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## THE IMPACT OF TRADE LIBERALIZATION OF ENVIRONMENTAL PRODUCTS ON WELFARE, TRADE, AND THE ENVIRONMENT IN ARGENTINA

**Ramos, María**

# The impact of trade liberalization of environmental products on welfare, trade, and the environment in Argentina

**María Priscila Ramos**[*]
Instituto de Economía, Universidad Argentina de la Empresa (UADE)
Buenos Aires, Argentina
Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)
Paris, France
*maramos@uade.edu.ar*

## Abstract

This paper aims to evaluate the potential improvement for trade, development and the environment to Argentina through the multilateral elimination of tariffs on environmental goods and services (EGS). A two-step methodology that combines a computable general equilibrium and a microsimulation models leads to assess this triple-win situation. The comparison of four EGS lists show that the UNCTAD list is the only one that leads to the triple-win situation for Argentina, while the Japanese and APEC lists generate increases in welfare and trade, but fail environmentally. The consideration of a Special and Differentiated Treatment for developing countries could improve these outcomes.

Keywords: trade liberalization, environental godos and servicies, CO2 emissions, Argentina.

Clasificación JEL: C68, C14, F13, F18, Q56

## Resumen

Este artículo evalúa las potenciales mejoras para el comercio, el desarrollo y el medio ambiente de Argentina como consecuencia de la liberalización comercial de bienes y servicios ambientales (BSA) en el ámbito multilateral. Combinando un modelo de equilibrio general computado y otro de microsimulaciones se muestra que de las cuatro listas de BSA simuladas la lista de la UNCTAD es la única que logra este triple objetivo en Argentina, mientras que las listas de Japón y de la APEC solo permiten incrementar su bienestar y comercio. Un tratamiento especial y diferenciado para los países en desarrollo podría mejorar estos resultados.

Palabras claves: liberalización comercial, bienes y servicios ambientales, emisiones de carbono, Argentina.

JEL classification: C68, C14, F13, F18, Q56

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## 1 Introduction

The 2001 Doha Ministerial Declaration singled out trade liberalization of environmental goods and services as a way to achieve sustainable development by creating a triple-win situation for trade, development, and the environment.[1] Several questions have been raised in this context about the definition of EGS, the need for compatibility between that definition and the Harmonized System (HS) of classification,[2] approaches to negotiation[3] and modalities of trade liberalization, inclusion of special and differential treatment (SDT) for developing countries in trade liberalization modalities, the level of stringency of environmental regulations across countries, and technological and financial assistance to developing countries to facilitate their access to clean technologies and compliance with environmental standards (Howse and van Bork, 2005; Zhang, 2010).

Various members of the WTO have submitted their negotiation proposals for EGS trade liberalization to the WTO Committee on Trade and Environment in Special Session. However, none of the proposals has gained a consensus due to conflicting interests among the negotiating parties and because the countries involved have argued that the proposals are far from meeting the triple-win objective.

Most of the proposals submitted follow the list approach, which consists of identifying sets of products, based on the HS, to be considered as EGS. These include the lists submitted by Japan, APEC, OECD, and UNCTAD. These lists mainly reflect the export interests of developed countries in non-agricultural trade, with the exception of the UNCTAD list, which includes some agricultural products that fall under the definition of EPPs. Moreover, the list approach entails the risk of dual or multiple uses of EGS, depending on their level of definition in the HS.[4]

The above four EGS lists would have different effects on Argentina. Depending on the list, their adoption could boost Argentina's exports of products in which it has a comparative advantage. Adoption could also improve Argentina's access to imported environmentally-friendly high-technology goods from developed countries, contribute to the country's sustainable development, and reduce the prices of domestic consumption goods. The changes in relative prices of goods and in remunerations of factors as a consequence of trade liberalization of such EGS would encourage changes in production patterns in the long run. These structural changes could support climate change mitigation and/or adaptation in countries like Argentina (Chisari, 2010) through more efficient use of resources and energy, and a related reduction of $CO_2$ and other emissions.

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[1] See World Trade Organization (WTO) Doha Ministerial Declaration, 20 November 2001 (WT/MIN(01)/DEC/1, paragraph 31), available at: http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.htm.

[2] When a 6-digit product of the HS includes both environmental and non-environmental goods, the environmental goods are identified in national tariff schedules at the 8- or 10-digit level by using "ex outs." This needs to be done in a way that would be compatible across countries in order to refer to the same product.

[3] The negative approach implies identifying goods and services to be banned from trade due to the environmental damage caused by their consumption or production (e.g. ozone-depleting substances banned by the Montreal Protocol), whereas the positive approach aims at promoting trade in goods and services that are environmentally "friendly."

[4] Few EGS defined at the 6-digit HS level serve a single-use environmental purpose (e.g. HS-841011 and HS-841012, which are hydraulic turbines). Most EGS can be used for both environmental and non-environmental purposes (e.g. windmill pumps, which could be considered as EGS, are included in the HS-841381 with other pumps, which are not EGS). One way to solve this conflict is to increase the level of detail of the products (i.e. go to the 8- or 10-digit levels), which poses another problem because the definitions of products at these levels are not harmonized across countries.

None of the lists covers all of the EGS of import and export interest to Argentina. It is therefore important to assess the benefits of each of them to understand which ones would be most beneficial for the country.

In addition to the list approach, several other approaches to EGS trade liberalization have been proposed by WTO members. The environmental project approach suggested by India identifies goods and services to be liberalized based on the criterion of the end use of each item, aiming to reduce the multiple-use risk of EGS mentioned above, and takes into account the needs of developing countries (e.g. SDT, mechanisms for clean technology transfer). The request-offer approach put forth by Brazil proposes that each country suggest its own commitments in bilateral negotiations. The integrated approach of Argentina combines elements of the environmental project and the list approaches in that the identified categories of environmental projects include lists of eligible EGS. These approaches are criticized because they are more difficult to implement, as the liberalization of EGS would depend on a unilateral decision of the national authority, and because they do not offer predictable and permanent liberalization. Finally, the combined approach (Chile and Mexico) and the hybrid approach (Australia, China, Colombia, Hong Kong (China), Norway, Singapore, and South Africa) introduce SDT for developing countries in the form of differentiated EGS lists, and suggest more flexibility for developing countries in implementing tariff cuts (lower cuts and longer phase-out periods).

Among the EGS lists under discussion, an option for some developing countries may be the liberalization of EPPs following the UNCTAD list, since that list also includes agricultural products (ICTSD, 2007; UNCTAD, 2005). Nevertheless, Argentina has reservations about including EPPs in the EGS negotiation because their identification could be based on processes and production methods (PPMs) and thus become a source of potential discrimination against (or higher costs for) some developing countries.[5]

Several studies (Vikhlyaev, 2004; Howse and van Bork, 2005; ICTSD and IISD, 2005; ICTSD, 2007; Hamwey, 2005; Steenblick, 2005; UNEP, 2013) have identified the concerns of developing countries regarding trade liberalization of EGS. These concerns – which are related to the definition of EGS, approaches to EGS liberalization, environmental regulation, and technology transfer – should be considered in order enable developing countries to enter the EGS market (Khatun, 2011; Monkelbaan, 2011). In this sense, SDT provisions in trade liberalization are essential to minimize trade liberalization costs (such as unemployment) in the short term and to ensure trade and welfare gains for these countries in the medium to long term (Laborde and Lakatos, 2012).

Existing literature on these issues suggests that liberalizing trade in EGS would not result in a triple-win situation. Gozlan and Ramos (2008) suggest that welfare implications (including environmental externalities) and their distributional consequences for a small importing country are larger under a global liberalization scenario (free trade) than under a preferential EGS trade liberalization scenario. This is because welfare gains are higher and pollution is shifted to foreign producers under a free trade scenario. Other studies also conclude that the slight increase in EGS trade is not sufficient to reduce environmental degradation (Balineau and De Melo, 2011), and that there is a trade-off between welfare and trade gains, and environmental improvement (Dijkstra and Mathew, 2010). Nimubona (2012) argues that trade liberalization of EGS could actually lead to less stringent environmental regulation, and thus a potential increase in pollution levels.

[5]According to the non-discrimination principle of the General Agreement on Tariffs and Trade, it may not be feasible to implement EGS trade liberalization on the basis of PPMs because of possible discrimination against countries using non-environmentally-friendly PPMs and favouritism towards countries meeting costly environmental standards.

Despite growing interest in the subject, a complete analysis of EGS proposals in terms of their trade, welfare, and environmental impact at the national and household levels has not yet been undertaken. Moreover, most of the applied research evaluates the impact of tariff cuts on EGS in low-income countries (e.g. African, Caribbean and Pacific countries, or least developed countries – LDCs), leaving aside middle-income countries (such as Argentina) that have better initial conditions to reach a triple-win situation. All the studies to date have chosen the list approach to simulate their EGS trade liberalization scenarios, since other approaches, including the Argentine one, are subject to discretional conditions (i.e. the existence of environmental projects and the approval of a national authority) that are difficult to simulate *ex ante*.

Argentina has not explicitly proposed a list of eligible EGS at the detailed level of each environmental project category included in its integrated approach. The quantitative evaluation of the main EGS lists under discussion in terms of trade, welfare, and the environment could therefore be useful for policymakers seeking to identify products for that list. In this context, this study aims to evaluate the effects of the elimination of multilateral tariffs under each of the four EGS lists (APEC, Japan, OECD and UNCTAD-EPP) on Argentine trade, welfare distribution across urban households, and the environment ($CO_2$ emissions). A thorough welfare analysis of the current alternatives for EGS liberalization could also be of interest to developing countries and move forward the negotiations at the WTO Committee on Trade and Environment in Special Session.

The study is organized as follows. Section 2 describes the main features of the four EGS lists mentioned above. Section 3 analyses the global trade and protection of goods in each of the lists and highlights the potential benefits and losses for Argentina under the four liberalization scenarios. Section 4 details the two-step top-down methodology applied in the study, which consists of (a) simulations of scenarios using a CGE multi-sector and multi-region model, and (b) microsimulations using as inputs the changes in the prices of goods and production factors from the CGE simulations to simulate the welfare distribution across households. Section 5 presents the changes in trade, welfare, and $CO_2$ emissions in the four scenarios. Section 6 discusses possible ways to include SDT provisions in the EGS trade liberalization process as a potential improvement of the EGS proposals, and Section 7 provides conclusions and suggestions for policymakers.

## 2 Trade liberalization lists for environmental goods and services

Since there is no universally accepted definition of EGS, it is difficult to identify and measure the opportunities and challenges faced by the WTO members in the EGS negotiations. Most proposals submitted to date use lists of products (list approach), and many of them follow the definition of EGS developed by the OECD. According to the OECD definition, "The environmental goods and services industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems…" (OECD and Eurostat, 1999: 9). Based on this definition, EGS are classified into three main groups: group A ("pollution management"), group B ("cleaner technologies and products"), and group C ("resources management").

The current OECD list consists of 119 HS 1996 products at the 6-digit (HS-6) level.[6] Most tariffs applied to these products have already been significantly reduced by OECD countries, while they remain high in other countries. The difference in the average applied protection between developed and developing countries – 1.3 and 6.1 per cent, respectively (see Table

[6] The 1996 Harmonized System was chosen because the *Base d'Analyse pour le Commerce International* (BACI) and Market Access Map (MAcMap)-HS-6 databases used in this study and described in Sections 3 and 4 use this product classification.

1) – suggests that liberalizing EGS trade based on this list of products would mainly improve access to developing countries' markets for goods produced in OECD countries.

Although an OECD member, Japan has proposed its own EGS list, which includes 57 products at the HS-6 level chosen on energy efficiency grounds. Although both the OECD and the Japanese lists include energy products, they do not match at the HS-6 level. For instance, both lists cover products from chapter 85 of the HS classification.[7] However, while those products from the OECD list are related to renewable energy (e.g. HS-854140, "Photosensitive Semiconductor Devices, including Solar Cells"), the products from the Japanese list concern more efficient high-tech devices in terms of energy use (e.g. HS-850680, "Other Primary Cells and Primary Batteries"). Thus, there is no overlap between the OECD and the Japanese lists at the HS-6 level of classification. The OECD list accounts for less than 2 per cent of Argentina's total exports and is therefore of little interest to the country. However, the Japanese proposal contains products accounting for about 10 per cent of Argentina's total exports in 2010 (see Figure 1, panel (a)) and thus opens up export opportunities for the country, especially for cars and trucks (HS-870323 and HS-870421).

Another EGS list under discussion is the EPP list proposed by UNCTAD, which also includes some agricultural goods. UNCTAD (1995: 7) defines EPPs as "products which cause significantly less environmental harm at some stage of their life cycle (production/processing, consumption, waste disposal) than alternative products that serve the same purpose, or products the production and sales of which contribute significantly to the preservation of the environment." One example from this list is "Oilcake and Other Solid Residues Resulting from the Extraction of Soya Bean Oil" (HS-230400), which represents half of Argentina's EGS exports under this proposal. The UNCTAD-EPP is a long list compared to others, because it includes some complete chapters of the HS classification (e.g. chapters 14, 23, 44), and also products defined at the HS 4-digit level (e.g. 0509, 1211, and 6701). However, this aggregate level of definition does not filter out some non-environmental goods. For Argentina, the liberalization of EPP would present a good opportunity to increase its trade and consequently improve its welfare, given the country's comparative advantage in agricultural products. However, the Argentine government also believes that EPP may result in a discriminatory effect against developing countries based on their PPMs (WTO, 2006). This last concern points to the necessity to find some mechanisms for the transmission of clean technologies to countries with lower levels of development.

Trade liberalization of EGS is not only discussed at the multilateral level; it has also been negotiated at the regional level. This is the case of APEC, whose membership consists of both developed and developing countries. Even though the APEC list is not formally part of the EGS negotiations at the WTO, it is interesting to assess whether it could be compatible with Argentina's interests, and it may be useful for the elaboration of the EGS list in Argentina's integrated proposal. The current APEC list of EGS consists of 48 non-agricultural products at the HS-6 level[8] that are supposed to "directly and positively contribute to green growth and sustainable development objectives" (Vossenaar, 2013:1). Twenty-eight HS-6 products from the APEC list are also part of the OECD list, and this is the only overlap between the four lists analysed in this study. Using the APEC list, Argentina is a net importer of EGS products, and the origins of imports vary significantly for these products. The only EGS product exported by Argentina is HS-903289 ("Automatic Controlling and Regulating Instruments such as Heliostats, Sensors for Solar Boiler/Water Heater"), which accounts for less than 1 per cent of Argentina's exports under the four EGS lists together.

[7] This HS chapter is described as "Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles."

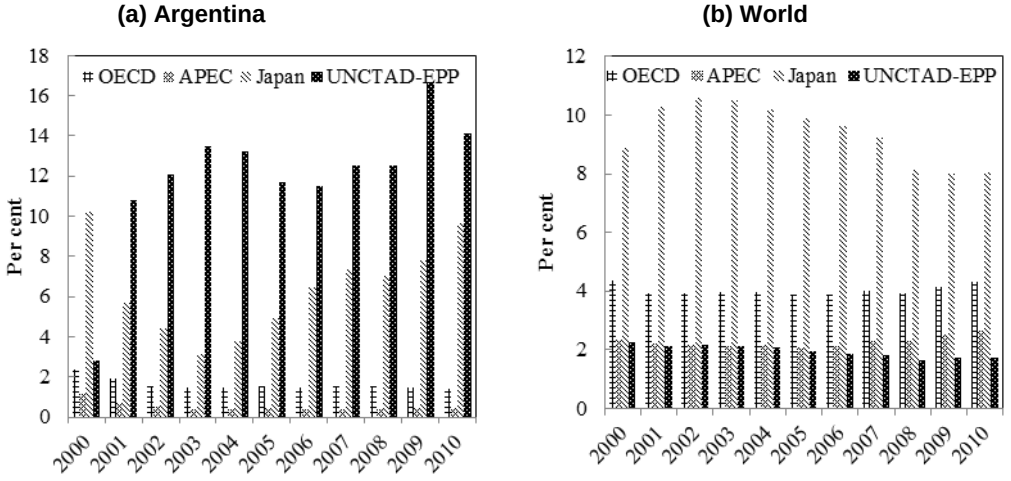
[8] The list uses the 2002 HS classification and consists of 54 products at the HS-6 level. The conversion to the 1996 HS classification reduces the number of products to 48.

## 3 Trade and protection of environmental goods and services: Opportunities and concerns

Although proposals based on the list approach do not fully cover all aspects of the ongoing negotiations (for instance, SDT), the simplicity of implementing such proposals facilitates their quantitative evaluation. The description of current EGS trade and protection is useful to identify trade opportunities and concerns for Argentina in these negotiations, based on the four EGS lists mentioned above.

Trade in EGS accounts for a small share of global trade. As shown in Figure 1 (panel (b)), EGS exports, defined according to the four EGS lists above, accounted for less than 10 per cent of global exports in the 2000–2010 period. Furthermore, the shares of products contained in different lists in world trade vary from one list to another. For instance, EGS exports defined according to the Japanese list amounted to four times the value of those for the UNCTAD-EPP list, despite the fact that the number of products is much larger in the latter.

**Figure 1: Export patterns of EGS for Argentina and the world (per cent of total exports)**



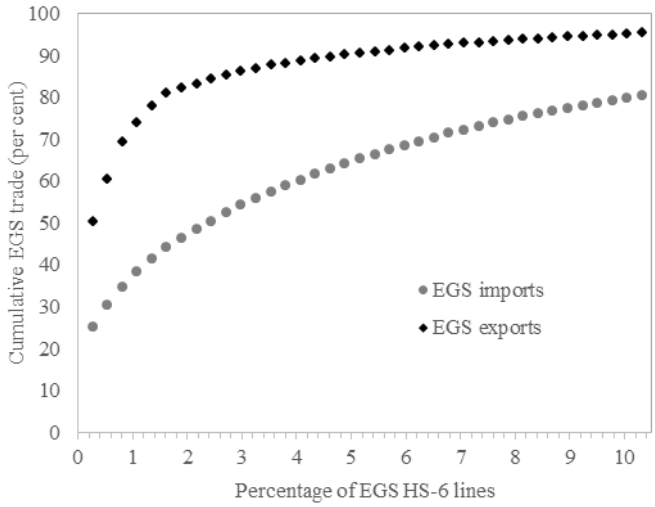

Source: Author's calculations, based on the BACI database (Gaulier and Zignago, 2010). BACI is a detailed international trade database that covers more than 200 countries and 5,000 products over 1994–2010. It is based on the UN COMTRADE database and reconciles exporting and importing countries' trade flows in order to have a single consistent figure of bilateral trade flows.
Note: The export share of EGS in the total exports of each region (Argentina and the world) are calculated for the four EGS lists based on the value of exports for the 2000–2010 period.

The shares of EGS in total exports of developed and developing countries are similar to those at the worldwide level, where the highest shares of EGS in total exports are found in the Japanese list, and the lowest in the UNCTAD-EPP list. By contrast, for LDCs, EGS exports in 2010 were higher for the UNCTAD-EPP list (2.5 per cent of total LDC exports) than for the Japanese list (0.2 per cent). This difference can be explained by the differences in comparative advantages of developed countries and LDCs that are reflected in high-tech EGS exports from developed countries, and agricultural and primary EGS exports from LDCs. Different comparative advantages also shape export patterns, and thus possible gains from EGS trade liberalization, for other developing countries. For instance, Brazil could find some opportunities for exports of its products related to agriculture and renewable energy under the UNCTAD-EPP list, while China could do so with technological products under the Japanese list. These export patterns across different groups of countries give us an idea of the opportunities at stake for each group in these negotiations.

In the particular case of Argentina, its EGS exports follow a similar pattern to that of LDCs, despite its higher level of development. Argentina shows higher exports under the UNCTAD-EPP list (14 per cent of its total exports in 2010) than under the OECD or APEC lists (less than 2 per cent of total exports in 2010 for each of the two lists). Interestingly, EGS exports of products included in the Japanese list have followed an increasing trend in recent years and represented 8 per cent of exports in 2010 (see Figure 1, panel (a)).

Putting together all HS-6 products from the four EGS lists, Figure 2 shows that Argentina's trade in EGS is concentrated in a few HS-6 products. Indeed, 83 per cent of Argentine EGS exports consist of only eight HS-6 products. The first product is soya oil cake (HS-230400), included in the UNCTAD-EPP list, which accounts for 50 per cent of Argentina's EGS exports, while 33 per cent is represented by automobiles from the Japanese list (HS-870323, 870421, 870321, 870322, 870431, 870333, and 870210). The remaining 17 per cent of Argentine EGS exports are composed of 160 HS-6 products; no exports of the remaining 266 HS-6 EGS products are recorded. Argentina's EGS imports are also concentrated on a limited number of HS-6 products, but less than in the case of exports. Five per cent of EGS HS-6 products (equivalent to 20 HS-6 products) account for more than 60 per cent of the country's EGS imports: 11 HS-6 EGS from the Japanese list, 7 from the OECD list, and 2 from the APEC list, with no overlapping across these lists.

**Figure 2: Concentration of Argentina's EGS trade on selected HS-6 products (per cent)**




Source: Author's calculations, based on the BACI database (Gaulier and Zignago, 2010).
Note: The figure includes all the EGS HS-6 products from the APEC, Japanese, OECD, and UNCTAD-EPP lists. The share of total Argentine EGS imports and exports is thus based on all the EGS lists.

The volume of EGS trade and protection varies from one list to another. The level of *ad valorem* equivalent (AVE) applied tariffs for different EGS lists and groups of countries provides an indicator of possible positions of these countries in the EGS trade negotiations. Table 1 provides data about the AVE duties based on the bilateral trade applied protection (*ad valorem*, specific and mixed tariffs, and even tariff-rate quotas) at the HS-6 level from the MAcMap-HS-6 dataset (Guimbard *et al.*, 2012) which uses the reference country group weighting scheme (Bouët *et al.*, 2008).[9]

[9] The reference group weighting scheme makes it possible to aggregate the MAcMap-HS-6 tariffs from its three dimensions (i.e. HS-6 product, reporter, and partner countries in the International Organization for Standardization codes) to a higher aggregation level of regions and sectors (e.g. 15 regions and 39 goods/sectors in this study) based on the trade of a group of similar countries. The clusters of countries (groups) are built according to their per capita GDP (in purchasing power parity)

On average, EGS are less protected in developed countries than in developing countries and LDCs. This difference in the level of protection is the largest for the Japanese list, where, on average, import AVE applied tariffs in developing and developed countries are higher than 16 per cent and less than 3 per cent, respectively. For Argentina, the import AVE applied tariff for products in the Japanese list exceeds 27 per cent, which is higher than the average for Latin America.

**Table 1: *Ad valorem* equivalent (applied) protection of EGS by groups of countries (per cent)**

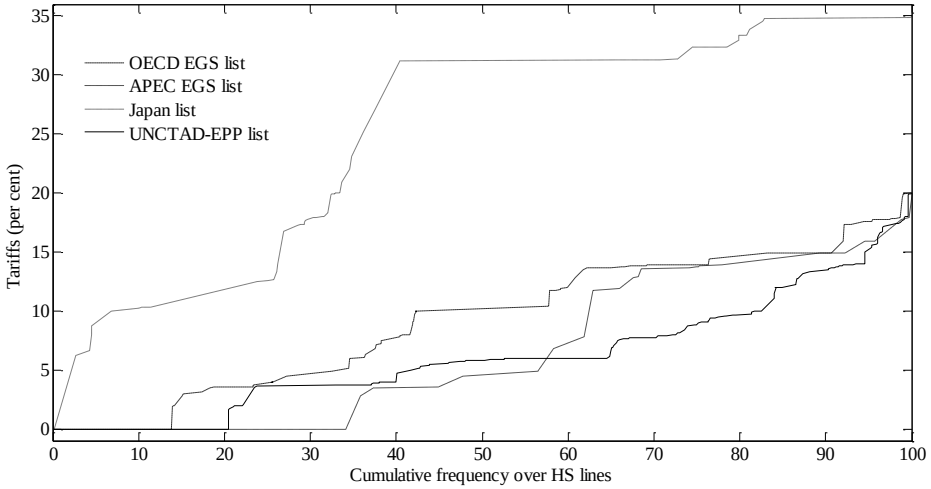
| | OECD list | APEC list | Japan list | UNCTAD-EPP list |
|---|---|---|---|---|
| World | 3.59 | 2.60 | 7.50 | 4.74 |
| Developed countries | 1.34 | 0.85 | 2.73 | 2.23 |
| Developing countries | 6.10 | 4.23 | 16.29 | 7.73 |
| Non-Latin American countries | 6.04 | 3.99 | 16.65 | 7.91 |
| Latin American countries | 6.30 | 5.21 | 14.99 | 7.12 |
| Argentina | 8.61 | 6.47 | 27.39 | 7.99 |
| LDCs | 8.79 | 6.65 | 14.60 | 12.55 |

Source: Author's calculations, based on the MAcMap-HS-6 database (Guimbard *et al.*, 2012).
Note: The method to calculate the *ad valorem* equivalent tariffs and aggregate them by EGS lists and groups of countries is the reference country group weighting scheme (Bouët *et al.*, 2008) developed for the MAcMap-HS-6 database in order to avoid the endogeneity bias from the trade-weighted scheme.

The applied tariff structure of EGS in Argentina (Figure 3) shows that a significant proportion of EGS – 30 per cent of the APEC list, 20 per cent of the UNCTAD-EPP list, and 14 per cent of the OECD list – enters the country duty free. For the Japanese list, no trade under duty-free conditions is recorded. Moreover, the protection for most of the products in this list, including the six major imports, ranges from 30 to 35 per cent, the Argentine bound tariff level. Three of these products (different types of cars and trucks) are also produced and exported by Argentina, making them sensitive products subject to external competition. Consequently, EGS liberalization under this list might lead to a significant increase in Argentina's imports and a reduction in domestic prices.

**Figure 3: Argentina's applied protection in EGS lists: Cumulative frequency of *ad valorem* equivalent tariffs**

and their trade openness. Argentina is in the same group as Chile, Croatia, Mexico, South Africa, and Uruguay. The advantage of using this scheme for protection aggregation over others (simple and trade-weighted averages) is that it reduces the risk of endogeneity between protection and imports by keeping at the same time the specificity of each country according to the country group to which it belongs.




Source: Author's calculations, based on 2007 tariffs from the MacMAp-HS-6 database (Guimbard *et al*., 2012).
Note: Share of imports (on the x-axis) of Argentina's reference group (Bouët *et al*., 2008) for which *ad valorem* equivalent tariffs are lower than the level on the y-axis.

## 4 Two-step methodology

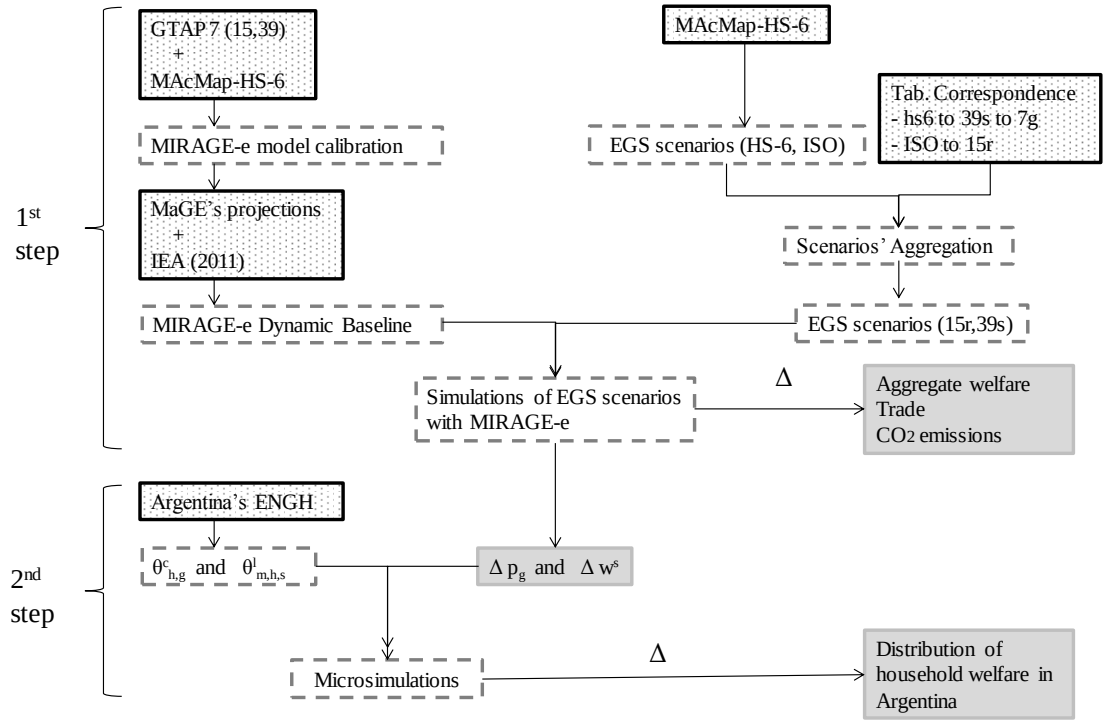
The assessment of the impact of trade liberalization (tariff cuts) under four scenarios (one for each EGS list) on trade, welfare, and the environment is undertaken using a two-step methodology that combines a recursive-dynamic, multi-sector and multi-region CGE model, and a microsimulation model (Figure 4). The advantage of CGE models is that they capture not only the direct but also the indirect effects of an economic shock or a government policy.

The first step simulates the four scenarios with the MIRAGE-e CGE model (Fontagné *et al.*, 2013) that provides changes in macroeconomic, environmental, and sector variables in Argentina and in other regions resulting from EGS trade liberalization. Given that the CGE model only considers one representative household for each region, the welfare impact is measured at an aggregated level and the welfare distribution across households cannot be observed.

Therefore, in the second step, the changes in consumer prices and wages simulated in the CGE model are transmitted to the microsimulation model to analyse the welfare impact across different groups of households. The microsimulation model accounts for heterogeneity in household consumption patterns (the types of goods they buy) and labour endowments (skilled or unskilled labour). These differences determine the effect of changes in consumer prices and wages resulting from EGS trade liberalization on the welfare of each household.

Both models provide estimates of welfare changes; however, their results may be different because of the specific assumptions of each model. For instance, the CGE model considers five sources of income (capital, land, natural resources, low-skill labour, and high-skill labour), while the microsimulation model considers only two: skilled and unskilled labour remuneration. Although the microsimulation model can be expanded to take into account all the income sources of the CGE model, the scope of this study is limited to labour income because of its large share in total income, especially for poor households.

**Figure 4: Two-step methodology scheme**




Source: Author.
Note: Data inputs are shown in dot-fill boxes; data and models processes are shown in dashed-line boxes, and model outputs are shown in grey boxes. 39s refers to the 39 sectors covered by the CGE model; 7g to the seven categories of goods compatible with the household survey data; ISO refers to reporters' and partners' codes in the MAcMap-HS-6 database; 15r refers to the 15 regions/countries covered by the CGE model; the symbol θ refers to the expenditure and wage shares at the household level; Δ refers to results in (percentage) deviations compared to the baseline; and *p* and *w* refer to prices of the seven categories of goods and wages differentiated by skills, respectively.
ENGH stands for Argentine National Survey of Household Expenditures; GTAP stands for Global Trade Analysis Project; IEA stands for International Energy Agency; MaGE stands for Macroeconometrics of the Global Economy.

## 4.1 First step: CGE simulations of multilateral trade liberalization of environmental goods and services

The general assumptions of the MIRAGE-e model are described in Section 4.1.1. The data needed to calibrate the model and generate the baseline are presented in Section 4.1.2. Section 4.1.3 describes the different scenarios to be simulated with the model.

### 4.1.1. The MIRAGE-e computable general equilibrium model

The CGE model used in this paper is the latest version of the multi-region[10] and multi-sector dynamic MIRAGE model (Bchir *et al.*, 2002; Decreux and Valin, 2007; Fontagné *et al.*, 2013), referred to as MIRAGE-e and developed by CEPII for the assessment of trade liberalization scenarios (e.g. Bouët *et al.*, 2005, 2007). The main features of the MIRAGE-e model are outlined below.

[10] A region in this CGE model refers to a country (e.g. Argentina or Brazil) or to a group of countries (e.g. Cairns Group developed countries).

A single regional agent, the representative consumer, which includes households and the government,[11] saves a fixed part of its income and the rest is spent on commodities. The maximization of the household's intra-temporal utility function for each commodity, subject to a budget constraint, results in a Linear Expenditure System – Constant Elasticity of Substitution (LES-CES) demand function.[12] Products are distinguished according to their geographical sources (Armington, 1969) using the GTAP estimates of Armington elasticities (Hertel *et al.*, 2007). Even though the most complete version of MIRAGE makes it possible to differentiate products across varieties, it was decided to maintain simple demand trees in agriculture, energy, primary products, and services so as to work with a tractable model. Finally, total demand is the sum of final and intermediate consumption, and investment in capital goods.

On the supply side, the MIRAGE model assumes imperfect competition in manufacturing sectors. Oligopolistic competition, with horizontal differentiation of products (varieties) and increasing returns to scale (economies of scale), is modelled in the line of the theoretical model of Krugman (1979) and the applied partial equilibrium model of Smith and Venables (1988). The specification in MIRAGE is very close to that used by Harrison *et al.* (1997). Each firm produces its own unique variety of a product and has yearly fixed costs expressed as a fixed amount of output and marginal costs that are constant at given factor prices. Firms are symmetrical within each sector of each region and compete in a Cournot-Nash way. The total level of the sector demand is affected by production decisions made by firms (revenue effect) and so is the sector price index due to the firms' market power. The mark-up of each firm is endogenous, allowing for a pro-competitive effect. To implement this modelling, three parameters are required for calibration (product substitution, economies of scale, and substitution intensity), which are also linked to the zero-profit condition. Unlike other models, in MIRAGE these parameters are estimated taking advantage of all the available information about them (values and variances). Moreover, the number of varieties is adjusted to match the zero-profit condition by affecting both the competition and mark-ups, particularly when the number of firms is small, and the consumer's preferences are also adjusted for variety.[13]

In contrast, the modelling of the agricultural and transport sectors assumes perfect competition conditions: these sectors are therefore depicted by a representative firm in each of them. The nesting of the production functions (see Figure A1 in the Annex) in these sectors initially combines value-added and intermediate consumption in fixed shares (Leontief's representation). Then, the value added is a constant elasticity of substitution bundle of imperfectly substitutable primary factors (capital, skilled and unskilled labour, land and natural resources). The total supply of all primary factors is assumed to be fixed and their growth rates are imposed exogenously according to the projections of the MaGE model (Fouré *et al.*, 2013). The installed capital stock is immobile across sectors (the sector-specific assumption), while investment, which represents the long-term adjustment possibilities of a capital market, is assumed to be perfectly mobile across sectors according to their capital rates of return. Skilled labour is perfectly mobile across sectors, while unskilled labour is imperfectly mobile between agricultural and other sectors (i.e. there is a dual labour market).[14] Land is imperfectly mobile across agricultural sectors. Finally, natural resources

[11] The MIRAGE model do not distinguished private (household) and public (government) consumers treating them as a single agent at the regional level that pays and collects taxes. Therefore, the regional welfare effect calculated as the variation of available income for this single agent is not only affected by changes in incomes from production factors and goods prices, but also by changes in tariff revenue when a trade liberalization scenario is simulated.

[12] This nested utility function allows for the evolution of the demand structure in each region due to income changes, and for the substitution across sectoral consumption above a minimum level (i.e. one-third of initial consumption in developed countries and two-thirds in developing ones).

[13] See Decreux and Valin (2007) for more details and equations.

[14] See Decreux and Valin (2007) for more details and equations.

are sector-specific. All production factors are immobile internationally and are assumed to be fully employed.

Consumption by firms of the five energy goods (electricity, coal, oil, gas, and refined petroleum) is aggregated in a single bundle, which is mainly substitutable by capital. The total amount of energy used in each sector of each region is affected by a parameter of productivity improvement (i.e. energy efficiency), which is estimated and projected by the MaGE model. Oil, gas, and refined petroleum are more substitutable among themselves than with coal or electricity. In addition, in order to avoid unrealistic results, a "constant energy technology" in production sectors of non-electricity energy was assumed. Thus, since it is impossible to produce crude oil from coal or refined petroleum from electricity, the substitution between these sources of energy is not directly allowed.[15]

Modelling of energy use also makes it possible to measure environmental consequences linked to these sectors ($CO_2$ emissions as an indicator of climate change mitigation). It tracks quantities of physical energy (in millions of tons of oil equivalent – Mtoe) so that the $CO_2$ emissions can be computed in millions of tons of carbon dioxide ($MtCO_2$). Using energy-, sector- and region-specific factors determined by the GTAP-e database (versions 6 and 7), $CO_2$ emissions are calculated as being proportional to the quantities of the types of fuel consumed (oil, gas, coal, and refined petroleum); electricity is the "clean" source of energy in the model.[16] It is thus expected that the shift from fuel energy to electricity will lead to a lower carbon content of traded goods.[17]

The dynamic baseline in MIRAGE-e is built based on projections of countries' GDP, savings, active populations, energy efficiency, and current account balances from the MaGE model, and on projections of world oil, gas, and coal prices from the International Energy Agency. The equilibrium is solved yearly, from 2004 to 2030, by adjusting it to the projected growth rates of the aforementioned variables (i.e. a sequential dynamic recursive set-up). For the saving-investment balance, the closure of the model considers the saving-driven assumption when the investment is boosted yearly by the projected saving rates of each region based on demographic, life cycle and purchasing power assumptions (Fouré *et al.*, 2013). The change in the capital stock is allocated across sectors according to their capital rate of return and the depreciation rate (i.e. uniform and constant 6 per cent rate across regions and during the period). The current account[18] imposes the projected share of each region in global current account imbalances. The external closure assumes that the exchange rate is adjusted endogenously, while the current account is fixed in terms of world GDP. The global current account imbalance is allocated between regions according to the annual MaGE projections using changes in exchange rates. Finally, the *numéraire* in relation to which all good and factor prices are measured is the shadow price of the utility of a particular region arbitrarily chosen, in this case Argentina.[19]

### 4.1.2. Calibration data

The MIRAGE-e model is calibrated using the Global Social Account Matrix from the GTAP (version 7.1),[20] with 2004 as the base year. The 57 sectors from the GTAP database have

[15] See Figure A1 in the Annex and Fontagné *et al.* (2013) for more details and equations.
[16] It is important to note, however, that there is no restriction for the electricity sector to use any energy source (clean or dirty) for its production.
[17] See more details and equations in Fontagné *et al.* (2013).
[18] Current account in this version of Mirage is defined as a balance of trade in goods and services; no foreign direct investment is allowed, similar to Decreux and Valin (2007).
[19] Any price could be chosen as the *numéraire* without affecting the results of the simulation because of the zero degree homogeneity property of prices in this kind of model.
[20] For more details, see the GTAP website: https://www.gtap.agecon.purdue.edu/databases/v7/default.asp.

been aggregated into 39 sectors to match Argentina's classification of trade commodities, but keeping separate those with an unambiguous relationship with $CO_2$ emissions, i.e. the five energy sectors. From the 113 regions in the original database, only 15 aggregated countries/regions are retained, namely the main developed regions (the EU27 and the North American Free Trade Agreement – NAFTA), large emerging countries (Brazil, China, and India) and, of course, Argentina. The rest of the world is aggregated according to their level of development and their geographical position, as shown in Table 2.

In order to get a better representation of worldwide trade protection, tariffs from the MacMAp-HS-6 dataset (Guimbard *et al.*, 2012) are used.[21] In this study, EGS trade liberalization is simulated as the bound tariff elimination, which also means that applied tariffs for all EGS listed are set to zero. To reconstruct tariff profiles at the sectoral and regional levels, AVE applied tariffs are calculated by aggregating remaining (non-zero) tariffs in the 39 sectors and 15 regions by using the reference group weighting scheme developed for MAcMap-HS-6 (Bouët *et al.*, 2008).

**Table 2: Country and sector aggregation**

| **2 categories of countries, 15 countries/regions** |
|---|
| Developed countries |
| EU27 |
| NAFTA |
| Cairns developed countries |
| Rest of developed countries* |
| |
| Developing countries |
| Argentina |
| Andean Community |
| Brazil |
| China and Hong Kong (China) |
| India |
| Russian Federation, Ukraine, and rest of the former Soviet Union |
| Mediterranean countries |
| Sub-Saharan Africa |
| Cairns developing countries |
| Rest of Latin America |
| Rest of developing countries |

| **7 categories of goods, 39 sectors** |
|---|
| Food & Beverages |
| Rice |
| Wheat |
| Cereals |
| Vegetables & fruits |
| Oil seeds |
| Sugar |
| Crops |
| Meat cattle |
| Other meat |
| Milk |
| Fishing |
| Fats |
| Dairy products |
| Food & beverages |
| Clothing |
| Wool |
| Textile |
| House Equipment and Maintenance |
| Furniture |
| Chemicals |
| Electronic devices |

[21] This dataset provides AVEs of applied tariffs for each HS-6 product in bilateral trade between two countries for 2001, 2004, and 2007. MacMAp-HS-6 allows for simulating multilateral trade liberalization of EGS through cuts in bound tariffs, and then calculating their impact on the effectively applied tariffs at the HS-6 level.

| | |
|---|---|
| | Machinery |
| Others | |
| | Forestry |
| | Primary |
| | Metal |
| | Other manufactures |
| | Other services |
| | Financial & business services |
| Housing, Transport & Communications | |
| | Coal |
| | Oil |
| | Gas |
| | Petrol & coal products |
| | Cars & trucks |
| | Transport equipment |
| | Electricity |
| | Housing |
| | Transport |
| | Communications |
| Health and Education | |
| | Health |
| | Education |
| Entertainment | |
| | Paper |
| | Leisure goods |

Source: Author.
Note: The seven categories of goods are those from the consumption household data that match with the 39 sectors used in the CGE model simulations. Regions, categorized as developed and developing in order to design the multilateral environmental goods and services trade liberalization scenarios, consist of 15 regions in the CGE model.
* The most important country in the Rest of developed countries region for this study is Japan; others are Switzerland and Norway.

### 4.1.3. Trade liberalization scenarios for environmental goods and services

The list approach facilitates the quantification of the possible consequences of EGS trade liberalization for the main EGS lists under discussion, as multilateral tariff elimination under each EGS list represents a scenario. Each scenario is implemented under two different tariff phase-out modalities, i.e. with and without an SDT for developing countries.

In the first set of scenarios, bound and applied tariffs are eliminated simultaneously by all WTO member countries for all goods in each EGS list. The remaining non-zero tariffs are then aggregated both at the regional (15) and sectoral (39) levels. These aggregated tariffs represent the new level of worldwide protection after EGS trade liberalization according to the four lists of EGS. Tariffs are reduced during a linear phase-out period of 10 years starting in 2013; the results of these simulated scenarios are presented in Section 5.

The non-list approaches to EGS trade liberalization highlight the necessity of an SDT for developing countries. One possible SDT modality consists of different timing of tariff elimination for developed and developing countries. Developed countries start reducing tariffs in 2013, while developing countries delay the phase-out until 2018. By 2030, tariffs on EGS are eliminated worldwide in all scenarios. The main results of this type of SDT concession are briefly discussed in Section 6.

Simulated changes in worldwide EGS trade protection would have a different impact on export and import prices, consumer and producer prices, and factor remunerations in all the regions in the world. The second step of our analysis aims to link those changes in consumer prices and wages to household welfare.

## 4.2 Second step: Microsimulations of the welfare impact on Argentine households

Even though the MIRAGE model used in the first step of the analysis estimates welfare changes for the representative agent in each of the 15 regions considered,[22] it does not allow for an analysis of the welfare distribution at the household level. Using Argentina's household surveys, this second step therefore assesses how EGS trade liberalization affects the welfare of Argentine urban households through simulated changes in prices and labour wages resulting from the CGE model.

### 4.2.1. Assumptions of the microsimulation model

The unit of analysis is household $h$, which has an expenditure function (equation (1), left-hand side) that equals household income (equation (1), right-hand side) (Dixit and Norman, 1980). Household expenditure depends on a vector of prices, $P$, the level of utility, $u_h$, and other characteristics of the household, such as its composition, $X_h$. Household income corresponds to the sum of wages, $\sum_m w_{m,h,s}$, for all members, $m$, taking into consideration the two types of labour, $s$, and other non-labour sources of income, $k_h$.[23] Levels of education in household surveys allow for defining the type of labour, i.e. unskilled or skilled, corresponding to each household member. Individuals with a primary (or lower) level of education are classified as unskilled labour, and those with higher levels of education as skilled labour. Argentine household surveys provide only scarce information on non-labour sources of income, and given that most Argentine households reported in these surveys live in urban areas where labour income is the most important source of income, our analysis only considers wages ($k_h = 0$).

$$e_h(P, u_h, X_h) = \sum_{m,s} w_{m,h,s} + k_h \qquad (1)$$

Welfare changes due to EGS tariff cuts will be measured as the income variation resulting from price and wage changes simulated by the CGE model. Equation 2 represents the compensating variation $(cv)$ of household $h$ obtained by differentiating equation 1, while

[22] In the MIRAGE model, the welfare measure is calculated as an equivalent variation, which is calculated at the country/region level based on the single representative agent assumption. Moreover, MIRAGE provides a welfare decomposition that makes it possible to account for gains and losses of regional welfare according to the model assumptions (allocative efficiency, capital accumulation, terms of trade, number of varieties in sectors under imperfect competition, etc.).

[23] Capital, land, or natural resource returns and direct transfers are frequent non-labour sources of income.

keeping the initial level of utility constant. These welfare changes are merely first-order effects, since no change in the purchased quantities is considered.[24]

$$cv_h = \sum_{m,s} \theta^{l}_{m,h,s} \frac{dw_{m,h,s}}{w_{m,h,s}} - \sum_{g} \theta^{c}_{h,g} \frac{dp_g}{p_g} \qquad (2)$$

To estimate the total consumption welfare effect of the EGS trade liberalization, we need as input the expenditure shares of each good, $g$ ($\theta^{c}_{h,g}$), consumed by household $h$ and income shares obtained by household $h$ from selling its (skilled or unskilled) labour, $\theta^{l}_{m,h,s}$. The variables $\frac{dp_g}{p_g}$ and $\frac{dw_{m,h,s}}{w_{m,h,s}}$ are price and wage changes simulated by the CGE model during the first step of the analysis.

### 4.2.2. Argentine household surveys

Argentina's National Household Expenditure Survey 1996–1997[25] (known by its Spanish acronym, ENGH) covers over 21,126 households (once outliers are eliminated) across urban areas in Argentina. It records consumption data on nine categories of goods[26] at the household level, which we aggregate into seven broad categories to be matched with the 39 sectors from the CGE model (see Table 2).

According to the ENGH survey, on average, a household's expenditure per capita in Argentina was USD 251.2 per month.[27] Argentine households spent, on average, 47 per cent of their budget on the category of Food & Beverages. Transport, Communications & Housing accounted for 20.9 per cent of the budget, while Other Traded Goods & Services accounted for another 8.5 per cent. Expenditure shares of Clothing were 7.8 per cent on average, while the Health & Education share was 6.3 per cent, and the Entertainment share 5.7 per cent. Finally, Argentine households spend 3.7 per cent of their total budget on the category of House Equipment & Maintenance Goods.

Combining income and consumption shares (Table A1) with price and wage changes from the CGE simulations, it is possible to identify the impact of the EGS trade liberalization scenarios on the welfare of Argentine households through a direct calculation of the compensating variation for each household.

However, before this two-step methodology is applied, correspondences between the different data sources need to be established using the standard tables of correspondence between the HS and GTAP classifications and aggregating GTAP sectors into the seven categories of goods from the ENGH. A caveat of these procedures is that they might introduce some biases into the welfare evaluation due to the loss of information resulting from data aggregation.

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[24] Second-order effects due to changes in purchased quantities are negligible as long as price and wage changes are small (see Table 7).

[25] Even though expenditure shares of households changed between the 1996–1997 survey and the 2004–2005 survey, those variations are not remarkable at the national level (on average). For instance, the expenditure share of the Food & Beverages category only falls 1.2 percentage points from 1996–1997 to 2004–2005. Moreover, the ranking of expenditure shares in the nine categories of goods did not really change — Food & Beverages, Transport & Communications, and Housing are at the top in the periods of both surveys, always accounting for 60 per cent of total expenditure at the national level. Expenditure shares in Entertainment and Clothing increased slightly according to the 2004–2005 survey (INDEC, 2006).

[26] Food & Beverages; Clothing; Housing; House Equipment & Maintenance Goods; Entertainment; Education; Health; Transport & Communications; and Other Traded Goods & Services.

[27] This average was calculated in terms of the male adult equivalent by applying the table of equivalence (by age and gender) provided by this survey.

## 5 Simulation results

Before simulating the EGS trade liberalization scenarios in the MIRAGE-e model, we established a dynamic baseline (Fontagné *et al.*, 2013) from 2004 to 2030 using the projections of the MaGE model mentioned above. In terms of trade policy, the baseline includes the expiration of the WTO Agreement on Textiles and Clothing in 2005; after that, no change in worldwide trade protection is introduced. This baseline is the reference against which each scenario of EGS liberalization is compared.

This study aims solely to analyse and compare trade and welfare implications for Argentina, as well as the global environmental ($CO_2$ emission) consequences under these scenarios.

The following section focuses on the discussion of simulation results for multilateral liberalization without SDT. Several ways of including SDT in the EGS negotiations are discussed in Section 6, which also provides a short analysis of a deferred implementation of EGS liberalization by developing countries.

### 5.1 Trade results

Table 3 shows that Argentina's total trade increases (both in volume and value) under all scenarios. Trade variations are greater under the liberalization of the Japanese and the UNCTAD-EPP lists. Argentina's terms of trade improve under the liberalization of the UNCTAD-EPP list and deteriorate in all other scenarios.

**Table 3: Argentina's GDP and total trade (percentage deviation from the baseline scenario)**

| Variables | APEC list | | Japan list | | OECD list | | UNCTAD-EPP list | |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| GDP (volume) | 0.004 | 0.014 | 0.101 | 0.260 | 0.007 | 0.024 | 0.009 | 0.026 |
| Terms of trade | -0.015 | -0.026 | -0.191 | -0.418 | -0.049 | -0.082 | 0.120 | 0.214 |
| Exports (value) | 0.031 | 0.058 | 0.340 | 0.630 | 0.130 | 0.245 | 0.364 | 0.774 |
| Exports (volume) | 0.061 | 0.105 | 0.631 | 1.204 | 0.192 | 0.335 | 0.240 | 0.550 |
| Imports (value) | 0.023 | 0.048 | 0.268 | 0.537 | 0.099 | 0.201 | 0.313 | 0.699 |
| Imports (volume) | 0.041 | 0.073 | 0.396 | 0.742 | 0.123 | 0.228 | 0.300 | 0.671 |

Source: Author.

Bilateral trade relations between Argentina and the different regions of the world would evolve differently depending on the EGS list implemented (see Table 4). Countries or regions that proposed the lists analysed in this study would intensify their commercial ties with Argentina. Moreover, most of the EGS lists, and particularly the UNCTAD-EPP list, would increase Argentina's trade with less traditional partners, while its trade with Brazil would decrease.

For instance, under the liberalization of the APEC list, Argentina's imports from NAFTA – whose countries are APEC members – increase by 0.35 per cent in 2030, and Argentina's exports to this region also increase, although at a slower pace (by 0.24 per cent in 2030). Moreover, Argentina's imports from the rest of developing countries category — which are less traditional partners — increase by 0.54 per cent in 2030, to the detriment of imports from Brazil, the Russian Federation, and the rest of Latin America (which fall by –0.16, –0.17 and –0.14, respectively, in 2030). The same is applicable to exports: they increase to distant

trade partners (e.g. by 0.28 per cent to India in 2030) and decrease to Latin American countries (e.g. by –0.27 per cent to Brazil in 2030).

The liberalization of the OECD list of EGS intensifies Argentina's trade relationships with some OECD countries. For instance, Argentina's imports and exports with NAFTA — whose members are also OECD members — increase by 0.98 and 0.54 per cent, respectively, in 2030. Moreover, even if China is not an OECD member, the elimination of trade protection under the OECD list increases Argentina's imports from China (1.44 per cent in 2030).

If the Japanese list of EGS is liberalized, Argentina's imports from Japan, which is the largest country included in the rest of developed countries category, increase significantly (by 19.73 per cent in 2030). Once again, Argentina increases its imports from less traditional origins (for instance, by 10 per cent from the rest of developing countries and 7 per cent from Mediterranean countries in 2030) to the detriment of its traditional partners (a decline by –8.5 per cent in imports from Brazil in 2030). Argentine exports follow the same pattern; while they increase to the rest of developed and developing countries (by 7 and 4 per cent, respectively, in 2030), they decrease to Brazil (by –8 per cent in 2030).

Finally, the liberalization of the UNCTAD-EPP list particularly increases bilateral trade between Argentina and other developing countries. For instance, Argentina's imports from the Russian Federation and from the Mediterranean countries increase by 1.8 per cent, those from India by 1.4 per cent, and those from the Andean Community by 1.1 per cent, while Argentine exports to India increase significantly (by 14.2 per cent in 2030).

**Table 4: Argentina's bilateral imports and exports (per cent)**

| Trade partners | APEC list | | Japanese list | | OECD list | | UNCTAD-EPP list | |
|---|---|---|---|---|---|---|---|---|
| | Exports | Imports | Exports | Imports | Exports | Imports | Exports | Imports |
| Andean Community | -0.083 | -0.037 | 3.144 | -1.098 | -0.218 | -0.066 | -0.147 | 1.081 |
| Brazil | -0.266 | -0.156 | -7.688 | -8.510 | -0.092 | -1.232 | -0.922 | 0.469 |
| Cairns developed countries | 0.196 | -0.106 | -0.797 | 4.225 | 0.552 | -0.064 | 0.527 | -0.226 |
| Cairns developing countries | 0.054 | -0.036 | 1.003 | -0.433 | 0.287 | 0.200 | -0.716 | 0.506 |
| China and Hong Kong (China) | 0.137 | -0.045 | 2.529 | 2.817 | 0.452 | 1.441 | 4.555 | 0.629 |
| EU27 | 0.201 | 0.039 | 1.691 | 2.597 | 0.381 | 0.152 | -0.285 | 0.678 |
| India | 0.283 | 0.026 | 3.210 | -0.125 | 0.442 | 0.225 | 14.206 | 1.377 |
| Mediterranean countries | 0.076 | -0.129 | 0.828 | 6.948 | 0.043 | 0.038 | 1.002 | 1.897 |
| NAFTA | 0.236 | 0.352 | 1.151 | 0.318 | 0.549 | 0.976 | 0.527 | 0.626 |
| Rest of developing countries | 0.120 | 0.537 | 4.366 | 10.109 | 0.245 | 0.737 | 0.457 | 1.126 |
| Rest of developed countries | 0.233 | -0.007 | 6.948 | 19.733 | 0.501 | -0.169 | 0.144 | 0.540 |
| Rest of Latin America | 0.071 | -0.138 | 4.251 | -1.237 | 0.155 | 0.250 | 0.028 | 0.946 |
| Russian Federation, Ukraine, and rest of the former Soviet Union | 0.088 | -0.165 | 1.046 | -1.630 | 1.033 | 0.654 | 0.355 | 1.833 |
| Sub-Saharan Africa | 0.076 | -0.103 | 1.779 | 3.375 | 0.044 | -0.152 | 0.736 | 0.909 |

Source: Author.
Note: Results refer to bilateral trade in value, i.e. imports are in cost, insurance, and freight (CIF) value and exports in free on board (FOB) value. All results are expressed as a percentage deviation from the baseline in 2030.

In terms of the seven categories of goods, the greatest export variations are observed under the Japanese list (see Table 5). Argentina's exports increase in almost all categories, except Transport, Communication & Housing (–0.4 per cent in 2030). Export growth is lower under the APEC proposition but shows a similar pattern of relative export changes **–** an increase **–**

across all categories of products except House Equipment & Maintenance). Finally, the liberalization of the UNCTAD-EPP list negatively affects Argentine exports in all categories, except Clothing (growth by 8 per cent in 2030) and Food & Beverages (growth by 0.3 per cent in 2030).

Argentine imports increase in all seven categories of goods under the UNCTAD-EPP scenario, showing that foreign competition could intensify in all categories, particularly Food & Beverages (growth of imports by 1.4 per cent in 2030). Under the liberalization of the Japanese list, Argentina's imports fall in all categories except Transport, Communications & Housing (a 5.5 per cent increase in 2030), which thus becomes the most affected category under this scenario. Eliminating protection according to the APEC and OECD lists shows the same pattern of imports – a decline in all categories except Food & Beverages and House Equipment & Maintenance – with lower import percentage variations under the APEC scenario (see Table 5).

**Table 5: Argentina's imports and exports by category of goods (per cent)**

| Categories (7) | APEC list | | Japan list | | OECD list | | UNCTAD-EPP list | |
|---|---|---|---|---|---|---|---|---|
| | Exports | Imports | Exports | Imports | Exports | Imports | Exports | Imports |
| Food & Beverages | 0.084 | 0.007 | 0.875 | -0.112 | 0.349 | 0.083 | 0.315 | 1.384 |
| Clothing | 0.322 | -0.050 | 5.429 | -1.411 | 0.985 | -0.389 | 7.975 | 0.907 |
| House Equipment & Maintenance | -0.084 | 0.283 | 0.539 | -0.165 | -0.491 | 0.872 | -0.641 | 0.727 |
| Others | 0.165 | -0.145 | 2.352 | -1.855 | 0.452 | -0.341 | -0.919 | 0.585 |
| Transport, Communication & Housing | 0.106 | -0.038 | -0.389 | 5.494 | 0.379 | -0.235 | -0.895 | 0.532 |
| Entertainment | 0.108 | -0.141 | 1.538 | -1.260 | 0.383 | -0.338 | -0.877 | 0.590 |
| Health & Education | 0.198 | -0.187 | 2.544 | -1.524 | 0.458 | -0.373 | -0.750 | 0.566 |

Source: Author.
Note: Results refer to imports and exports in volume and are shown as a percentage deviation from the baseline in 2030.

## 5.2 Welfare results

The welfare effect is calculated as the variation of available income for the single representative agent in each region. The income of the agent is affected by changes in remunerations of production factors and prices of goods, but also by changes in tariff revenue following trade liberalization.

Before analysing Argentina's welfare implications, it is necessary to put in perspective the potential gains of EGS trade liberalization as part of the Doha Development Agenda. According to the literature, a potential multilateral trade agreement in Doha could lead to an increase in Argentina's welfare ranging from 0.23 per cent (Decreux and Fontagné, 2011) to 1.2 per cent (Bouët *et al*., 2007), depending on the assumptions considered. Since EGS represent a small component of aggregate exports of Argentina, the expected variation in the country's welfare is rather small. As this study and the aforementioned ones use the same CGE model, the same dataset of protection, and the same procedure to aggregate scenarios, their results on aggregate welfare are therefore directly comparable.

Table 6 shows changes in aggregate welfare under all scenarios. The results are expressed in percentage variations with respect to the baseline, and presented for 2020 (the medium

term) and 2030 (the long term). Moreover, the MIRAGE model makes it possible to break down welfare changes into different components.[28]

Argentina's welfare is negatively affected by the trade liberalization of EGS based on the OECD list (–0.011 per cent in 2020, and –0.006 per cent in 2030). The impact is mitigated in the long run due to greater capital accumulation and more efficient allocation of national resources across sectors in Argentina. It is worth noting that terms of trade losses are quite important under this list – export prices fall more than import prices – given the current applied protection and trade patterns. Regarding the APEC list, more than half of the EGS on this list are also included in the OECD list, and therefore results do not differ considerably. The most notable difference is that Argentina's welfare improves slightly in the long run (0.001 per cent in 2030).

While welfare changes for Argentina under the OECD and APEC lists appear to be negligible, liberalization under the Japanese and UNCTAD-EPP lists seems to generate more encouraging results. Both scenarios show a welfare increase in the long run (0.03 and 0.06 per cent, respectively), but the origin of those gains is quite different. Tariff elimination under the Japanese list implies greater allocation efficiency and capital accumulation gains by stimulating capital investment in less traditional categories, such as Electronic Devices, Transport Equipment, and Cars and Trucks. The welfare gains associated with the UNCTAD-EPP list are related to the improvement of Argentina's terms of trade[29] as a result of the liberalization of some agricultural products on that list.

**Table 6: Welfare and welfare decomposition in Argentina (per cent)**

| Variables | APEC list | | Japan list | | OECD list | | UNCTAD-EPP list | |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| Changes in aggregate welfare | -0.005 | 0.001 | -0.006 | 0.029 | -0.011 | -0.006 | 0.025 | 0.056 |
| Breakdown of welfare changes | | | | | | | | |
| Allocation efficiency | 0.003 | 0.008 | 0.044 | 0.085 | 0.001 | 0.007 | 0.006 | 0.042 |
| Capital accumulation | 0.002 | 0.009 | 0.021 | 0.083 | 0.003 | 0.012 | 0.001 | 0.006 |
| Terms of trade | -0.003 | -0.004 | -0.031 | -0.065 | -0.008 | -0.013 | 0.018 | 0.032 |
| Other gains/losses | -0.008 | -0.012 | -0.041 | -0.079 | -0.008 | -0.013 | -0.002 | -0.031 |

Source: Author.

Note: The change in welfare in the MIRAGE model is computed as an equivalent variation of the utility of the regional representative agent in percentage with respect to the baseline scenario. Results are presented for two horizons, 2020 and 2030.

In order to enrich the above welfare analysis, we use changes in factor remunerations and consumer prices to estimate changes in the distribution of welfare across households.

[28] Allocative efficiency gains refer to welfare gains due to more efficient allocation of national resources across sectors, in this case as a consequence of trade liberalization. When market access improves, welfare can also change due to an increase in capital investment, referred to as capital accumulation gains. Moreover, trade liberalization modifies import and export prices differently, and welfare variations are also due to gains/losses in the terms of trade. National welfare changes can also involve a wider welfare decomposition depending on the model assumptions; for example, the MIRAGE model also distinguishes variety gains because of the imperfect competition assumption in manufacturing sectors.

[29] The liberalization of this list of products mainly increases export prices in sectors where Argentina displays a comparative advantage (i.e. Crops, Fats, Oilseeds, Forestry, and Wool).

As expected, real remunerations of production factors[30] are affected differently depending on the lists of EGS under consideration (see Table 7). Skilled and unskilled real wages increase in all the scenarios in the long run, but the liberalization of the Japanese list of EGS is preferable for Argentina (a 0.163 and 0.126 per cent increase in skilled and unskilled wages, respectively, in 2030).[31] The least beneficial scenario for skilled labour is the UNCTAD-EPP list (0.004 per cent in 2030),[32] while tariff elimination per the APEC list is the least preferable one for unskilled labour (0.01 per cent in 2030). A similar pattern is observed in the remuneration of land and natural resources, which increase their real returns under the liberalization of the four lists. Here, the Japanese list is the most beneficial one for Argentina, as returns on land and natural resources increase by 1.049 and 1.063 per cent, respectively, in 2030. The APEC list appears to be the worst alternative for landowners (0.099 per cent in 2030), while the UNCTAD-EPP list is worst for owners of natural resources (0.081 per cent in 2030). Thus, except for capital owners, trade liberalization under the Japanese list shows the highest returns for all production factors.

**Table 7: Consumer prices and factor remunerations in Argentina (percentage deviation from the baseline)**

| Variables | APEC list | | Japan list | | OECD list | | UNCTAD-EPP list | |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| Consumer prices | | | | | | | | |
| Food & Beverages | -0.030 | -0.047 | -0.241 | -0.516 | -0.067 | -0.100 | 0.082 | 0.194 |
| Clothing | -0.034 | -0.069 | -0.267 | -0.812 | -0.081 | -0.167 | 0.025 | -0.184 |
| Others | -0.034 | -0.057 | -0.290 | -0.650 | -0.070 | -0.106 | 0.091 | 0.222 |
| Transport, Communication & Housing | -0.033 | -0.052 | -0.421 | -0.822 | -0.066 | -0.099 | 0.079 | 0.189 |
| House Equipment & Maintenance | -0.067 | -0.107 | -0.278 | -0.576 | -0.171 | -0.260 | 0.012 | 0.066 |
| Entertainment | -0.032 | -0.049 | -0.280 | -0.600 | -0.067 | -0.099 | 0.085 | 0.205 |
| Health & Education | -0.032 | -0.044 | -0.259 | -0.520 | -0.069 | -0.094 | 0.087 | 0.203 |
| Real returns | | | | | | | | |
| Capital | 0.000 | -0.012 | -0.027 | -0.162 | 0.007 | -0.003 | 0.032 | 0.081 |
| Land | 0.058 | 0.099 | 0.428 | 1.049 | 0.195 | 0.331 | 0.454 | 0.566 |
| Natural resources | 0.050 | 0.085 | 0.451 | 1.063 | 0.110 | 0.168 | -0.108 | -0.262 |
| Real wages | | | | | | | | |
| Skilled labour | -0.000 | 0.012 | 0.048 | 0.163 | -0.002 | 0.011 | 0.003 | 0.004 |
| Unskilled labour | 0.002 | 0.010 | 0.045 | 0.126 | 0.009 | 0.023 | 0.026 | 0.051 |

Source: Author.
Note: Consumer prices are shown for the seven categories of goods compatible with the household survey data.

With regard to consumer prices, they fall in the case of the APEC, Japanese, and OECD lists, while they rise (except for Clothing) when the UNCTAD-EPP list of products is used. Argentina is a net importer of EGS from the first three lists but a net exporter of EGS from the UNCTAD-EPP list.[33]

[30] The remuneration of production factors is deflated by the consumer price index (CPI) computed in the model of each country/region.
[31] The Japanese list of EGS mainly contains high-tech products related to the energy sector, which are skilled-labour intensive.
[32] Since the UNCTAD-EPP list includes agricultural products, an example is organic agriculture, which is relatively more intensive in unskilled than skilled labour.
[33] At a more disaggregated level of products (39 products), consumer prices also fall in all the sectors in the liberalized APEC and Japanese lists. However, consumer prices slightly increase for Rice and

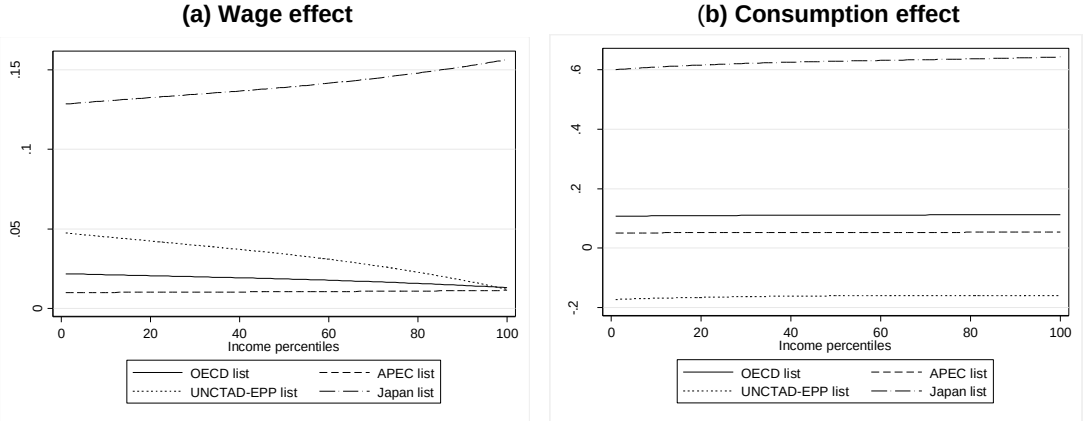
Since simulations in the first step consider general equilibrium effects, changes in prices and wages used in the microsimulation model account for all potential effects. However, the latter procedure does not take into account non-labour sources of income, which explains why the aggregate welfare effect of the CGE model and the microsimulation model will differ.

Changes in consumer prices are rather small and negative in all the scenarios except the UNCTAD-EPP list (see Table 7).[34] Consequently, changes in household welfare due to consumption effects are expected to be small, and their distribution across percentiles of income is not expected to show significant differences between welfare changes for poor and rich households (see Figure 5, panel (b)).

Panel (a) in Figure 5 shows the welfare changes due to changes in the remuneration of labour. The panel shows the change in the real labour income for households in 2030 across percentiles of initial income. The overall effect on wages is positive, ranging between 0.01 and 0.16 per cent. The Japanese list appears to be the preferable scenario for Argentina; however, the gains are greater for non-poor households. Liberalization under the UNCTAD-EPP list shows a slightly pro-poor distribution of labour income gains, while distribution related to the APEC and the OECD lists is quite homogenous.

The overall consumption effect ranges between –0.17 (UNCTAD-EPP) and 0.61 per cent (Japanese list), and these results are consistent with the consumer price changes in Table 7. Once again, the Japanese list appears as the first choice in terms of average consumption welfare change. The other scenarios do not display any significant distributional impact.

**Figure 5: Wage and consumption effects in Argentina – A comparison among the EGS lists (per cent)**




Source: Author.

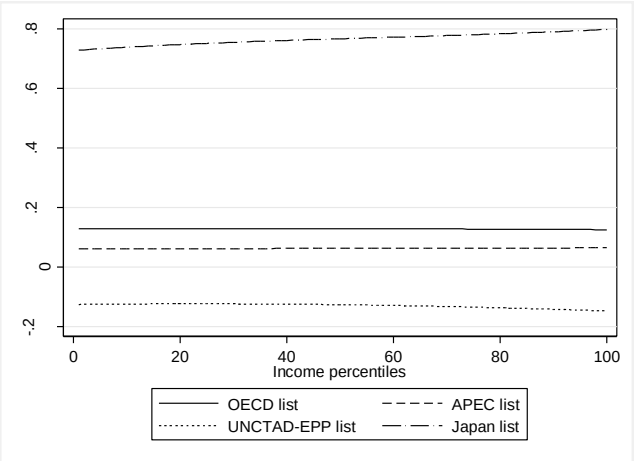
The sum of wage and consumption effects gives the total welfare effect (Figure 6), which confirms that tariff elimination proposed by the Japanese list increases welfare and is the preferred scenario for Argentina, despite its slight pro-rich bias. In fact, non-poor households

Wheat under the scenario of the OECD list, while they decrease for Fats, Furniture, and Textiles in the case of the UNCTAD-EPP list (see Table A2 in the Annex).

[34] The procedure that first simulates tariff cuts at a higher level of product disaggregation (39) and then aggregates price changes in seven categories of goods explains the fact that these prices variations are small and that nearly all have the same sign. In order to better capture the welfare-distributional impact across income percentiles, it would be better to work at the same level of product aggregation of the CGE model. But Argentine household surveys do not allow for that.

benefit from lower prices of technological goods in the Japanese list as well as a higher increase in the real wages of skilled workers.

**Figure 6: Total welfare effect in Argentina – A comparison among the EGS lists (per cent)**




Source: Author.

## 5.3 Environmental results

Having reviewed the impact of EGS liberalization on Argentina's trade and welfare, it is also important to determine if this multilateral trade agreement would reduce global $CO_2$ emissions as expected.

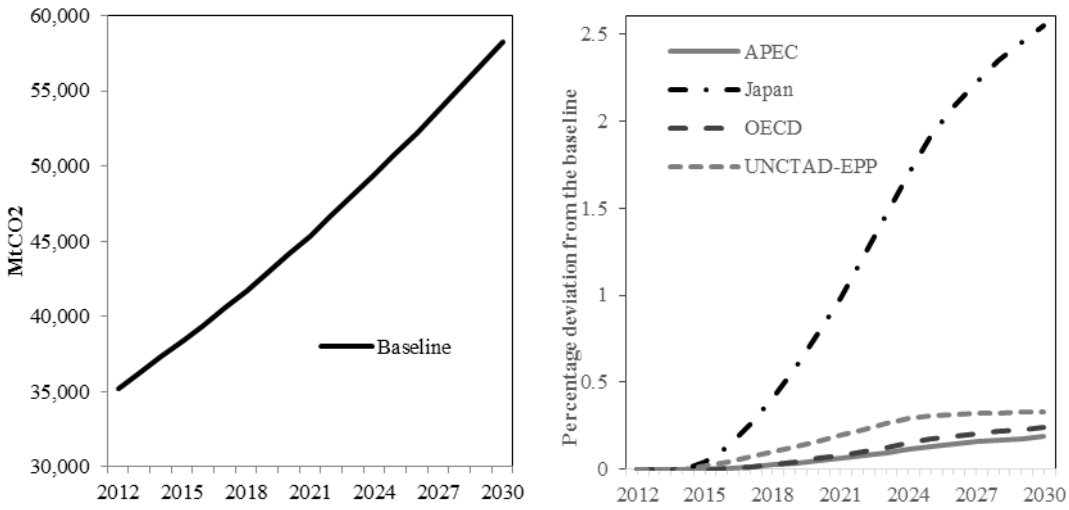
Figure 7 shows that, according to baseline assumptions (i.e. energy efficiency, saving rates, GDP, and population growth rates at the regional level), $CO_2$ emissions continue increasing (Figure 7, panel (a)). Despite the improved environmental conditions sought by EGS liberalization, panel (b) shows that global $CO_2$ emissions under the four scenarios increase even more. To better understand these results, it is necessary to determine how emissions under the four lists are reallocated across regions and sectors compared to the baseline scenario (Figure 8).

Under the liberalization of the Japanese list, Brazil is the only country that reduces its emissions, while $CO_2$ emissions increase in the rest of the world (see Figure 8). In Brazil, carbon intensity[35] is strongly reduced for liberalized products (Cars and Trucks, Transport Equipment, and Electronic Devices). In fact, these industries produce fewer emissions by substituting fossil fuels with electricity in their production processes. In other regions, substituting clean fuels for polluting ones is much less generalized. For instance, Argentina's $CO_2$ emissions fall solely due to lower final consumption of fossil fuels by households, while consumption of these sources of energy increases in production.

**Figure 7: Global $CO_2$ emissions**

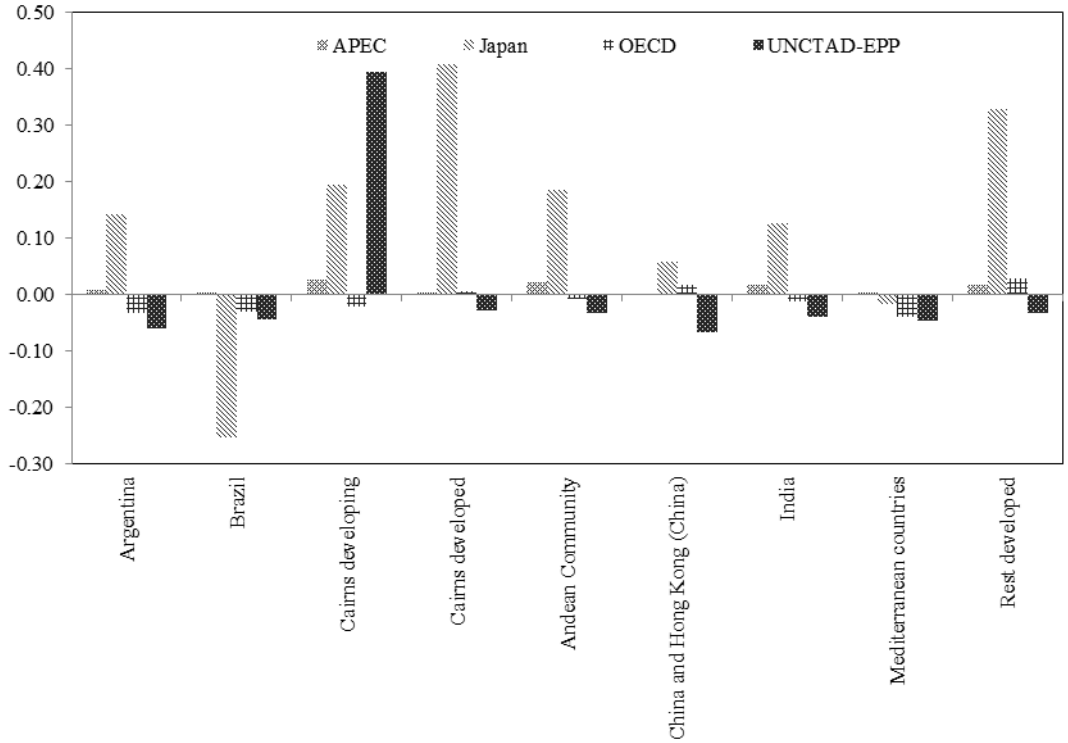
**(a) Baseline** **(b) EGS trade liberalization**

[35] Carbon intensity is computed as the ratio between the level of $CO_2$ emissions and the level of production of firms in each sector.




Source: Author.
Note: Panel (a) shows worldwide $CO_2$ emissions in millions of tons of carbon dioxide ($MtCO_2$) under the "business-as-usual" baseline, while panel (b) displays $CO_2$ emissions under the EGS scenarios in percentage deviation from the baseline in panel (a).

**Figure 8: Regional contributions to global $CO_2$ emissions (percentage deviation from the baseline in 2030)**




Source: Author.

Changes in regional $CO_2$ emissions vary significantly across lists. For instance, liberalizing the OECD list makes it possible to reduce $CO_2$ emissions in Brazil, but also in Argentina and other developing countries, due to reduced carbon intensity, particularly for Chemical and Machinery goods. Argentina's $CO_2$ emissions are reduced due to the substitution of fossil fuels with electricity in the Chemicals sector.

Improving access to the EPP market, as suggested by the UNCTAD list, makes it possible to reduce $CO_2$ emissions in even more regions, including Argentina. In Argentina and Brazil, sectors reducing their emission content are mainly industrial (e.g. Electronic and Machinery in Brazil, and Metal, Cars and Trucks, and Chemicals in Argentina). Nevertheless, carbon intensity in agriculture-based exports in Argentina increases (e.g. Fats and Oilseeds).

Changes in $CO_2$ emissions are negligible under the APEC list. Only China and Hong Kong (China) show a slight reduction in emissions, while in the rest of the world the consumption of fossil fuel energies still prevails over electricity.

Globally, none of the proposed EGS trade liberalization lists is able to reduce $CO_2$ emissions because lower emissions in some regions do not offset higher emissions in others. Sectors reducing their $CO_2$ emissions through lower consumption of fossil fuels are mainly in manufacturing, even under the UNCTAD-EPP list, which focuses on agricultural goods.

## 6 Designing an EGS trade liberalization proposal: Some policy recommendations

According to the results presented above, eliminating trade protection as proposed by the four EGS lists evaluated does not attain the triple-win objective at the global level. However, under the UNCTAD-EPP list, this triple-win objective is achieved for Argentina. The Japanese and APEC lists generate increases in Argentina's trade and aggregate welfare (the welfare gain is almost negligible for the APEC list), but do not reduce the country's $CO_2$ emissions. For this reason, when we assess possible inclusion of SDT in EGS trade liberalization, we only focus on comparing the results of this analysis with the two scenarios that are the most favourable for Argentina: the UNCTAD-EPP and Japanese lists.

Trade liberalization based on the Japanese EGS list increases Argentina's welfare, although its distribution across households is not pro-poor. This list stimulates Argentine exports of all categories of products (except for Transport, Communication & Housing). Nevertheless, Argentina's $CO_2$ emissions increase because higher carbon intensity in some sectors cannot be offset by cleaner household energy consumption or by substituting clean for dirty energy in other sectors.

Improved market access as proposed by the UNCTAD-EPP list increases Argentina's welfare without significantly affecting the distribution of welfare among households. Argentina's trade also increases, in particular with other developing countries, i.e. the Latin American region and India. Households do not shift to cleaner energy as in the Japanese scenario, but firms from the non-agricultural sector, which face higher competition in imports, substitute fossil energies for electricity, thus leading to lower emissions in Argentina.

When considering trade, national welfare, and $CO_2$ emissions in Argentina, the UNCTAD-EPP list would be preferable to the Japanese one. A more detailed analysis could certainly provide qualitative results (e.g. changes in trade composition and carbon intensity of sectors) that point to potential improvements of these EGS trade liberalization proposals.

Assuming that the list approach is retained, these EGS trade liberalization proposals could enhance their benefits for Argentina by including SDT provisions for developing countries, as suggested by the non-list approaches. In this sense, three (non-exclusive) ways to introduce SDT might be considered by policymakers.

The first way is in line with the combined and integrated approaches, which introduce the necessity of differentiated EGS lists across WTO members. Since countries are different in terms of trade, protection, and social and technological development, it is practically impossible for a single list to achieve the threefold objective of these negotiations for all the

members. Thus, Argentina, like every other WTO member, should think about identifying EGS whose liberalization could accomplish the ambitious objective of these negotiations. It is therefore essential to define common criteria by which all the WTO members can choose EGS. Moreover, these criteria should not only be trade indicators, such as in Balineau and De Melo (2013), but also indicators related to development and environmental objectives. In the case of Argentina, policymakers could be driven to include some products with a high level of $CO_2$ embedded (e.g. HS-230400 as part of Oilseeds) if they base their decisions on EGS trade and bilateral protection information (see Figures 2 and 3).[36] As regards development, countries should consider common indicators (i.e. per capita income, income distribution, and poverty indicators) when developing their EGS lists. In terms of the environment, it would be necessary to first determine the scope of environmental damages at stake (i.e. local or global, due to production or consumption, etc.). This study only focuses on $CO_2$ emissions caused by the final and intermediate consumption of fossil fuels; however, $CO_2$ emissions may originate from other sources (e.g. cattle raising, which is relatively more important in Argentina), so other kinds of greenhouse emissions or pollution should also be considered for the purpose of the EGS negotiations. Thus, ranking goods according to those trade, development, and environmental indicators would be an objective way to help each country establish its own list of EGS, based on common criteria.

The second way of introducing SDT in EGS negotiations consists of providing more flexibility in the implementation of tariff cuts, i.e. by allowing for lower cuts and/or a longer (deferred) phase-out period for developing countries. Tariff cuts scenarios similar to those discussed in Section 5 were run in which tariff cuts in developing countries started five years later than in developed countries (see Section 4.1). Table 8 presents the main results for Argentina. According to these results, Argentina's welfare slightly increases under the Japanese list of EGS (by 0.04 per cent in 2030 instead of 0.03 per cent without SDT), while under the other EGS scenarios, it remains unchanged. The same occurs with trade, particularly import volumes, which double with SDT under the Japanese list. No noticeable differences for trade appear under the other scenarios. $CO_2$ emissions in Argentina and worldwide show slower increases compared to the baseline scenario until 2027 but then their increase accelerates for the rest of the period analysed, consequently leading to a higher level of emissions than in the scenarios without SDT for developing countries. To sum up, a deferred schedule for tariff cuts does not significantly improve Argentina's results by 2030. Consequently, other modalities for tariff cuts (e.g. lower cuts depending on the product and country, or even the use of tariff-rate quotas) should also be assessed to improve the negotiation proposals.

**Table 8: Welfare, trade, and $CO_2$ emissions variations in Argentina in tariff cuts scenarios with SDT (percentage deviation from the baseline)**

| Variables | APEC list with SDT | | Japan list with SDT | | OECD list with SDT | | UNCTAD-EPP list with SDT | |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| Welfare | -0.006 | 0.001 | -0.018 | 0.038 | -0.012 | -0.006 | 0.024 | 0.057 |
| Exports (value) | 0.030 | 0.059 | 0.334 | 0.631 | 0.127 | 0.248 | 0.357 | 0.796 |
| Exports (volume) | 0.059 | 0.107 | 0.632 | 1.196 | 0.188 | 0.339 | 0.233 | 0.572 |
| Imports (value) | 0.022 | 0.048 | 0.261 | 0.540 | 0.096 | 0.204 | 0.307 | 0.719 |
| Imports (volume) | 0.040 | 0.074 | 0.401 | 0.727 | 0.121 | 0.228 | 0.295 | 0.690 |
| $CO_2$ emissions | 0.002 | 0.009 | 0.036 | 0.164 | -0.017 | -0.034 | -0.012 | -0.070 |

Source: Author.

[36] Among the four lists of EGS evaluated here and based on Argentina's trade and bilateral protection on those lists (Section 3), 25 products have been identified at the HS-6 level. A scenario of full trade liberalization of these products has also been run but results (welfare, trade and $CO_2$ emissions) do not show more consequences for Argentina than the Japanese or the UNCTAD-EPP scenarios.

Finally, the third way of introducing SDT into EGS trade liberalization proposals involves technology and financial transfers to developing countries to facilitate the adoption of more environmentally-friendly technologies and practices. Even though such concessions would most likely only apply to LDCs, their implementation could change Argentina's opportunities and challenges under these negotiations, for instance, by creating new competitors in the EGS market.

To sum up, none of the four lists evaluated allows for achieving the ambitious triple objective of the EGS negotiations in Argentina and worldwide simultaneously. If WTO members agree to implement a list-based approach, the lists should be differentiated across countries based on common trade, development, and environmental criteria. Moreover, modalities to reduce tariffs should be evaluated in order to prevent possible negative consequences of EGS trade liberalization for developing countries, but also to minimize environmental damage. Finally, technological assistance and financial aid should also be considered for LDCs.

## 7 Concluding remarks

Current discussions about multilateral liberalization of EGS trade by the WTO Committee for Trade and the Environment in Special Session have largely inspired this research study. Proposed EGS lists at the WTO are far from meeting the threefold objective of these negotiations. In fact, existing literature has raised several doubts about the benefits that developing countries, such as Argentina, could derive from EGS trade liberalization.

In this context, this study assessed the implementation of four proposals for EGS trade: the lists of APEC, Japan, and OECD, and UNCTAD-EPP. The analysis focused on their effects on Argentine trade, welfare and their distribution across households, , and environmental outcomes in the event that they are accepted as a multilateral agreement.

Among the four scenarios, the UNCTAD-EPP and the Japanese lists appear as the preferred ones for Argentina. However, when looking at the results in detail (i.e. considering bilateral trade relations, trade composition, carbon intensity by sector), there are significant differences between the two lists. While the UNCTAD-EPP scenario intensifies Argentina's trade relations with other developing countries, the Japanese one mainly increases Argentina's trade with developed countries. Argentina's exports increase in the Clothing and Food & Beverages categories under the UNCTAD-EPP scenario, whereas under the liberalization of the Japanese list the increase in exports is more diversified across all categories of goods (except for Transport, Communication & Housing). Finally, Argentina's total $CO_2$ emissions fall under the UNCTAD-EPP scenario but increase under the Japanese one. Breaking down the sources of $CO_2$ emissions in Argentina shows that both scenarios encourage their reduction in different ways. Households are encouraged to consume cleaner energy under the Japanese scenario, whereas firms in manufacturing sectors reduce their consumption of fossil fuels under the UNCTAD-EPP scenario. Thus, as in the agricultural negotiations in Doha (Gouel *et al.*, 2011), the potential gains of EGS trade liberalization in terms of trade, welfare, and the environment lie in the details (i.e. EGS coverage and the trade liberalization modalities accounting for country differences).

Since liberalization under a single EGS list leads to limited gains in terms of the triple objective in Argentina (and worldwide), this study suggests the need to consider different forms of SDT provisions for developing countries – that is, differentiated EGS lists across countries based on common trade, development, and environmental criteria, differentiated tariff cut modalities between developed and developing countries, and the inclusion of technology transfer and financial aid to LDCs – in order to improve the results of the lists. These recommendations support proposals submitted by developing countries, such as Argentina's integrated approach, India's project approach, the combined approach of Chile

and Mexico, and others that go beyond the full trade liberalization at the multilateral level (e.g. the hybrid approach).

Although there are some methodological limitations related to the datasets and models[37] used in the analysis, evaluating different lists of EGS can help identify which of them could allow Argentina to get as close as possible to a triple-win situation.

Further research on EGS trade liberalization should seek to evaluate more complete scenarios that include some of the recommendations highlighted here.

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[37] In terms of datasets, for instance, imperfect data correspondence and data aggregation could result in some losses of information and biased results. In terms of models, methodological limitations could include no political economy analysis, no extensive margin of trade due to constant elasticity of substitution (CGE) function assumptions, full employment of resources, and $CO_2$ emission caused only by fuel energy consumption in the CGE model (e.g. omission of agricultural sources of $CO_2$ emissions, which mainly concern Argentina).

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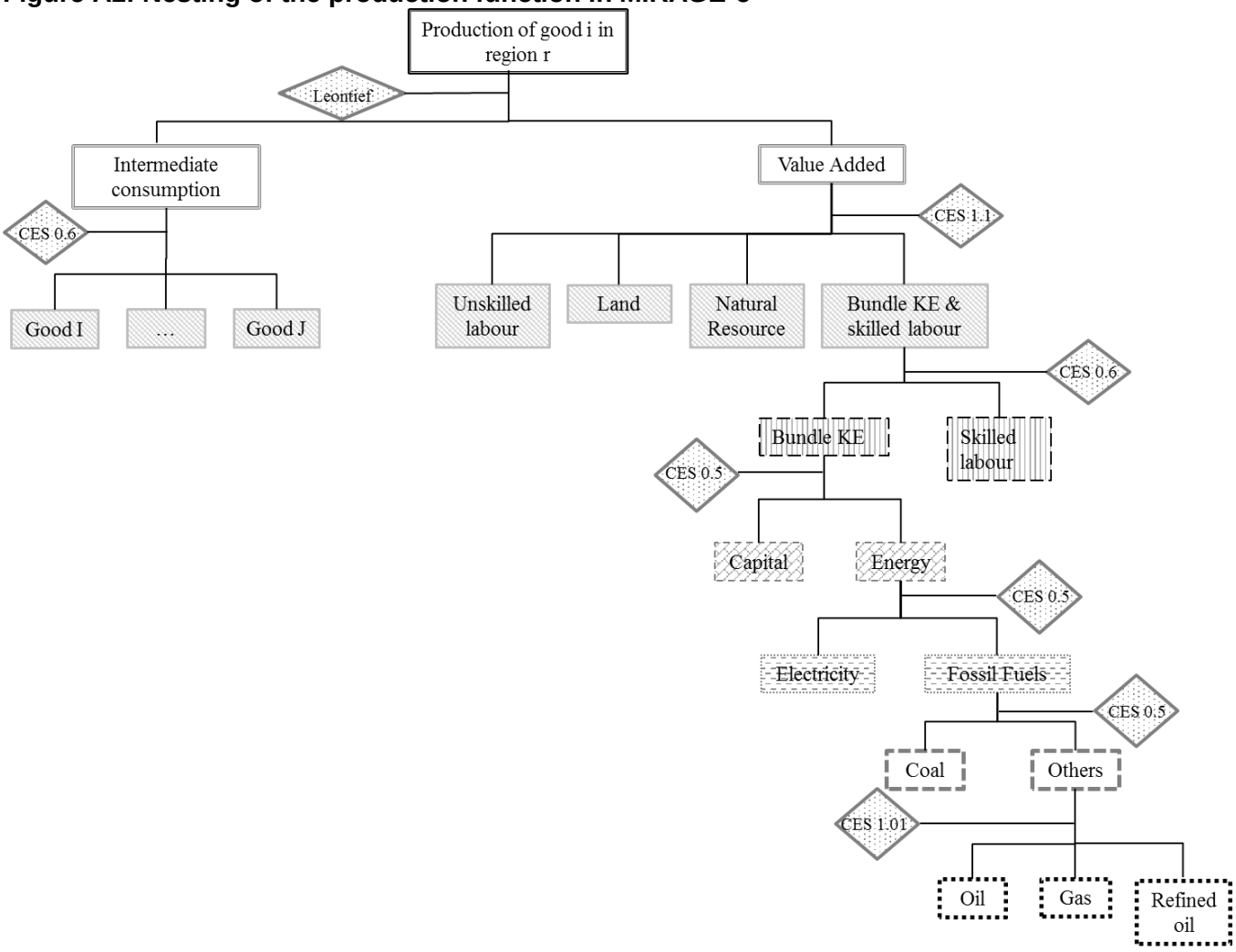
## Annex

### Figure A1: Nesting of the production function in MIRAGE-e




Source: Based on Fontagné *et al.* (2013).
Note: CES stands for constant elasticity of substitution; KE stands for capital and energy bundle.

### Table A1: Consumption budget shares and wage per cent shares

| | **Consumption shares** | | | | | | | **Wage shares** | |
|---|---|---|---|---|---|---|---|---|---|
| Household clusters | Food & Beverages | Clothing | House Equipment & Maintenance | Others | Housing, Transport & Communications | Health & Education | Entertainment | Skilled | Unskilled |
| 1 | 63 | 5 | 3 | 5 | 20 | 2 | 3 | 9 | 91 |
| 2 | 56 | 7 | 3 | 6 | 20 | 3 | 4 | 15 | 85 |
| 3 | 53 | 7 | 3 | 7 | 21 | 4 | 5 | 20 | 80 |
| 4 | 50 | 8 | 4 | 8 | 21 | 5 | 5 | 26 | 74 |
| 5 | 48 | 9 | 4 | 8 | 21 | 5 | 6 | 32 | 68 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 45 | 9 | 4 | 9 | 20 | 7 | 6 | 38 | 62 |
| 7 | 43 | 9 | 4 | 10 | 21 | 8 | 6 | 43 | 57 |
| 8 | 40 | 8 | 4 | 11 | 20 | 9 | 7 | 55 | 45 |
| 9 | 37 | 9 | 4 | 11 | 21 | 10 | 8 | 64 | 36 |
| 10 | 34 | 9 | 5 | 11 | 21 | 12 | 9 | 77 | 24 |

Source: Based on Argentina's ENGH 1996–1997.
Note: The shares are calculated in the 10 clusters of households based on their adult equivalent per capita income.

**Table A2: Consumer prices of selected products in Argentina (percentage deviation from the baseline)**

| Sectors | APEC list | | Japan list | | OECD list | | UNCTAD-EPP list | |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| Coal | -0.005 | -0.006 | -0.035 | -0.030 | -0.002 | 0.004 | 0.017 | 0.023 |
| Crops | -0.018 | -0.024 | -0.144 | -0.233 | -0.013 | 0.003 | 0.117 | 0.269 |
| Fats | -0.027 | -0.040 | -0.222 | -0.457 | -0.052 | -0.070 | -0.107 | -0.292 |
| Furniture | -0.034 | -0.056 | -0.264 | -0.603 | -0.071 | -0.114 | -0.060 | -0.060 |
| Rice | -0.037 | -0.056 | -0.259 | -0.531 | 0.010 | 0.033 | 0.069 | 0.157 |
| Textile | -0.034 | -0.070 | -0.267 | -0.814 | -0.081 | -0.167 | 0.020 | -0.195 |
| Wheat | -0.018 | -0.022 | -0.163 | -0.291 | 0.019 | 0.080 | 0.058 | 0.130 |

Source: Author.
Note: Consumer prices of other sectors are also available.