



ASOCIACION ARGENTINA
DE ECONOMIA POLITICA

ANALES | ASOCIACION ARGENTINA DE ECONOMIA POLITICA

L Reunión Anual

Noviembre de 2015

ISSN 1852-0022

ISBN 978-987-28590-3-9

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RESUMEN

El objetivo de este trabajo es estudiar los efectos en el bienestar de la economía argentina asociados a la entrada de China a la OMC. Para ello, examinamos las importaciones argentinas en el período 1999—2008 con el fin de medir los cambios en productos y variedades asociados a este evento. Mediante un análisis contrafactual, encontramos que el incremento en las variedades importadas desde China tuvo un efecto importante en términos de bienestar.

ABSTRACT

The purpose of this paper is to analyze China's accession to the WTO and the effects it had on Argentina's welfare. In order to do so, we examine Argentine imports data for the 1999—2008 period to see how products and varieties changed due to this event. Using a counterfactual analysis, we find that the increase in imported varieties coming from China had a large effect on welfare.

Clasificación JEL: F11, F13, F14, F15.

Palabras clave: Gains from trade, Product varieties, WTO.

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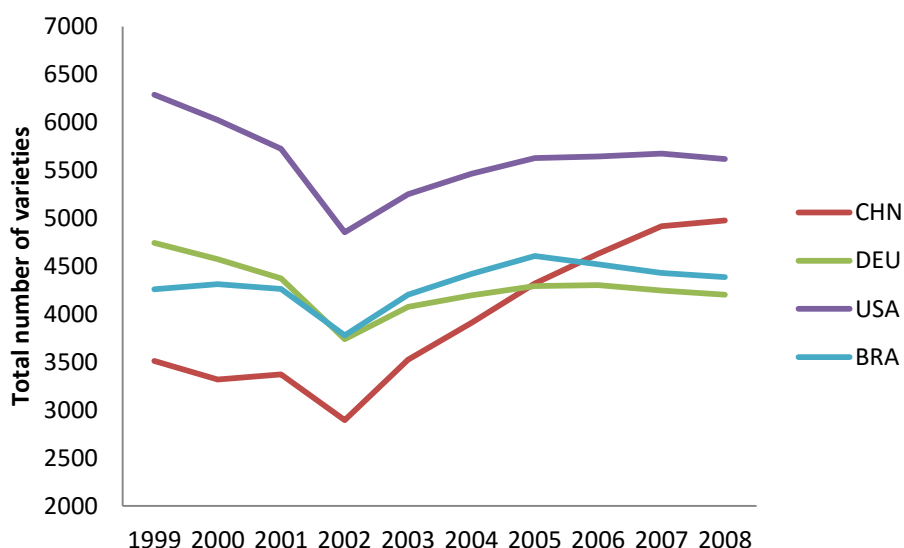
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1. Introduction

China's entrance to the World Trade Organization (WTO) in December 2001 meant a dramatic change in worldwide commercial relations: its deeper integration to the world economy injected thousands of products into the world markets. At the same time, it has been demonstrated by economic theory that having access to a greater variety of products raises a country's welfare, particularly, that is one of the most important factors explaining this welfare raise caused by trade globalization. In this paper we will quantify the effect of China's integration to the WTO on Argentina's welfare by using a standard CES utility function which can represent substitution between both products and product-varieties.

In Figure 1, we show the evolution of the total number of imported varieties for the whole period of our sample, distinguishing between Chinese (CHN) and other main commercial partners. Varieties from all groups drop sharply due to the Argentine 2001-2002 crisis, but Chinese imports recover faster and outgrow previous years, while the rest never quite full recover. The idea behind this is that, in spite of the Argentine crisis, the sharp increase in Chinese varieties can be attributed to its joining to the WTO in December 2001. Additionally, we include the total number of varieties by year in Table 1 of the appendix.

Figure 1: Change in the number of imports from China and main commercial partners



To quantify the effect on welfare of this raise in varieties, we will look at product categories and product varieties following Brambilla and Tomé (2014), which use an analytical framework first developed by Feenstra (1994) in order to measure the welfare losses due to the reduction in varieties caused by the 2002 Argentine crisis. We use this framework but with a different meaning, while they compare two real situations, we use the same indices to measure the welfare changes between an observed situation and a counterfactual situation in which we only maintain those Chinese varieties that were imported in 1999, before it joined the WTO. That is, a counterfactual situation assuming that varieties from China would remain constant if China wouldn't have joined the WTO.

As Brambilla *et al* show, varieties fell considerably during the Argentine recession that started in 2000 and ended with the big crisis of 2002. So, even though we would like to take the year before China joined the WTO as counterfactual – that is, 2001 –, this wouldn't be right. We would be overestimating the gains in welfare because parts of that

gain would be coming from the raise in varieties caused by the economy's recovery after the crisis. That is the reason why we take 1999 as counterfactual year.

2. Data

The imports data covering the years 1999 to 2008 was collected by Argentina's national statistics institute, INDEC. Import values in constant US dollars are classified by product (at the 8 digit level of the Harmonized System) and source country. We also use estimations on the elasticity of substitution between products, calculated in Brambilla *et al*, which are shown in Table 2 of the appendix³.

Since our goal is to estimate the welfare effect of changes in varieties within product groups, the definition we use of products and varieties is extremely relevant. The product groups used in the paper take the first two digits of the Harmonized System and classify them into fifteen categories, shown in Table 3 of the appendix. In the contrary, varieties are defined at a much greater level of disaggregation, with a variety being the combination of each 8 digit category of the Harmonized System and country.

³ These are very important results since they show how easily a product group can be substituted for others. Table 2 included in the appendix shows that between the groups with highest substitution are "Food Manufactures", "Animals and Animal Products" and "Vegetable Products", while the lowest substitution is found in "Stone and Glass Products" and "Machinery and Electrical Machinery" and "Miscellaneous products".

3. Estimation strategy

In order to estimate the welfare effects in Argentina caused by the raising of varieties imported from China after its entrance to the WTO we propose a utility function and then aggregate it. We will only consider changes on imported varieties from China, supposing local varieties remain unchanged.

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

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

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

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

Where 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 (logically bigger than elasticity between products just for the fact that varieties are more numerous than 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.

$$\phi_j(P_{jt}, B_{jt}, \Omega_{jt}) = \left(\sum_{v \in \Omega_{jt}} b_{vjt} p_{vjt}^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}}$$

When prices, qualities and available varieties are given, the unit cost function is the minimum cost required to achieve one unit of utility from the composite product. The unit cost increases with prices, and decreases with quality and available varieties (which is a direct consequence of the convexity of preferences). Additionally, the unit cost function satisfies that $\phi_{jt} X_{jt}$ is total expenditure on product j .

We are interested in welfare comparisons between an observed and a counterfactual situation, which will be the year 1999 for the reasons explained before. For each product, we 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 observed and the counterfactual situations. The percentage change in welfare between p^c , the counterfactual, and p , the observed, can be written as

$$\Delta w_{jt} = 1 - \frac{\phi_j(P_{jt}, B_{jt}, \Omega_{jt})}{\phi_j(P_{jtc}, B_{jtc}, \Omega_{jtc})}$$

The ratio of unit costs functions is an exact cost of living index, as defined by Diewert (1976). It can be interpreted as 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 B_{jt} and B_{jtc} , a result that is very useful from an empirical point of view because qualities are generally unobserved and difficult to estimate. Let us denote the price index by $\pi_{jt} = \frac{\phi_{jt}}{\phi_{jtc}}$, 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,

$$\pi_{jt} = \left(\prod_{v \in \Omega_{jt}^*} \left[\frac{p_{vjt}}{p_{vjt_c}} \right]^{\omega_{vjt}} \right) \left(\frac{\lambda_{jt}}{\lambda_{jt_c}} \right)^{\frac{1}{\sigma_j - 1}}$$

The first factor, derived by Sato (1976) and Vartia (1976), is a geometric mean of changes in the prices of the varieties that were available both in the observed year and in 1999 (denoted by $\Omega_{jt}^* = \Omega_{jt} \cap \Omega_{jt_c}$). 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. For the purpose of this paper we will only be estimating the second term of the equation.

The variable λ_{jt} is defined as the share in expenditure of varieties available in both periods (observed and counterfactual) relative to the varieties available only in t. Formally, λ_{jt} and λ_{jt_c} can be written as

$$\lambda_{jt} = \frac{\sum_{v \in \Omega_{jt}^*} p_{vjt} x_{vjt}}{\sum_{v \in \Omega_{jt}} p_{vjt} x_{vjt}} ,$$

$$\lambda_{jt_c} = \frac{\sum_{v \in \Omega_{jt}^*} p_{vjt} x_{vjt}}{\sum_{v \in \Omega_{jt_c}} p_{vjt} x_{vjt}} .$$

4. Estimation of welfare effects

We now proceed to estimate the welfare effects that were described in the previous section. It is very important to remember that this exercise looks at changes in varieties between the situation observed each year and a counterfactual one in which we only keep the varieties that were available in 1999, used as benchmark period before China's entrance to the WTO. Another important aspect to take into account is that we will not be

considering changes in prices in this exercise. That is, we will only look at the welfare effects of changes in varieties.

Table 4 in the appendix shows the welfare effects by year and product group. At first glance, it is clear that welfare decreases between 1999 and 2002 due to the Argentine crisis, after this year welfare starts rising again, with many product groups reaching its highest level on 2008. This effect is isolated of the effects of the crisis due to the fact that we use 1999 as counterfactual year.

Another interesting result is that the welfare gains are concentrated in groups where we would expect Chinese imports to be more competitive, such as “Stone and Glass Products”, “Chemicals and Machinery” and “Electrical Machinery”. On the other hand, no welfare improvements are registered in categories like “Skins, Leather and Fur Products”, “Food Manufactures” and “Transportation Equipment”.

In addition to these results, Tables 5, 6 and 7 included in the appendix, show the effects for Brazil, USA and Germany, used as robustness checks. While imported varieties from these countries, and thus Argentine welfare, increases over time, none of them provoke such a clear raise in welfare between 1999 and 2008 as China does.

5. Conclusions

We have estimated the welfare changes associated to the Chinese enrollment in the WTO. The derived increase in varieties caused an aggregate increase in Argentina’s welfare that varied across product groups. When compared with imports from other important trade partners, the gains in welfare originated by Chinese imports are much larger. In conclusion, policies that favor trade diversification between China and Argentina might induce further welfare gains in future years.

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7. Appendix

Table 1: Number of imports from China and main commercial partners by year

Year	CHN	DEU	USA	BRA
1999	3513	4742	6287	4261
2000	3320	4572	6023	4312
2001	3373	4374	5725	4262
2002	2894	3738	4854	3778
2003	3526	4075	5250	4204
2004	3909	4197	5464	4419
2005	4321	4292	5628	4608
2006	4629	4304	5645	4519
2007	4916	4245	5674	4429
2008	4978	4204	5616	4385

Table 2: Estimated elasticity of substitution (σ) by product group

Product Group	σ
Animals and Animal Products	6.81
Vegetable Products	4.20
Food Manufactures	8.21
Mineral Products	2.69
Chemicals	2.45
Plastics and Rubbers	2.80
Skins, Leather and Fur Products	2.93
Wood and Wood Products	2.50
Textiles	2.74
Footwear and Headgear	3.13
Stone and Glass Products	1.78
Metals	2.16
Machinery and Electrical Machinery	1.69
Transportation Equipment	2.42
Miscellaneous	1.48

Table 3: Harmonized System codes (HS2) classified into product groups

Product Group	HS2
Animals and Animal Products	01, 02, 03, 04, 05.
Vegetable Products	06, 07, 08, 09, 10, 11, 12, 13, 14, 15.
Food Manufactures	16, 17, 18, 19, 20, 21, 22, 23, 24.
Mineral Products	25, 26, 27.
Chemicals	28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38.
Plastics and Rubbers	39, 40.
Skins, Leather and Fur Products	41, 42, 43.
Wood and Wood Products	44, 45, 46, 47, 48, 49.
Textiles	50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63.
Footwear and Headgear	64, 65, 66, 67.
Stone and Glass Products	68, 69, 70, 71.
Metals	72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83.
Machinery and Electrical Machinery	84, 85.
Transportation Equipment	86, 87, 88, 89.
Miscellaneous	90, 91, 92, 93, 94, 95, 96, 97.

Table 4: Welfare effect (China)

Product Group	2000	2001	2002	2003	2004	2005	2006	2007	2008
Animals and Animal Products	0.018	0.022	-0.011	0.036	0.012	0.025	0.022	0.015	0.045
Vegetable Products	0.006	0.009	0.008	0.087	0.244	0.113	0.095	0.118	0.157
Food Manufactures	0.000	0.001	-0.002	0.002	0.004	-0.011	0.020	0.013	0.020
Mineral Products	0.014	-0.394	0.251	0.001	0.009	0.029	-0.192	0.035	0.002
Chemicals	0.003	0.054	0.101	0.178	0.166	0.188	0.259	0.307	0.305
Plastics and Rubbers	-0.005	-0.003	-0.002	0.014	0.042	0.053	0.059	0.070	0.067
Skins, Leather and Fur Products	0.001	0.000	0.009	0.011	0.009	0.010	0.015	0.014	0.015
Wood and Wood Products	0.009	0.018	0.039	0.087	0.066	0.110	0.132	0.225	0.214
Textiles	0.002	0.005	-0.075	0.014	0.048	0.036	0.050	0.151	0.153
Footwear and Headgear	0.000	0.000	-0.004	0.000	-0.001	0.000	0.000	0.204	0.215
Stone and Glass Products	-0.011	0.010	-0.056	0.172	0.150	0.347	0.363	0.382	0.393
Metals	0.007	0.055	0.114	0.054	0.057	0.019	0.072	0.135	0.203
Machinery and Electrical Machinery	-0.002	0.017	0.042	0.077	0.090	0.098	0.118	0.290	0.273
Transportation Equipment	-0.001	-0.011	0.003	0.028	0.040	0.002	-0.001	0.003	0.011
Miscellaneous	0.000	0.007	0.133	0.212	0.148	0.148	0.164	0.184	0.101
Average effect	0.003	-0.014	0.037	0.065	0.072	0.078	0.078	0.143	0.145

Table 5: Welfare effect (Brazil)

Product Group	2000	2001	2002	2003	2004	2005	2006	2007	2008
Animals and Animal Products	0.000	0.002	0.003	0.003	-0.015	0.008	-0.012	-0.014	-0.015
Vegetable Products	-0.005	0.004	0.006	0.011	0.010	0.008	-0.006	0.020	0.011
Food Manufactures	0.001	0.001	-0.001	0.001	0.004	0.003	0.004	0.002	0.001
Mineral Products	-0.001	0.010	0.002	0.009	-0.020	0.098	-0.025	0.165	0.038
Chemicals	0.005	-0.040	0.009	0.016	0.018	0.026	0.010	0.047	0.042
Plastics and Rubbers	0.001	0.002	0.017	0.022	0.031	0.025	0.029	0.022	0.023
Skins, Leather and Fur Products	-0.001	-0.001	0.670	0.451	0.483	0.301	0.508	0.398	0.327
Wood and Wood Products	0.000	0.001	0.267	0.347	0.360	0.379	0.376	0.361	0.362
Textiles	0.001	0.005	0.006	0.018	0.024	0.034	0.041	0.061	0.057
Footwear and Headgear	0.000	0.000	-0.004	0.000	0.000	0.000	0.000	0.078	0.097
Stone and Glass Products	-0.001	0.009	0.157	0.115	0.061	0.109	0.116	0.126	0.144
Metals	-0.006	0.007	0.026	0.004	-0.007	0.005	0.015	0.023	0.051
Machinery and Electrical Machinery	0.002	0.003	-0.019	0.053	0.077	0.094	0.075	0.227	0.222
Transportation Equipment	0.003	0.019	0.014	0.022	0.024	0.063	0.040	0.043	0.041
Miscellaneous	0.006	-0.002	0.117	0.106	0.090	0.074	0.084	0.100	0.059
Average effect	0.000	0.001	0.085	0.079	0.076	0.082	0.083	0.111	0.097

Table 6: Welfare effect (USA)

Product Group	2000	2001	2002	2003	004	2005	2006	2007	2008
Animals and Animal Products	0.007	0.007	0.008	-0.031	-0.007	0.005	-0.010	-0.001	0.046
Vegetable Products	0.013	-0.003	-0.005	0.083	0.000	0.004	-0.003	0.006	0.005
Food Manufactures	0.000	0.000	0.004	0.006	0.003	-0.001	0.000	0.000	0.002
Mineral Products	0.064	0.015	0.236	0.212	0.150	0.557	0.446	0.613	0.604
Chemicals	-0.001	0.002	0.021	0.012	0.013	0.016	0.019	0.045	0.062
Plastics and Rubbers	0.000	0.000	0.029	0.044	0.043	0.031	0.027	0.037	0.038
Skins, Leather and Fur Products	-0.013	-0.038	0.575	0.227	0.256	0.712	0.551	0.384	0.092
Wood and Wood Products	0.005	0.015	0.139	0.146	0.126	0.127	0.164	0.194	0.129
Textiles	-0.003	-0.021	-0.019	0.018	0.053	0.048	0.065	0.109	0.081
Footwear and Headgear	-0.026	-0.018	-0.112	-0.096	-0.044	-0.017	-0.025	0.001	0.009
Stone and Glass Products	0.001	-0.025	0.280	0.294	0.350	0.407	0.261	0.233	0.171
Metals	-0.005	-0.007	-0.005	-0.005	0.005	0.000	0.016	0.014	0.040
Machinery and Electrical Machinery	-0.002	0.001	-0.039	0.004	0.030	0.063	0.117	0.063	-0.038
Transportation Equipment	0.023	0.130	-0.023	0.028	0.030	0.077	0.051	0.025	0.060
Miscellaneous	0.002	-0.003	0.136	0.150	0.177	0.171	0.228	0.254	0.174
Average effect	0.005	0.004	0.082	0.073	0.079	0.147	0.127	0.132	0.098

Table 7: Welfare effect (Germany)

Product Group	2000	2001	2002	2003	2004	2005	2006	2007	2008
Animals and Animal Products	0.003	-0.102	-0.032	-0.026	0.000	0.008	-0.016	-0.015	-0.018
Vegetable Products	-0.036	0.051	0.007	-0.058	0.061	0.022	0.021	0.012	0.014
Food Manufactures	0.001	0.004	-0.006	0.006	0.010	0.028	0.021	0.002	0.015
Mineral Products	-0.007	0.003	0.172	0.473	0.473	0.582	0.604	0.567	0.635
Chemicals	0.001	0.004	0.043	0.035	0.022	0.040	0.069	0.050	0.043
Plastics and Rubbers	-0.001	-0.005	0.030	0.022	0.037	0.049	0.059	0.041	0.034
Skins, Leather and Fur Products	-0.014	0.066	0.834	0.806	0.788	0.512	-0.142	-0.076	-0.159
Wood and Wood Products	0.017	0.019	0.398	0.546	0.594	0.633	0.553	0.618	0.537
Textiles	0.017	0.018	-0.022	-0.003	0.067	0.026	0.053	0.063	-0.043
Footwear and Headgear	-0.008	0.040	-0.115	-0.027	-0.084	-0.057	-0.020	0.048	0.094
Stone and Glass Products	-0.067	-0.075	-0.054	-0.022	-0.011	-0.033	-0.017	-0.010	-0.013
Metals	-0.007	-0.001	-0.023	-0.004	0.044	0.158	0.053	0.129	0.064
Machinery and Electrical Machinery	0.007	0.050	0.047	-0.022	0.056	0.091	0.040	0.034	0.077
Transportation Equipment	-0.009	0.006	-0.008	0.004	-0.003	-0.001	0.045	0.069	0.054
Miscellaneous	-0.015	0.031	0.034	0.009	0.097	0.069	0.222	0.176	0.274
Average effect	-0.008	0.007	0.087	0.116	0.143	0.142	0.103	0.114	0.107