Imports and Welfare: Variety Losses of the Argentine Crisis of 2001-2002

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Abstract

The access to a large variety of products is one of the main sources of gains from international trade and globalization. When an economy goes through a crisis, aggregate demand shrinks resulting in fewer product varieties being imported. In this paper we quantify short-run and medium-run welfare losses that resulted from the reduction in the number of imported product varieties during the Argentine crisis of 2001-2002. We find that short-run welfare losses vary widely across products and that medium-run recovery depends on the ability to substitute towards new varieties.

El acceso a una mayor variedad de productos es una de las fuentes principales de ganacias del comercio internacional y la globalización. Cuando una economía atravieza una crisis, la demanda agregada se reduce resultando en una menor variedad de productos importados. En este artículo cuantificamos las pérdidas de bienestar de corto y mediano plazo que resultan de la reducción en el número de variedades importadas durante la crisis Argentina de 2001-2002. Encontramos que a corto plazo las pérdidas de bienestar varían significativamente entre productos y que la recuperación a mediano plazo depende de la habilidad de sustitutir hacia nuevas variedades.

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Key Words: Gains from trade, Product varieties, Argentine crisis

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1 Introduction

The access to a large variety of products is one of the main sources of gains from international trade and globalization. In the early theoretical models of international trade with product differentiation and fixed costs, such as Krugman (1979, 1980), the total number of available products depends on the size of world markets and are the same for all countries. In more recent models that introduce heterogeneity across firms and costs of entry into export markets, namely Melitz (2003), Helpman, Melitz and Yeaple (2004), and extensions thereafter, firms can decide to enter some markets but not others. As a result, some products are not available in smaller economies.[1] From a dynamic viewpoint, market size and aggregate demand fluctuate. In particular, when an economy goes through a macro crisis that shrinks aggregate demand, the number of available product varieties goes down, resulting in a welfare loss for consumers.[2]

In this paper we quantify short-run and medium-run welfare losses that resulted from the reduction in the number of imported product varieties during the Argentine crisis of 2001-2002. After almost a decade of currency board during which the peso was pegged one to one to the dollar, Argentine GDP growth started to decline in the late 1990s leading to a big recession and financial collapse. In December 2001 bank deposits were frozen (the so called "corralito") and in January 2002 Argentina defaulted its external debt. During the first few months of 2002, the Argentine peso depreciated by 300 percent. The crisis took a big toll on imports. Total value of imports dropped by 64 percent between 2000 and 2002, from 25 to 9 billion dollars. Together with a reduction in the total value of imports, there was also a reduction in the number of imported products and in the number of countries from which each product was imported. Customs data show that products defined at the 8-digit level of the Harmonized System (the highest level of disaggregation available) went from 8,052 in 2000 to 7,540 in 2002; whereas the median number of countries from which each 8-digit product was imported dropped from 13 to 9.

The methodology to estimate the variety welfare loss is based on Feenstra (1994). It was originally developed to correct price indexes by the introduction of new products. Broda and Weinstein (2006) later utilized this methodology to measure the gains from the secular increase in varieties of US imports. In our paper we apply the same analytical framework as Feenstra (1994) to the estimation of variety-based welfare losses during the Argentine crisis of 2001-2002. We work with a nested-CES utility function and define welfare effects at the 2-digit product level (second nest) and at the aggregate level (first nest). To estimate the welfare effects we use customs data available through the Instituto Nacional de Estadísticas y Censos (INDEC) on imports by 8-digit product and source country from 1999 to 2008.

We estimate two sets of welfare comparisons, related to short and medium run effects. In the first set, we compare 2000 and 2002. We find that welfare losses vary widely by product, ranging from 1 to 57 percent. The aggregate welfare loss is 7.1 percent. In the second set of results, we compare 2000 and 2008. By 2008 the total number of imported varieties recovers; however, welfare losses are still estimated for several product categories in which new varieties

[1] The mechanism works through revenue and fixed costs. In smaller economies the possibilities of revenue are smaller and thus it becomes harder to cover the fixed costs of entry to that market. The relatively more inefficient firms, for which revenue is lower than for their more efficient competitors, decide not to enter. Notice that since firms produce a single differenciated product, firms and products are equivalent.

[2] We can think of consumer preferences as being of "love of variety"' or "ideal variety" type. In both scenarios, the reduction in the number of varieties implies a welfare loss for consumers. In the love of variety case the welfare loss is straightforward, since consumers have convex preferences and like to diversify. In the second case, the availability of a smaller number of varieties implies a greater average distance to the ideal variety.

are not good substitutes for varieties that ceased being imported. On aggregate, we find a medium-run welfare loss of 4.5 percent. A caveat of this analysis is that comparisons are of "before and after" type and, as the crisis cannot be separated from other concurrent factors, no causal relation can be attached to them. The crisis is, however, the major event in the economy during 2001-2002 and thus the major factor driving welfare results in the short-run. In the medium-run, it is natural for product varieties to follow an increasing trend, independently of the recovery from the crisis. The estimates for 2000-2008 are thus a lower bound for the medium-run effect of the crisis.

The rest of the paper is organized as follows. In Section 2 we discuss the analytical framework. In Section 3 we describe the data, estimation strategy, and results. Section 4 concludes.

2 Product Varieties and Welfare

In this section we discuss the welfare effects that result from changes in the varieties that are available to consumers. To simplify the exposition we focus on imported varieties only; the extension to domestic varieties is straightforward and is briefly discussed at the end of the section (see Broda and Weinstein, 2006, for more details).

We work with a two-tier demand structure. We assume there are J differentiated products, each denoted by j. Within product j, there are, at time t, Ω_{jt} differentiated varieties, each denoted by v. The two-tier specification allows us to define changes in welfare due to changes in the set of available varieties for each product. Preferences are represented by a nested constant-elasticity-of substitution (CES) utility function. The upper-tier, defined over products, is given by

$$(1) \quad U_{jt} = \left(\sum_j X_{jt}^{(\gamma-1)/\gamma} \right)^{\frac{\gamma}{\gamma-1}} .$$

The parameter $\gamma > 1$ is the elasticity of substitution across products and X is total quantity of product j. Each product is defined as a non-symmetric CES aggregation of varieties v, given by

$$(2) \quad X_{jt} = \left(\sum_{v \in \Omega_{jt}} b_{vjt}^{1/\sigma_j} x_{vjt}^{(\sigma_j-1)/\sigma_j} \right)^{\frac{\sigma_j}{\sigma_j-1}} .$$

In this equation, Ω_{jt} is the set of varieties of product j available at time t, $\sigma_j > \gamma > 1$ is the elasticity of substitution across varieties (which can vary across products), x_{vjt} is quantity consumed, and b_{vjt} is a quality parameter that works as a demand shifter.

This utility specification yields the well-known quality-adjusted CES unit cost function.

$$(3) \quad \phi_j(\mathbf{p}_{jt}, \mathbf{b}_{jt}, \Omega_{jt}) = \left(\sum_{v \in \Omega_{jt}} b_{vjt} p_{vjt}^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} .$$

For given prices, qualities, and available varieties, the unit cost function is the minimum cost required to achieve one unit of utility from the composite product. The unit cost is lower when prices are lower, when qualities are higher, and when there are more varieties available (due to convexity of preferences). Additionally, the unit cost function satisfies that $\phi_{jt} X_{jt}$ is total expenditure on product j.[3]

We are interested in welfare comparisons across time. For each product, we can define the change in welfare due to changes in prices and available varieties as the compensating variation, that is, the negative of the additional income that would leave the representative consumer indifferent between the former and the new situations. The percentage change in welfare between $t-1$ and t can be written as[4]

$$(4) \quad \Delta w_{jt} = 1 - \frac{\phi_j(\mathbf{p}_{jt}, \mathbf{b}_{jt}, \Omega_{jt})}{\phi_j(\mathbf{p}_{jt-1}, \mathbf{b}_{jt-1}, \Omega_{jt-1})}.$$

The ratio of unit costs functions in (4) is an exact cost of living index, as defined by Diewert (1976). Intuitively, this ratio captures the relative difficulty across periods of achieving the same level of utility. Diewert (1976) shows that the ratio can be computed without direct observation of the qualities $\mathbf{b}_{jt}$ and $\mathbf{b}_{jt-1}$, a result that is useful from an empirical perspective as qualities are generally unobserved and difficult to estimate.[5] Let us denote the price index by $\pi_{jt} = \frac{\phi_{jt}}{\phi_{jt-1}}$, so that $\Delta w_{jt} = 1 - \pi_{jt}$.

For the CES case, the price index can be written as the product of two factors that capture two separate effects: changes in prices and changes in the sets of available varieties,

$$(5) \quad \pi_{jt} = \left(\prod_{v \in \Omega^*_{jt}} \left[\frac{p_{vjt}}{p_{vjt-1}} \right]^{\omega_{vjt}} \right) \left(\frac{\lambda_{jt}}{\lambda_{jt-1}} \right)^{\frac{1}{\sigma_j - 1}}$$

The first factor, derived by Sato (1976) and Vartia (1976), is a geometric mean of changes in the prices of the varieties available in both time periods (denoted by $\Omega^*_{jt} = \Omega_{jt} \cap \Omega_{jt-1}$). The price changes are weighted using ideal log-change weights given by

$$(6) \quad \omega_{vjt} = \frac{(s_{vjt} - s_{vjt-1})/(\ln s_{vjt} - \ln s_{vjt-1})}{\sum_{v \in \Omega^*_{jt}} ((s_{vjt} - s_{vjt-1})/(\ln s_{vjt} - \ln s_{vjt-1}))}$$

where s_{vjt} denotes the share of variety v in total expenditure on product j. The first factor, usually referred to as "conventional price index," is the exact price index if the set of varieties is the same in the two periods.

The second factor was introduced by Feenstra (1994), who pointed out that the conventional price index was not exact in the event of a change in the set of available varieties. The variable λ_{jt} is defined as the share in expenditure of varieties available in both periods relative to the varieties available in t. Formally, λ_{jt} and λ_{jt-1} can be written as

$$(7) \quad \lambda_{jt} = \frac{\sum_{v \in \Omega^*_{jt}} p_{vjt} x_{vjt}}{\sum_{v \in \Omega_{jt}} p_{vjt} x_{vjt}},$$

[3] The trade literature usually refers to the CES unit cost function as the "CES price index." This terminology might be confusing in the current setting as we will also be referring to cost of living indices, which are ratios. We thus prefer to use the term unit cost function to refer to the function ϕ.

[4] For any linearly homogeneous utility function, the compensating variation, in nominal terms, is $[\phi_j(\mathbf{p}_{jt-1}, \mathbf{b}_{jt-1}, \Omega_{jt-1}) - \phi_j(\mathbf{p}_{jt}, \mathbf{b}_{jt}, \Omega_{jt})] X_{jt-1}$. The percentage change in welfare is obtained by dividing by the initial level of welfare $\phi_j(\mathbf{p}_{jt-1}, \mathbf{b}_{jt-1}, \Omega_{jt-1}) X_{jt-1}$.

[5] The ratio is not independent of the qualities, though, but qualities are absorbed by the shares of each variety, a variable that is usually observed.

(8) $$\lambda_{jt-1} = \frac{\sum_{v \in \Omega^*_{jt}} p_{vjt-1} x_{vjt-1}}{\sum_{v \in \Omega_{jt-1}} p_{vjt-1} x_{vjt-1}}.$$

The Feenstra (1994) correction factor is interpreted as the hypothetical price change that would have resulted in the same welfare effect as the observed change in the set of available varieties. Notice that this factor does not depend on the number of new and exiting varieties per se, but rather on their share in expenditure. It also depends on the elasticity of substitution across varieties. The welfare effect of changes in the set of varieties becomes more important when the relative share of exiting varieties is higher and when varieties are more imperfect substitutes for each other.

We now move up to the upper-tier and aggregate across products. The aggregate minimum cost function is defined as $\Phi_t = \left(\sum_j \phi_{jt}^{1-\gamma}\right)^{\frac{1}{1-\gamma}}$ and the aggregate price index as $\Pi_t = \frac{\Phi_t}{\Phi_{t-1}}$. Broda and Weinstein (2006) show that, under the assumption that quality is time-invariant ($b_{vjt} = b_{vjt-1}$), the exact aggregate price index becomes a weighted average of the product indeces

(9) $$\Pi_t = \prod_j (\pi_{jt})^{\omega_{jt}}$$

where ω_{jt} are log-change ideal weights defined analogously as in (6). Using equation (5), the aggregate price index can be written as

(10) $$\Pi_t = \prod_j \left(\prod_{v \in \Omega^*_{jt}} \left[\frac{p_{vjt}}{p_{vjt-1}}\right]^{\omega_{vjt}} \right)^{\omega_{jt}} \prod_j \left(\frac{\lambda_{jt}}{\lambda_{jt-1}}\right)^{\frac{\omega_{jt}}{\sigma_j - 1}}$$

The aggregate effect of new and exiting varieties is given by the term $\prod_j \left(\frac{\lambda_{jt}}{\lambda_{jt-1}}\right)^{\frac{\omega_{jt}}{\sigma_j-1}}$. Using this result, we can obtain the percentage aggregate change in the welfare derived from imported products as

(11) $$\Delta w|_{p_{vjt}=p_{vjt-1}} = 1 - \prod_j \left(\frac{\lambda_{jt}}{\lambda_{jt-1}}\right)^{\frac{\omega_{jt}}{\sigma_j-1}}.$$

The total change in consumption welfare (including domestic products and imports) is obtained by weighting the change in welfare from imported varieties by the share of imports in total consumption.[6]

Due to the devaluation in 2002, Argentina stopped importing a large number of varieties that were being imported prior to the crisis. Using the Feenstra (1994) factor in (5), we can compute, for each product, the total change in welfare that resulted from the decrease in varieties. To be more precise in our question, we make the additional assumption of monopolistic competition with constant marginal costs (which need not the be same across firms). This assumption, together with the CES utility function, yields that prices are a constant mark-up over marginal costs and do not depend on the set of available varieties. By making this simplifying assumption, we rule out potential effects of changes in the number of varieties in prices, thus isolating a more precise variety effect.

[6] Broda and Weinstein (2004) explicitly model a third nest in the utility function, which is actually the first tier, that splits consumption into domestic products and imports.

3 Change in Welfare during the Argentine Crisis of 2002

In this section we estimate the variety welfare effects of the Argentine crisis of 2001-2002, by constructing the Feenstra (1994) correction factors. The construction of the correction factors is based on the computation of the share of exiting and entering varieties in total expenditure, and the econometric estimation of the elasticity of substitution for each product.

3.1 Data

We use data on Argentina imports by products and source country from 1999 to 2008. The data is collected from Customs by the Instituto Nacional de Estadisticas y Censos (INDEC). The information is disaggregated at the 8 digit level of the Harmonized System (the first 6 digits are common to all countries which subscribe to the system).

In order to compute the welfare effects described in Section 2, we need to define what constitutes a product (j) and what constitutes a variety (v). Recall that our aim is to estimate welfare effects of changes in the available varieties, for an unchanging set of products. If products are defined at a highly disaggregate level, the set of products varies over time. Whereas if products are defined at a highly aggregate level, the substitution among them is low, and the resulting welfare changes are too high. We define products at the highest level of disaggregation for which the set of products is constant over time, which is the 2-digit level of the Harmonized System (HS2). Examples of 2-digit products are "Articles of apparel and accessories, knitted or crochetted" (line 61), "Ships, boats and other floating structures" (line 89), and "Fertilizers"(31). There are 96 different 2-digit products.

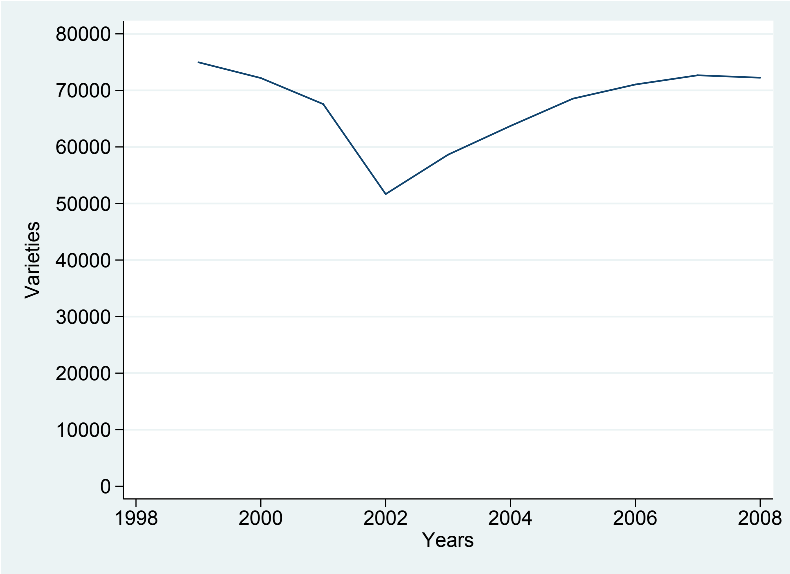
Using the highest level of disaggregation, varieties are defined as an 8-digit category(HS8)–source country combination. For example, "Women's and girls' knitted dresses made of cotton" (line 61044200) imported from Brazil. Line 61044200 is also imported from 14 other countries, including China, the US, India, Portugal and Spain. Each of these constitutes a different variety within 2-digit product 61. Within product 61 we have other 8-digit lines as well, for example, "Women's and girls' knitted dresses made of synthetic fibers" (61044300), which is imported from 18 different source countries, adding up to 18 more varieties. A total of 72,185 different varieties was imported in 2000.

Figure 1 plots the evolution of the total number of imported varieties during the period 1999-2008. There is a significant drop in the number of varieties during the crisis. Table 1 compares varieties in 2000 and 2002. Of the 72,185 varieties that were being imported in 2000, 33,520 varieties stopped being imported between 2000 and 2002 (column 3). During the same period, 13,000 new varieties entered the market (column 4), for a net decline of 20,520 varieties (column 5) or 28.4 percent. The largest declines occur for Animal products (50 percent), Footwear (49 percent), Textiles (43 percent), Leather and fur products (38 percent), and Stone and glass products (37 percent). The largest product groups in terms of number of varieties are Metals and metal products, Chemicals, and Machinery, which account for 56 percent of the number of varieties imported in 2000 and 46 percent of the decline in the number of imported varieties between 2000 and 2002.

3.2 Estimation of the Elasticity of Substitution

The estimation of the elasticity of substitution is based on the utilily model of Section 2. From the lower-tier utility function in equation (2), we can derive demand functions for each variety

Figure 1
Number of Available Varieties



Varieties are defined as a combination of HS8 product line and country of origin.

Table 1
Change in Number of Varieties (2000–2002)

	HS8 Product * Source Country				
	2000 (1)	2002 (2)	Exiting (3)	New (4)	Change (5)
Animals and animal products (01-05)	523	264	358	99	-259
Vegetable products (06-15)	1571	1042	832	303	-529
Food manufactures (16-24)	1889	1265	1023	399	-624
Mineral products (25-27)	744	574	456	286	-170
Chemicals (28-38)	12898	11527	4939	3568	-1371
Plastics and rubbers (39-40)	4427	3583	1983	1139	-844
Skins, leather, and fur products (41-43)	750	465	450	165	-285
Wood and wood products (44-49)	2842	1956	1641	755	-886
Textiles (50-63)	6983	3968	3965	950	-3015
Footwear and headgear (64-67)	582	297	335	50	-285
Stone and glass products (68-71)	2446	1534	1276	364	-912
Metals (72-83)	17992	12813	7637	2458	-5179
Machinery and electrical machinery (84-85)	9589	6711	4197	1319	-2878
Transportation equipment(86-89)	5572	3892	2533	853	-1680
Miscellaneous (90-97)	3377	1774	1895	292	-1603
All product groups	72185	51665	33520	13000	-20520

Varieties are defined as an HS8 product–country of origin combination. Table shows number of varieties in 2000 (column 1), in 2002 (column 2), varieties that exited between 2000 and 2002 (column 3), new varieties incorporated between 2000 and 2002 (column 4), and the net change in the number of varieties (column 5).

conditional on total expenditure on product j, given by E_{jt}.

(12) $x_{vjt} = b_{vjt} p_{vjt}^{-\sigma_j} E_{jt} \phi_{jt}^{\sigma_j - 1};\ \forall v \in \Omega_{jt}.$

Transforming quantities into shares in total product expenditure and taking logarithms, we obtain the following demand system,

(13) $\ln s_{vjt} = \beta_{vjt} + (1 - \sigma_j) \ln p_{vjt} + (\sigma_j - 1) \ln \phi_{jt};\ \forall v \in \Omega_{jt},$

where s is the share of variety v in total expenditure in product j, given by $s_{jvt} = p_{jvt} x_{jvt} / E_{jt}$, and $\beta_{vjt} = \ln(b_{vjt})$. We estimate σ_j from equation (13) by running a separate regression for each product j (defined at the 2-digit level) for the time period 1999-2006.[7] Unit costs are controlled for with year effects (ψ_{jt}). Unobserved quality (β_{vjt}) is parameterized as the sum of source-country fixed effects (β_{jc}), hs8-product fixed effects (β_{jh}), and a time variant component (ϵ_{vjt}), similarly to Khandelwal (2010) and Brambilla, Khandelwal and Schott (2010).[8] Thus, $\beta_{vjt} = \beta_{jc} + \beta_{jh} + \epsilon_{vjt}$. The regression equation is

(14) $\ln s_{vjt} = \beta_{jc} + \beta_{jh} + \psi_{jt} + (1 - \sigma_j) \ln p_{vjt} + \epsilon_{vjt}.$

The variable s is constructed as the participation of variety v (a combination of hs8 product and source country) in total expenditure in product j (defined at the hs2 level). Prices are approximated using unit values.

Time-varying quality changes ϵ_{vjt} could be correlated with unit values. Moreover, unit values arguably suffer from measurement error.[9] To address both issues, which would lead to inconsistent estimates of the elasticity of substitution, we use three instruments for unit values. The first instrument is the unit transport cost of each variety (it thus varies at the hs8–source country–year level). The second instrument is the number of source countries in the hs8-product category, which is a measure of competition at the most disaggregate product level available. This instrument varies at the hs8–year level. The third instrument is based on unit values of exports of the source country to other destinations, which are correlated with unit values of exports to Argentina through production costs. To construct the third instrument, we use data from COMTRADE at the hs6 level of disaggregation (the highest available). Thus, the instrument is constructed as the weighted average unit value of exports of a source country to all destinations except Argentina, where the weights are the participation of each destination in total exports of the source country. This instrument varies at the hs6–source country–year level.

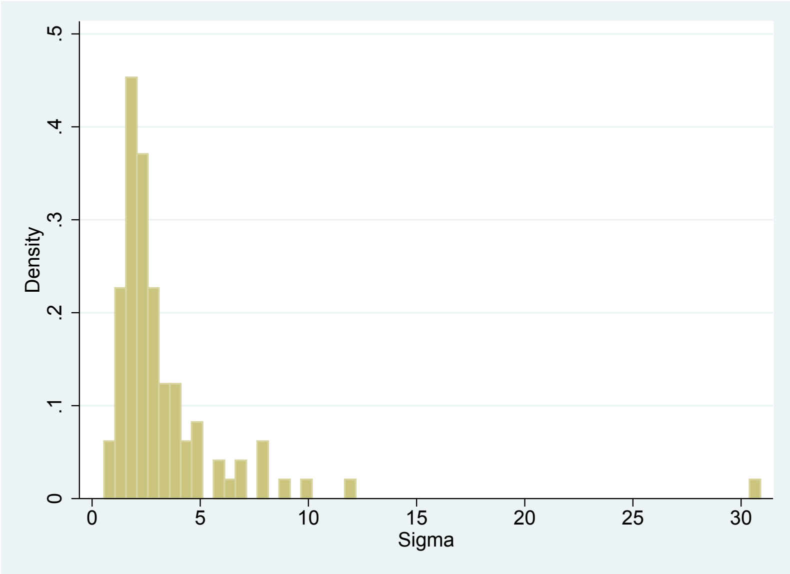
We estimate equation (14) separately for each 2-digit product, for a total of 96 different elasticities of substitution. Figure 2 displays the distribution of the estimates and Table 2 shows descriptive statistics by broad groups of products. The majority of the estimates of the elasticity of substitution lie between 1 and 5. The product groups with highest substitution are Food manufactures, Animal products, and Vegetable products, with average estimates of 9.8, 6 and

[7] We have access to data on Argentina imports up to 2008, however, we use data at the HS6–country of destination level from COMTRADE to build an instrument based on average export unit values (described below) which is incomplete after 2006. We choose to drop the years 2007 and 2008 from the estimation of the elasticity of substitution in order to be able to use the instrument built from the COMTRADE data.

[8] Khandelwal (2010) parameterizes unobserved quality with fixed effects in a nested logit model. In his specification there is a country-variety component and a time component.

[9] We drop outliers defined as observations with unit values below or above 4 standard deviations from the hs8-year mean.

Figure 2
Elasticity of Subsitution. Distribution of Estimates



Graph shows the distribution of the estimates of the elasticity of substitution (σ) at the 2-digit level. There is a total of 96 estimates.

4. Groups with low estimated elasticity of substitution are Stone and glass products, Machinery and electrical machinery, and Transportation equipment. The average over the 96 products is 3.3 and the median is 2.3. These numbers are in line with results in Broda and Weinstein (2006), who estimate a median elasticity of substitution of 2.2 for 3-digit products of the SITC classification.

3.3 Variety Welfare Effects

We now turn to the estimation of the welfare effects. As discussed in Section 2, variety welfare effects do not depend on the change in the raw number of varieties but rather on their share in 2-digit product expenditure, as defined in equations (7) and (8). Table 3 shows the share of varieties available in both periods in 2 digit-product expenditure before the crisis (λ_{j2000}) and after the crisis (λ_{j2002}). A low λ_{j2000} is associated with a high welfare loss, since it indicates that the participation of exiting varieties in product expenditure was high. A high λ_{j2002}, on the other hand, indicates that new varieties (which drive welfare up) have not gained a large market share. Column 3 shows the ratio of the market shares. From column 3, we can expect larger welfare losses in the groups with higher ratios: Animal products, Mineral products, Textiles, Wood and wood products, Vegetable products, Food manufactures, and Leather and fur products.

The last row of Table 3 shows that the total (across all products) market share of exiting varieties is 14 percent, and the market share of entering varieties is 10 percent. These results suggest that the substitution towards new varieties is larger than indicated when considering the raw count of exiting and entering varieties in Table 1 (33,520 exiting varieties versus 13,000 entering varieties), but that it is not high enough to fully compensate for the loss of varieties.

Combining the shares in expenditures and the estimated elasticities of substitution we compute the welfare effect that results from the change in the number of varieties for each

Table 2
Elasticity of Substitution. Summary Statistics

	Mean (1)	Median (2)	Min (3)	Max (4)
Animals and animal products (01-05)	6.0	7.0	1.4	9.9
Vegetable products (06-15)	4.0	4.0	2.2	5.8
Food manufactures (16-24)	9.8	7.7	3.8	30.9
Mineral products (25-27)	2.7	2.3	2.3	3.4
Chemicals (28-38)	2.9	2.7	1.9	4.3
Plastics and rubbers (39-40)	2.7	2.7	2.6	2.9
Skins, leather, and fur products (41-43)	2.7	1.7	1.2	5.1
Wood and wood products (44-49)	2.4	2.0	1.5	4.7
Textiles (50-63)	2.5	2.4	1.0	3.9
Footwear and headgear (64-67)	2.2	1.5	1.1	4.8
Stone and glass products (68-71)	1.7	1.8	1.1	2.0
Metals (72-83)	2.1	2.1	1.5	2.9
Machinery and electrical machinery (84-85)	1.7	1.7	1.7	1.7
Transportation equipment (86-89)	1.8	1.6	1.1	2.7
Miscellaneous (90-97)	1.6	1.5	1.3	2.0
All product groups	3.3	2.3	1.0	30.9

Table shows summary statistics based on the estimates of the elasticity of substitution at the 2-digit level of the Harmonized System.

Table 3
Share of varieties available in both periods (2000–2002)

	λ_{j2000} (1)	λ_{j2002} (2)	$\lambda_{j2002}/\lambda_{j2000}$ (3)
Animals and animal products (01-05)	0.73	0.92	1.30
Vegetable products (06-15)	0.84	0.91	1.08
Food manufactures (16-24)	0.87	0.93	1.08
Mineral products (25-27)	0.68	0.76	1.14
Chemicals (28-38)	0.87	0.91	1.05
Plastics and rubbers (39-40)	0.89	0.91	1.03
Skins, leather, and fur products (41-43)	0.92	0.97	1.10
Wood and wood products (44-49)	0.60	0.65	1.09
Textiles (50-63)	0.85	0.94	1.13
Footwear and headgear (64-67)	0.94	0.97	1.03
Stone and glass products (68-71)	0.84	0.84	1.00
Metals (72-83)	0.91	0.94	1.04
Machinery and electrical machinery (84-85)	0.88	0.92	1.04
Transportation equipment(86-89)	0.82	0.86	1.06
Miscellaneous (90-97)	0.89	0.94	1.07
All product groups	0.86	0.90	1.06

See equations (7) and (8) for the definition of λ_{jt} and λ_{jt-1}.

Table 4
Welfare Effects (2000–2002)

	$\widehat{\sigma}$ (1)	$\sigma=1.5$ (2)	$\sigma=2$ (3)	$\sigma=2.5$ (4)	$\sigma=3$ (5)
Animals and animal products (01-05)	-0.569	-0.722	-0.297	-0.186	-0.135
Vegetable products (06-15)	-0.022	-0.190	-0.084	-0.054	-0.039
Food manufactures (16-24)	-0.011	-0.167	-0.077	-0.050	-0.037
Mineral products (25-27)	-0.062	-0.308	-0.139	-0.090	-0.066
Chemicals (28-38)	-0.043	-0.112	-0.054	-0.035	-0.026
Plastics and rubbers (39-40)	-0.015	-0.054	-0.027	-0.018	-0.013
Skins, leather, and fur products (41-43)	-0.241	-0.264	-0.100	-0.061	-0.044
Wood and wood products (44-49)	-0.062	-0.194	-0.092	-0.060	-0.045
Textiles (50-63)	-0.084	-0.314	-0.130	-0.082	-0.060
Footwear and headgear (64-67)	-0.256	-0.062	-0.030	-0.020	-0.015
Stone and glass products (68-71)	0.009	0.002	0.002	0.001	0.001
Metals (72-83)	-0.049	-0.074	-0.036	-0.024	-0.018
Machinery and electrical machinery (84-85)	-0.055	-0.075	-0.037	-0.024	-0.018
Transportation equipment(86-89)	-0.168	-0.117	-0.056	-0.037	-0.028
Miscellaneous (90-97)	-0.248	-0.158	-0.068	-0.043	-0.032
Total welfare effect–imports	-0.071	-0.126	-0.057	-0.037	-0.028
Total welfare effect–consumption	-0.009	-0.015	-0.007	-0.004	-0.003

Table shows the percentage change in welfare defined as in equation (11).

2-digit product following equation (4). Table 4, column 1, shows the average welfare effects for each broad product group. Welfare effects vary largely by product. The biggest effects are observed for groups with high market share ratios: Animal products (57 percent) and Footwear (26 percent).[10] Other groups with large welfare losses are Leather and fur products (24 percent) and Transportation equipment (17 percent), all of which have a relative low elasticity of substitution. On the other end of the spectrum we have four groups with average welfare losses between 0.9 and 2.2 percent: Vegetable products, Food manufactures, Plastics and rubbers, Stone and glass products. For the remaining six product groups, average welfare losses range between 4.3 and 8 percent.

The total loss in welfare derived from imported products is obtained by weighting the welfare change in each product by the product participation in total imports, as per equation (11). The resulting welfare loss is 7.1 percent. We can also compute the loss in welfare derived from total consumption (including imports and domestic consumption), which is 0.9 percent. Notice that this welfare loss does not consider the exit of domestic varieties from the market and thus underestimates total welfare loss. It is the total welfare loss in consumption due to the change in imported varieties only.

In columns 2 to 5 we perform a sensitivity analysis with respect to the elasticity of substitution. Rather than using a different (estimated) elasticity of substitution for each product, we evaluate the welfare loss using a homogeneous elasticity of substitution for all products (of 1.5, 2, 2.5 and 3 in each column, respectively). Using the homogeneous elasticities of substitution, the resulting welfare losses range from 12.6 to 2.8 percent in total imports, and from 1.5 to 0.3 percent in total consumption. This exercise shows that results are very sensitive

[10]These changes should be interpreted as equivalent to an increase in the price index. In the case of animal products, for example, the welfare loss due to the decrease in the number of varieties is the same welfare loss that would occur if the price index rose by 57 percent.

to the elasticity of substitution for low values of the parameter, but that the sensitivity declines as the parameter increases. It also highlights the importance of using elasticities that vary by product. Our estimated median elasticity of substitution is 2.3, which, if applied to all products homogeneously, would lead to welfare losses between 3.7 and 5.7 percent (columns 3 and 4). When we use the estimated elasticities that vary by product, we obtain higher welfare losses, of 7.1 percent. This difference would be even larger if we used the estimated mean elasticity of substitution of 3.3, which would result in welfare losses between 2.8 and 3.7 percent (columns 4 and 5).

Figure 1 shows that starting in 2003 there is a gradual recovery in the number of imported varieties. Table 5 compares 2000 and 2008, and in columns (1) and (2) shows that the number of available varieties is virtually identical in both years (72,185 in 2000 versus 72,244 in 2008). How should we interpret this seeming recovery? There are two main issues to consider. The first issue is substitutability between varieties. Table 5 shows that there is considerable turn-over of varieties between 2000 and 2008 (columns (3) and (4)). In other words, there is a substantial number of varieties that exit in 2000 and do not enter again in 2008. This is consistent with the findings of Burstein (2005) and McKenzie and Schargrodsky (2011), who document that, during the Argentine crisis, domestic consumers substituted varieties (imported or domestic) towards lower cost alternatives. The extent to which the new varieties are good substitutes for exiting varieties is in our analysis captured by the ratios of market shares, displayed in column (6) of Table 5. These ratios are smaller than the ratios for 2002-2000, indicating that in the medium-run (2008) consumers have been more successful at substituting towards new varieties than in the short-run (2002). Most remarkably, several of the ratios are smaller than one, which indicates a welfare gain.

The second issue is that, in an economy that is stable from a macro perspective, the number of varieties follows an increasing trend both due to the worldwide development of new varieties and to the increase in trade linkages. The study of the welfare effects of this phenomenon is the focus of Broda and Weinstein (2006). From this perspective, even though the number of available varieties in 2008 is slightly higher than in 2000, this difference would be even higher had the crisis not occurred. An accurate welfare measurement would compare the observed varieties in 2008 with the counterfactual varieties in 2008 in the absence of the crisis.

In column (7) of Table 5, we report welfare comparisons between 2000 and 2008. As discussed above, this comparison does not contemplate the increasing trend in the number of varieties, and thus underestimates the (negative) medium-run welfare effects of the crisis. As expected, the negative welfare effects are higher for product groups with high market share ratios: Leather and fur products (welfare loss of 30 percent), Animals and animal products (19.5 percent), and Metals (10 percent). On the other hand, there are considerable welfare increases in Mineral products (20 percent) and Stone and glass products (10 percent). Other product groups with welfare increases are Vegetable products, Chemicals, and Wood and wood products, all between 1.2 and 2.1 percent. The aggregate welfare loss in the consumption of imports is 4.2 percent, and the welfare loss including domestic consumption is 0.5 percent.

4 Conclusion

In this paper we have estimated the welfare loss of Argentine consumers due to the decrease in the number of imported varieties between 2000 and 2002, a period in which the country was hit by a large economic crisis. The estimates show welfare losses between 1 and 57

Table 5
Medium Run Analysis (2000–2008)

	Number of Varieties					$\lambda_{j2008}/$	Welfare
	2000	2008	Exiting	New	Change	λ_{j2000}	effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Animals and animal products (01-05)	523	363	361	201	-160	1.20	-0.195
Vegetable products (06-15)	1571	1483	834	746	-88	0.96	0.021
Food manufactures (16-24)	1889	1743	916	770	-146	1.04	-0.005
Mineral products (25-27)	744	718	454	428	-26	0.74	0.201
Chemicals (28-38)	12898	13875	5673	6650	977	0.98	0.017
Plastics and rubbers (39-40)	4427	4687	1828	2088	260	1.05	-0.026
Skins, leather, and fur prod. (41-43)	750	511	477	238	-239	1.10	-0.298
Wood and wood products (44-49)	2842	2559	1603	1320	-283	0.98	0.012
Textiles (50-63)	6983	6691	3441	3149	-292	1.02	-0.012
Footwear and headgear (64-67)	582	472	312	202	-110	1.06	-0.018
Stone and glass products (68-71)	2446	2143	1256	953	-303	0.95	0.099
Metals (72-83)	17992	18774	6524	7306	782	1.06	-0.102
Machinery and elect.mach. (84-85)	9589	9683	4596	4690	94	1.02	-0.029
Transportation equipment(86-89)	5572	5855	2262	2545	283	1.02	-0.048
Miscellaneous (90-97)	3377	2687	1587	897	-690	1.11	-0.319
All product groups	72185	72244	32124	32183	59	1.02	
Total welfare effect–imports							-0.042
Total welfare effect–consumption							-0.005

Varieties are defined as an HS8 product–country of origin combination. Table shows number of varieties in 2000 (column 1), in 2008 (column 2), varieties that exited between 2000 and 2008 (column 3), new varieties incorporated between 2000 and 2008 (column 4), and the net change in the number of varieties (column 5). Column (6) shows the market share ratios. Column (7) shows the welfare effects based on the estimated elasticity of substitution that varies by 2-digit product.

percent across different product groups, and an aggregate welfare loss in total consumption of imports of 7.1 percent. Medium-run analysis shows that even though the total number of varieties recovers by 2008, important welfare losses still persist during that year for several product groups, leading to an aggregate welfare loss of 4.2 percent.

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