic Mineral Products	131	196	49.2	4.03	0.10	-3.93
321	Wood Products	133	207	56.2	3.30	0.06	-3.24
311	Food	364	572	57.2	3.20	0.09	-3.11
331	Primary Metals	92	113	22.8	2.82	0.02	-2.81
333	Machinery	392	571	45.6	2.29	0.05	-2.24
334	Computer & Elect. Products.	463	981	111.8	1.74	0.02	-1.72
	Subtotal	**4422**	**7042**	**59.2**			
324	Petroleum & Coal Products	82	108	32.7	0.60	0.01	-0.59
336	Transportation Equipment	301	469	55.5	0.62	0.14	-0.48
114	Fishing, Hunting & Trapping	1	2	90.0	0.06	0.00	-0.06
212	Mining (except Oil and Gas)	2	3	80.3	0.01	0.00	-0.01
115	Support for Agri. & Forestry	2	4	92.5	0.00	0.00	0.00
221	Utilities	11	26	148.9	0.00	0.00	0.00
211	Oil & Gas Extraction	1	4	187.5	0.00	0.00	0.00
111	Crop Production	2	3	36.4	0.00	0.00	0.00
113	Forestry & Logging	2	4	73.9	0.00	0.00	0.00
210	Other Mining	4	9	128.1	0.00	0.00	0.00
310	Other Manufacturing	15	33	122.5	0.00	0.00	0.00
	Subtotal	**423**	**664**	**57.2**			

Table 9. Changes in the Average Annual registrations of Canadian Trademarks in the U.S. and U.S. Tariffs against the U.S. Imports from Canada

		Trademark			Tariffs		
NAICS	Industry	1980-89	1990-02	Growth (%)	1989	2001	Change
315	Apparel	53	156	193.8	10.87	0.39	-10.48
313	Textile Mills	26	56	113.0	9.34	0.06	-9.29
316	Leather Products	32	86	170.2	6.67	0.28	-6.39
314	Textile Products	17	48	180.3	4.80	0.44	-4.36
326	Plastics & Rubber Products	58	158	170.5	3.66	0.03	-3.63
325	Chemical Products	85	207	144.7	2.88	0.10	-2.78
337	Furniture	19	56	194.3	2.56	0.00	-2.56
339	Miscellaneous Manufacturing	112	266	137.9	2.61	0.05	-2.56
335	Elect. Equip. & Appliance	52	131	151.4	2.66	0.17	-2.49
332	Fabricated Metal Products	81	196	140.6	2.42	0.09	-2.33
311	Food	78	198	152.5	2.39	0.14	-2.24
327	Non-metallic Mineral Prod.	23	69	197.4	1.79	0.02	-1.76
111	Crop Production	1	2	80.0	1.63	0.01	-1.61
333	Machinery Manufacturing	78	191	146.7	1.56	0.06	-1.50
312	Beverage & Tobacco Products	28	63	127.4	1.27	0.01	-1.26
334	Computer & Electronic Prod.	116	394	239.6	1.22	0.02	-1.19
331	Primary Metals	24	44	83.1	1.09	0.01	-1.07
	Subtotal	**831**	**2165**	**160.6**			
324	Petroleum & Coal Products	18	37	107.1	0.87	0.06	-0.81
321	Wood Products	36	78	116.8	0.44	0.01	-0.43
322	Paper Products	44	113	159.6	0.40	0.00	-0.40
114	Fishing, Hunting & Trapping	1	1	40.0	0.35	0.00	-0.35
323	Printing	69	175	152.5	0.34	0.01	-0.33
211	Oil & Gas Extraction	1	2	114.3	0.25	0.00	-0.25
336	Transportation Equipment	61	153	153.1	0.30	0.10	-0.20
	Subtotal	**230**	**561**	**144.2**			
113	Forestry & Logging	2	3	100.0	0.00	0.00	0.00
212	Mining (except Oil and Gas)	2	4	75.0	0.00	0.00	0.00
110	Other Agr., For. & Fishing	1	2	120.0	0.00	0.00	0.00
115	Support Activities for Agr.	1	2	50.0	0.00	0.00	0.00
210	Other Mining	3	3	27.3	0.00	0.00	0.00
213	Support Activities for Mining	2	2	0.0	0.00	0.00	0.00
	Subtotal	**10**	**15**	**56.4**			

Industry-level regression analysis

The disaggregated industry-level trademark statistics allow one to test whether the observed trend in bilateral trademark registrations are systematically related to the tariff reductions that occurred over the Canada-U.S. FTA period. The following panel specialization will be estimated:

$$\ln V_{it}^{k} = \alpha_i^k + \beta_t^k + \eta \ln \tau_{it}^k + \varepsilon_{it}^k \qquad (2)$$

The variables are defined next. The subscript *i* represents host country, Canada or the U.S., and *t* represents year. Superscript *k* denotes the type of products, namely, homogeneous, referenced, and differentiated products. V_{it} is the number of trademarks registered by source country at the host country *i* in year *t*. α_i^k are the industry fixed effects, and β_t^k are the year effects. τ_{it}^k are host country *i*'s tariff rate for the product *k* in year *t*. ε_{it}^k is the stochastic error term, representing other influences on bilateral trademark registrations.

Equation (2) is applied to Canadian and U.S. data separately, and is estimated for each of three groups: differentiated products, referenced products, and total products for the period of 1980 and 2002. Homogenous products are excluded from the estimation since the product differentiation model is only applied to differentiated products,

Table 10 reports the estimated effects of Canadian tariff reductions on Canada's imports of U.S. varieties for three product groups: differentiated products, referenced products and total products. Differentiated products had the strongest variety-enhanced effect with the estimated tariff coefficient coming to –0.1023; this was followed by total products of –0.0601, and referenced products of –0.0307. This result is to be expected as trade in homogeneous products is driven by changes in quantity within a narrow set of varieties; while trade in differentiated products is driven by changes in varieties with a wider range of selections. Table 11 confirms the same trend based on U.S. data. The estimated coefficient for U.S. tariffs on U.S. imports of differentiated products from Canada was -0.1018, while that for total products and referenced products were –0.0765 and –0.0417, respectively. Overall, the variety-enhanced effect of tariff reductions was slightly higher in the case of the U.S. imports from Canada relative to Canada's imports from the U.S. The estimated tariff coefficient for the U.S. total imports of Canadian varieties was -0.0765, compared to the corresponding Canadian figure of –0.0601. This is consistent with what has been discussed above, based on Table 6, that gives an account of stronger growth of Canadian registrations in the U.S. relative to U.S. registrations in Canada during the Canada-U.S. FTA period.

To control the effect of business cycles, in particular the recession in the early 1990s on the imports of varieties, the estimation of (2) includes a fixed time-effect represented by a dummy variable "90". For the Canadian data, the estimated time-effect had the expected negative signs. They were significant for both total products and referenced products, but were less significant in the case of differentiated products (negative and significant at the 10 percent level). This implies that business cycles, or economic downturns in Canada, had a negative impact on Canada's imports of varieties for both homogeneous and referenced products from the U.S. But, in the case of differentiated products, Canada's imports of variety appeared less sensitive to economic downturns. The estimated time-effects were even weaker in the U.S. data as reported in Table 11. The estimated time effects for both total products and referenced products were negative but significant only at the 10 percent level, while that for differentiated products was statistically insignificant.

The estimation results reported at Table 10 also takes account of strong industry-effects, reflected in large and positive estimated coefficients for computer, chemical, food, and apparel industries. This is consistent what has been reported in Table 5, that Canada had the most variety gains from the U.S. in the sectors that experienced the most rapid technology changes and the sectors that were subject to heavy advertisements. The estimation results based on the U.S. data also report the similar strong fixed industry-effects in the industries of computer, chemical, food, and apparel products.

Table 10. The estimated effects of Canadian tariff reductions on U.S. trademark registrations in Canada by product

	Total imports	Differentiated products	Referenced products
Tariffs	-0.0601	-0.1023	-0.0307
Apparel	0.7751	0.7014	
Chemical	1.2661		
Computer	1.276	1.0613	
Electrical prods.	0.5363		
Fabricated medal	0.8367		
Food	0.8726	0.7104	
Plastics	0.6111		
Printing	0.7788	0.5991	
Textile products	-0.2955		0.1721
Transportation	0.5407		
90	-0.2451	-0.1153*	-0.315
N	311	198	86
Adjusted R-square	0.5325	0.3968	0.8936

* Statistically significant at the 10 percent level.

Table 11. Effects of U.S. tariff reductions on Canadian trademark registrations in the U.S. by product

	Total imports	Differentiated products	Referenced products
Tariffs	-0.0765	-0.1018	-0.0417
Apparel	0.8363	0.9496	
Chemical	0.9391		
Computer	1.508	1.5497	
Electrical prods.	0.552	0.6236	
Fabricated medal	0.9163	0.9823	
Food	0.9423	1.0081	
Machinery	0.8249		
Plastics			
Printing	0.6023	0.6044	
Textile products			0.1951
Transportation			
90	-0.2309*	-0.1836**	-0.2542*
N	273	171	78
Adjusted R-square	0.5085	0.7425	0.844

* Statistically significant at the 10 percent level.
** Statistically insignificant.

Conclusions

Nations are trading far fewer varieties than is commonly supposed, and there is strong "home bias' in the global production and consumption of differentiated products. This is true even after taking account of language, distance, and regional preferential trade arrangements that are commonly seen as major factors explaining global trade and production patterns.

Language, trade liberalization, distance, and per capita income matter in the context of global trade in variety. Nations that share the same language and culture are more likely to trade their varieties among themselves. This is because product differentiation often has a strong information component, requiring substantial advertising by the firm in order to inform customers of its product's uniqueness. Low-income countries produce far fewer varieties than high-income ones. This implies that the recent export expansion from China, India, and other low-income countries to industrialized countries was mainly driven by "process trade" or "outsourcing" by firms in industrialized countries with little contribution of intellectual property from these low-income countries.

Trade liberalization has contributed significant variety-enhancing effects to both Canada and the U.S. The underlying premise is that there are fixed costs to importing a variety, so that tariffs limit the imports of varieties by shrinking the market for each variety, while free trade expands the size of the market and enhances access to varieties by lowering the fixed costs of importing a given product from other countries.

Canada's access to U.S. varieties was three times more than what the U.S. obtained from Canada. This asymmetric pattern of exchange in varieties suggests that the size of the market matters with respect to the availability of varieties. When trade is liberalized, a medium-size country like Canada gains more by expanding its trading relationship with a larger one than vice-versa, not only because trade liberalization gives Canada an opportunity to increase its volume of trade, but also because it enhances Canada's access to varieties that are often more available in large economies. Under the Canada-U.S. FTA, Canada has increased its annual access to U.S. new varieties (goods) by 60 percent, or average annual gains of 3,319 new varieties during the period of 1990-2002.

Appendix: The theoretical framework

Consider a representative consumer's utility in country *j* is portrayed by a CES utility function with a preference that is allowed to vary across countries. Consumers in country *j* maximize

$$\left[\sum_i \omega_i^{-\beta}\left(\alpha_{ij} q_{ij}\right)^{\beta}\right]^{1/\beta}, \qquad \beta = \left(1 - \frac{1}{\sigma}\right), \qquad \sigma > 1, \tag{A1}$$

subject to the budget constraint

$$\sum_i p_{ij} q_{ij} \leq y_j \tag{A2}$$

Here q_{ij} is country *j*'s imports of all varieties from country *i*, p_{ij} is the price of country *i* products for country *j* consumers, y_j is the country *j*'s normal income, ω is a parameter, σ is the elasticity of substitution between varieties, and α_{ij} is the preference intensity of country *j*'s consumers over the varieties produced by country *i*. The preference parameter varies across countries according to the similarity (or differences) in cultures, languages, distances, and preferential trade arrangements between nations as discussed above. If *j* country consumer's preference over the varieties produced by country *i* is high, a larger share of *j* country consumer's income (higher α_{ij}) will be spent on those varieties; otherwise, a smaller share spent on those varieties. By allowing α_{ij} varying across countries, this preference structure accommodates that fact that importers value and therefore will purchase only their preferable varieties.

The first-order condition that satisfying maximization of (A1) subject to (A2) is

$$\Psi^{(1/\beta)-1} \omega_i^{-\beta} \alpha_{ij}^{\beta} q_{ij}^{\beta-1} = \lambda\ p_{ij}, \tag{A3}$$

Here λ is the marginal utility of income and $\Psi = \sum_i \omega_i^{-\beta} \alpha_{ij}^{\beta} q_{ij}^{\beta}$. Rearrange the terms in (A3) to give

$$q_{ij} = (\lambda)^{1/(\beta-1)} \left(\frac{\omega_i^{\beta} p_{ij}}{\alpha_{ij}^{\beta}} \right)^{1/(\beta-1)} \Psi^{1/\beta}$$

(A4)

Multiple both sides of (A4) by p_{ij}, sum up the condition for all varieties, and make use of the budget constraint to give

$$I_j = (\lambda)^{1/(\beta-1)} \sum_i \left[\frac{\omega_i p_{ij}}{\alpha_{ij}} \right]^{\beta/(\beta-1)} \Psi^{(1/\beta)}$$

(A5)

Substitute (A5) into (A4) to yield *j* country consumers' demand for the varieties produced by country *i*,

$$q_{ij} = \frac{\left(\frac{\omega_i t_{ij} p_i}{\alpha_{ij}} \right)^{1-\sigma}}{\sum_i \left(\frac{\omega_i t_{ij} p_i}{\alpha_{ij}} \right)^{1-\sigma}} I_j$$

(A6)

Here, p_i denotes the exporter's supply price, and t_{ij} is the importing country's tariffs. Thus, $p_{ij} = t_{ij} p_i$. Following Deardorff's approach (1998), namely, using the market clearance to solve for the coefficient ω_i while imposing the choice of units such that all supply prices equal to one and then substituting into the import demand equation, one will get,

$$q_{ij} = \frac{y_i y_j}{y_w} \left(\frac{t_{ij} / \alpha_{ij}}{P_i P_j} \right)^{1-\sigma}$$

(A7)

where y_w is normal world income, P_j is the price index of country *j*, given by

$$P_j^{1-\sigma} = \sum_i P_i^{\sigma-1} \frac{y_i}{y_w} \left(\frac{t_{ij}}{\alpha_{ij}} \right)^{1-\sigma}$$

(A8)

Further, assuming the consumers' preference, α_{ij} , is influenced by languages and distances,

$$\ln \alpha_{ij} = \rho_1 \ln d_{ij} + \rho_{ij} \ln l_{ij}$$

(A9)

(A7) can be rewritten as,

$$\ln \alpha_{ij} = c + \ln y_i + \ln y_j + (1-\sigma)\ln t_{ij} - (1-\sigma)\rho_1 \ln d_{ij} - (1-\sigma)\rho_2 \ln l_{ij}$$
$$-(1-\sigma)\ln P_i - (1-\sigma)\ln P_j$$

(A10)

Assuming the same quantity for each variety imported by country *j*, the number of varieties can be obtained by dividing (A10) with the standard quantity for each variety, this will give rise to

$$\ln v_{ij} = c + \ln y_i + \ln y_j + (1-\sigma)\ln t_{ij} - (1-\sigma)\rho_1 \ln d_{ij} - (1-\sigma)\rho_2 \ln l_{ij}$$
$$-(1-\sigma)\ln P_i - (1-\sigma)\ln P_j$$

(A11)

where *c* is a constant, and v_{ijz} is the number of varieties that country *j* imports from country *i*. Using the source-country fixed effect, ϕ_i and the target-country fixed effect, ϕ_j , to capture the multilateral resistance terms P_i and P_j as Anderson and van Wincoop (2003) suggested, one gets the following equation,

$$\ln v_{ij} = c + \ln y_i + \ln y_j + (1-\sigma)\ln t_{ij} - (1-\sigma)\rho_1 \ln d_{ij} - (1-\sigma)\rho_2 \ln l_{ij}$$
$$-(1-\sigma)\ln \phi_i - (1-\sigma)\ln \phi_j$$

(A12)

(A12) forms the basis for the econometric estimation used in Section 4 to investigate the determinants of global trade in variety.

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