EUTAX Observatory

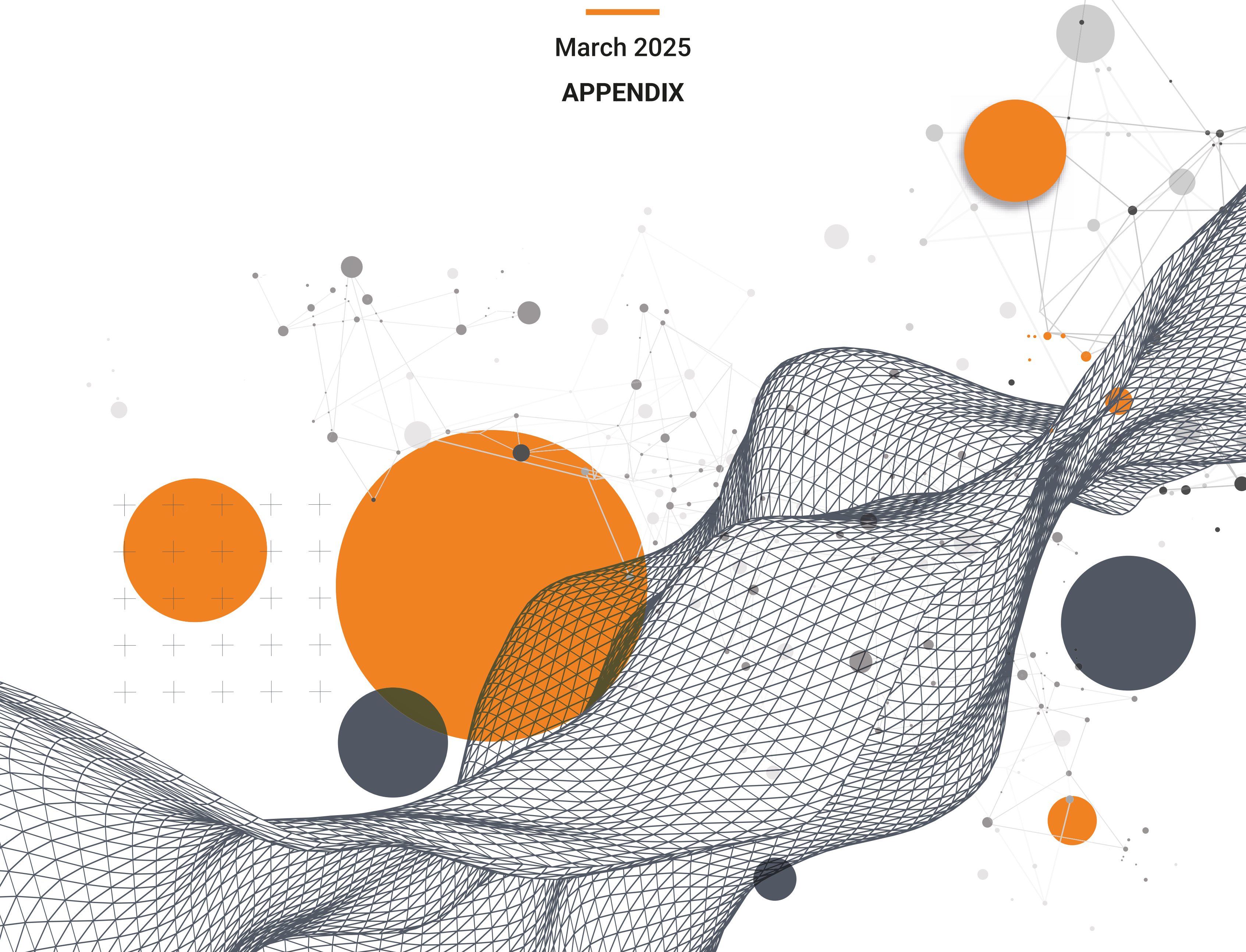
Aligning Competitiveness and Sustainability:

How Border Adjustments Can Strengthen the EU's Agricultural Policy

Carl Gaigné (SMART-INRAE), Elsa Leromain (U. Antwerp), Riccardo Norbiato (PSE & EUTO), Mathieu Parenti (PSE-INRAE & EUTO), Giulia Varaschin (EUTO)

March 2025

APPENDIX



Appendix

A1: The Phytosanitary Footprint of EU Consumption

Data. To compute the phytosanitary footprint of EU consumption, we consider five data sources. First, we rely on PEST-CHEMGRIDS (Maggi et al., 2019)[1], a dataset including crop- and active substance-specific application rates (i.e., the amount of active substance per harvested area) at the 5 arc-minute resolution (about 10 km at the equator). Second, we use crop-specific data provided by GAEZ v4[2]. More specifically, we consider information on actual yields (tonnes per harvested area) and harvested areas (thousands of hectares) at the 5 arc-minute resolution. Third, we use the Food and Agriculture Biomass Input–Output (FABIO) database (Bruckner et al., 2019)[3]. FABIO provides a set of multi-regional physical supply-use and input-output tables covering global agriculture and forestry. FABIO currently covers 191 countries plus Rest-of-World, 121 processes and 130 commodities for 1986-2013[4]. Fourth, we rely on the active substance-specific toxicity measures provided by the Pesticide Property Database (PPDB)[5] developed by the Agriculture & Environment Research Unit (AERU) at the University of Hertfordshire. It contains information on pesticide chemical identity, physicochemical, human health and ecotoxicology. Lastly, we use information provided by the Consolidated List of Banned Pesticides[6] and the EU Pesticide Database about country-specific bans related to any active substance considered. Due to data constraints, we consider two main primary crop groups: cereals and oil crops. Table 1A reports all the considered crops by primary crop group.

---

[1] The Global Pesticide Grids (PEST-CHEMGRIDS), Version 1.01 data set contains 20 of the most-used pesticide active ingredients on 6 dominant crops and 4 aggregated crop classes at 5 arc-minute resolution (about 10 km at the equator).

[2] Information on Agro-Ecological Zones (AEZ) modelling framework and databases are available at this link: https://gaez.fao.org/

[3] For more information, see https://www.fineprint.global/resources/fabio/

[4] For our analysis, we considered the latest year available: 2013.

[5] For a comprehensive description of the database see https://sitem.herts.ac.uk/aeru/ppdb/en/index.htm

[6] The Consolidated List of Banned Pesticide is a publicly available dataset provided by the Pesticide Active Network (PAN). For more details, see https://pan-international.org/pan-international-consolidated-list-of-banned-pesticides-explanatory-note/

Table 1A: Crops and Crop Categories

Crop Category	Crop
Cereals	Barley, Maize, Millet, Oats, Rice, Rye, Sorghum, Wheat, Other Cereals
Oil crops	Groundnuts, Oil Palm, Rape and Mustard seed, Soybeans, Sunflower Seed, Other Oil Crops

For each crop, we identify the ten most widely used active substances worldwide (Maggi et al., 2019). In total, we analyze 32 active substances: 13 permitted in EU agricultural production and 19 banned under EU regulations. Table 2A lists all the active substances included in our analysis.

Table 2A: Active Substances

EU regulation	Active Substance
Allowed	2,4-d, azoxystrobin, clomazone, clopyralid, dicamba, dimethenamid(-p), fluroxypyr, glyphosate, mcpa, mesotrione, metam, pendimethalin, tebuconazole
Banned	acetochlor, atrazine, bromoxynil, chloropicrin, chlorothalonil, dichloropropene, fomesafen, glufosinate, imazethapyr, metolachlor(-s), metribuzin, paraquat, propanil, propargite, propiconazole, quinclorac, simazine, sulfentrazone, thiobencarb

As to the countries, we consider four main regions: “European Union” (EU27 and UK), “Mercosur” (Argentina, Brazil, Paraguay, Uruguay), “North America” (Canada and United States of America), “Rest of the World” (all other countries).

Methodology. To account for the phytosanitary footprint of EU’s consumption, we adopt a three-steps procedure. Firstly, we compute a country-, crop- and active substance-specific measure for the amount of active substance used to produce one unit of crop product in a given country. To do so, we combine PEST-CHEMGRID (application rates) and GAEZ (actual yields) data. By matching them, we obtain the amount of active substance used to produce one unit of crop at the 5 arc-minute resolution. Then, within each country and for each crop- and active substance-specific observation, we average by using harvested areas as weights. As a result, we obtain $\zeta_i^{k,s}$: the amount of active substance s used in country i-production of crop k. Second, we exploit input-output information in FABIO to obtain, for each country i, j and crop k, r pair, the Leontief coefficients b_{ij}^{kr}. This latter represents the amount of crop k produced in country i which is contained in crop r consumed in country j. Hence, the active substance s-specific footprint of EU consumption is computed as

$$F_{EU}^{s} = \sum_{i,k,r} \zeta_i^{k,s} b_{iEU}^{kr} d_{EU}^{r},$$

where d_{EU}^{r} is the amount of crop r consumed in the EU. The active substance s- and country of origin i-specific footprint of EU consumption is

$$F_{EU}^{s} = \sum_{k,r} \zeta_i^{k,s} b_{iEU}^{kr} d_{EU}^{r}.$$

Hence, the active substance s-specific footprint share is given by $F_{iEU}^{s} \,/\, F_{EU}^{s}$. Finally, we compute the phytosanitary footprint by converting each active substance s-specific use in the glyphosate equivalent. To do that, we use the active substance-specific acute oral lethal dose, $LD50$. The total phytosanitary footprint of EU consumption (in glyphosate-equivalent measure) is given by

$$F_{EU} = \sum_{s,i,k,r} \frac{LD50^{glypho}}{LD50^{s}} \zeta_i^{k,s} b_{iEU}^{kr} d_{EU}^{r},$$

and the country-specific component is

$$F_{EU} = \sum_{s,k,r} \frac{LD50^{glypho}}{LD50^{s}} \zeta_i^{k,s} b_{iEU}^{kr} d_{EU}^{r}.$$

Analogously to the active substance case, the country i-phytosanitary footprint share is computed as F_{iEU}/F_{EU}.

A2: Quantification of the border-adjusted pesticide tax

We discuss the impact of a 50 % cut in pesticide use on the change in EU demand for domestic products and EU imports from a simplified version of trade model based on Armington structure, i.e. agricultural products are differentiated by their region of production. Such models are often used to evaluate the potential impacts of agricultural policies. Then, we compute two types of import tax: (i) a tax on imported products to avoid pesticide leakage (holding EU market share constant) and (ii) a tax on the pesticide content of agricultural products.

The model. We aggregate countries into four main regions: European union (EU), Mercosur countries (MC), North America (NA), and rest of the world (RW). We index exporting countries by i (with i =EU, MC, NA, RW) and importing countries by j (with j =EU, MC, NA, RW)). As many models with agriculture trade (like GTAP-BIO), we consider two elasticities: (i) η^k that captures the ease of substitution between domestic and foreign products; and (ii) σ^k that represents the degree of substitution among different countries of origin for imports. Both elasticities are assumed to be constant (the so-called Armington elasticity). The magnitude of import responses with respect to price change increases with η^k . This model implies that, in the home country (say EU), the expenditures for domestic products are given by

$$(1) \qquad d_j^k = E_j^k (\mathrm{P}_j^k)^{\eta^k - 1} (p_j^k / \theta_j^k)^{1-\eta^k}$$

with p_j^k the price of crop k produced in country j and purchased by domestic consumers, θ_j^k is an exogenous demand shifter (it encompasses all attributes of product *k* from *j* other than price which purchasers value, e.g. protein content, grain hardness), and

$$(2) \qquad \mathrm{P}_j^k = \left[(p_j^k / \theta_j^k)^{1-\eta^k} + (P_j^k)^{1-\eta^k} \right]^{\frac{1}{1-\eta^k}} \quad \text{and} \quad P_j^k = \left[\sum_{i \neq j} (p_{ij}^k / \theta_i^k)^{1-\sigma^k} \right]^{\frac{1}{1-\sigma^k}}$$

where E_j^k is the amount of income allocated to product k , P_j^k is the price index, p_{ij}^k is the trade-cost and tariff inclusive price of goods produced in country i and purchased in country j , and P_j^k is the import price index in country j .[7] The import demand for commodities produced in country i is

---

[7] Our calibration requires demand-shifter adjusted prices before the implementation of border-adjustments (see, e.g., equation (10) below). Crop-specific monthly prices are computed from the Eurostat COMEXT database. We take the average price ratio (EU vs non-EU) for the years 2023-2024. The demand shifters are calibrated to replicate the observed import shares, computed from FAOStat data for the year 2023.

$$m_{ij}^k = \lambda_j^{m,k} E_j^k (P_j^k)^{\sigma^k-1} (p_{ij}^k / \theta_i^k)^{1-\sigma^k} \quad \text{with} \quad \lambda_j^{m,k} = (\mathrm{P}_j^k / P_j^k)^{\eta^k-1} \tag{3}$$

where $\lambda_j^{m,k}$ represents the share of expenditures allocated to imported products k in country j. Note that $E_j^k = \sum_{i\neq j} m_{ij}^k + d_j^k$ and the import-to-domestic consumption ratio (the *import-domestic* ratio)

$$r_j^k \equiv \frac{\sum_{i\neq j} m_{ij}^k}{d_{jj}^k} = \frac{\sum_{i\neq j} (P_j^k)^{1-\eta^k} (P_j^k)^{\sigma^k-1} (p_{ij}^k / \theta_i^k)^{1-\sigma^k}}{(p_j^k / \theta_j^k)^{1-\eta^k}} = \left(\frac{P_j^k}{p_j^k / \theta_j^k} \right)^{1-\eta^k} . \tag{4}$$

The farm-to-fork strategy is expected to raise EU agriculture prices and, in turn, implies an increase in EU imports from less-regulated countries, a decrease in EU exports, and more trade across less-regulated countries. Let $\hat{p}_{\text{eu}}^k$ the variation in EU farm-gate prices due to the farm-to-fork strategy (for any variable, $\hat{x} \equiv x' / x$ where x denotes the factual value and x' denotes the counterfactual value). The magnitude of the price effects of F2F strategy is discussed below. Using (2) and (3), the change in EU import demand for commodities produced in country i without border measures is given by

$$\hat{m}_{i,\text{eu}}^k = (\hat{\mathrm{P}}_{\text{eu}}^k)^{\eta^k-1} \quad \text{where} \quad \hat{\mathrm{P}}_{\text{eu}}^k = \left(\lambda_{\text{eu}}^{d,k} (\hat{p}_{\text{eu}}^k)^{1-\eta^k} + \lambda_{\text{eu}}^{m,k} \right)^{\frac{1}{1-\eta^k}} \tag{5}$$

with $\lambda_{\text{eu}}^{d,k} = 1 - \lambda_{\text{eu}}^{m,k}$ the share of expenditure on domestic varieties of product *k*. Total expenditures in country j on product k are assumed to be constant.

In addition, given (5), the change in EU exports is

$$\hat{x}_{\text{eu}}^k = \sum_{j\neq\text{eu}} \hat{m}_{\text{eu},j}^k \lambda_{\text{eu},j}^{x,k} \quad \text{with} \quad \hat{m}_{\text{eu},j} = \hat{\lambda}_j^{m,k} (\hat{P}_j^k)^{\sigma^k-1} \hat{p}_{\text{eu}}^{1-\sigma^k} , \tag{6}$$

where $\lambda_{\text{eu},j}^{x,k}$ is the share of EU exports to country j in EU total exports (with $\sum_{j\neq i} \lambda_{ij}^{x,k} = 1$) and

$$\hat{\lambda}_j^{m,k} = (\hat{\mathrm{P}}_j^k / \hat{P}_j^k)^{\eta^k-1} \tag{7}$$

with

$$\hat{\mathrm{P}}_j^k = \left(\lambda_j^{d,k} + \lambda_j^{m,k} (\hat{P}_j^k)^{1-\eta^k} \right)^{\frac{1}{1-\eta^k}} \quad \text{and} \quad \hat{P}_j^k = \left(1 - \lambda_{\text{eu},j}^{m,k} + \lambda_{\text{eu},j}^{m,k} (\hat{p}_{\text{eu}}^k)^{1-\sigma^k} \right)^{\frac{1}{1-\sigma^k}} , \tag{8}$$

where $\lambda_{\mathrm{eu},j}^{m,k}$ is the share of imports from EU in total imports of country j (with $\sum_{i \neq j} \lambda_{ij}^{m,k} = 1$)

Farm to Fork Strategy and market mechanisms

We now present the methodology to compute the impact of a farm-to-fork strategy leading to a 50% cut in pesticides on the change in agricultural prices $\hat{p}_{\mathrm{eu}}^{k}$. The pesticide use associated with crop *k* is $H_i^k = \zeta_i^k Q_i^k$ where ζ_i^k is the application rate of a pesticide and Q_i^k is the total production (quantity) of crop k in country i and

$$Q_i^k = E_i^k (\mathrm{P}_i^k)^{\eta^k - 1} (p_i^k)^{-\eta^k} (\theta_i^k)^{\eta^k - 1} + \sum_j \lambda_j^{m,k} E_j^k (P_j^k)^{\sigma^k - 1} (p_{ij}^k)^{-\sigma^k} (\theta_i^k)^{\sigma^k - 1}.$$

The objective is $\hat{H}_{\mathrm{eu}}^k = 1/2$ with

$$\hat{H}_{\mathrm{eu}}^k = \hat{\zeta}_{\mathrm{eu}}^k \left[\phi_{\mathrm{eu}}^k (\hat{\mathrm{P}}_{\mathrm{eu}}^k)^{\eta^k - 1} (\hat{p}_{\mathrm{eu}}^k)^{-\eta^k} + \sum_{j \neq \mathrm{eu}} \phi_{\mathrm{eu},j}^k (\hat{\mathrm{P}}_j^k / \hat{P}_j^k)^{\eta^k - 1} (\hat{P}_j^k)^{\sigma^k - 1} (\hat{p}_{\mathrm{eu}}^k)^{-\sigma^k} \right] \tag{9}$$

where ϕ_{eu}^k is the share of EU production that is not exported, $\phi_{\mathrm{eu},j}^k$ is the share of EU production exported to country j while $\hat{\mathrm{P}}_{\mathrm{eu}}^k$ is given in (5) and $\hat{\mathrm{P}}_j^k$ and $\hat{P}_j^k$ are given in (8).

Two polar scenarios can be implemented: (a) EU farmers do not change their practices (the application rate keeps constant $\hat{\zeta}_{\mathrm{eu}}^k = 1$) and (b) all EU farmers adopt new technologies (the application rate falls $\hat{\zeta}_{\mathrm{eu}}^k < 1$). Under Scenario (a) where EU farmers do not change their practices, $\hat{\zeta}_{\mathrm{eu}}^k = 1$ so that we can compute $\hat{p}_{\mathrm{eu}}^k$ by solving $\hat{H}_{\mathrm{eu}}^k = 1/2$. Under scenario (b) where all EU farmers adopt alternative technologies, the change in application rate $\hat{\zeta}_{\mathrm{eu}}^k$ is calibrated such that $\hat{H}_{\mathrm{eu}}^k = 1/2$ where $\hat{p}_{\mathrm{eu}}^k$ depends on $\hat{\zeta}_{\mathrm{eu}}^k$ as a change in application rates modify yield and production costs.

We compute the impact of $\hat{\zeta}_{\mathrm{eu}}^k$ on $\hat{p}_{\mathrm{eu}}^k$ as follows. First, assuming free entry (all farms operate at zero “pure” profit), price of EU agricultural products is $p_j^k = C_j^k / Q_j^k$ where C_j^k denotes the total cost and Q_j^k agricultural production (price equals to average cost). The price can be rewritten as follows

$$p_j^k = \frac{C_j^k / L_j^k}{Q_j^k / L_j^k} = \frac{c_j^k}{y_j^k} \quad (10)$$

where L_j^k is agricultural land area, $c_j^k \equiv C_j^k / L_j^k$ is the production cost per hectare, $y_j^k \equiv Q_j^k / L_j^k$ is agricultural yield (crop specific). Using (10), the change in price is

$$\hat{p}_{\text{eu}}^k = \frac{\hat{c}_{\text{eu}}^k}{\hat{y}_{\text{eu}}^k}. \quad (11)$$

Second, public databases provide c_j^k and y_j^k for organic farming (OF) and conventional farming (CF) allow us to determine the change in application rate from a shift from C-F to O-F, denoted by $\hat{\zeta}_{\text{of}}^k$ as well as the change in yield, denoted by $\hat{y}_{\text{of}}^k$, and where the change in costs per ha, denoted by $\hat{c}_z^{\text{of}}$, if farmers shift from C-F to O-F. Hence, the change in yield and cost per hectare associated with the farm-to-fork strategy can be computed as follows

$$\hat{y}_{\text{eu}}^k = 1 - (1 - \hat{y}_{\text{of}}^k)\frac{1 - \hat{\zeta}_{\text{eu}}^k}{1 - \hat{\zeta}_{\text{of}}^k} \text{ and } \hat{c}_z = 1 + (\hat{c}_z^{\text{of}} - 1)\frac{1 - \hat{\zeta}_{\text{eu}}^k}{1 - \hat{\zeta}_{\text{of}}^k} \quad (12)$$

The underlying assumption is that a change in yield and cost due to the farm-to-fork strategy is proportional to the change associated with a shift from C-F to O-F. Hence, by inserting (12) and (11) in (9), we can determine $\hat{\zeta}_{\text{eu}}^k$ such that $\hat{H}_{\text{eu}}^k = 1/2$.

Trade policies. We can first determine an ad-valorem border tax T_{eu}^k such that the EU market share is constant, that is $\hat{r}_{\text{eu}}^k = 1$ or, equivalently, $\hat{P}_{\text{eu}}^k = \hat{p}_{\text{eu}}^k$. Under this scenario, EU purchasers pay $p_{i,\text{eu}}^k T_{\text{eu}}^k$ instead of p_{ij}^k so that $\hat{p}_{i,\text{eu}}^k = T_{\text{eu}}^k$ and the change in the import price index is $\hat{P}_{\text{eu}}^k = T_{\text{eu}}^k$. Hence, $T_{\text{eu}}^k = \hat{p}_{\text{eu}}^k$.

The F2F strategy can be also interpreted as equivalent to a tax τ^k applied to pesticide content in products paid by purchasers that we can compute. Indeed, τ^k is such that $p_{\text{eu}}^k + \tau^k \zeta_{\text{eu}}^k = p_{\text{eu}}^{k,'}$ where ζ_{eu}^k is the pesticide content per unit of products (observable variable) and $p_{\text{eu}}^{k,'}$ is the price of EU products under the counterfactual scenario. It follows that

$$\tau^k = \frac{p^k_{\mathrm{eu}}(\hat{p}^k_{\mathrm{eu}} - 1)}{\zeta^k_{\mathrm{eu}}}. \tag{13}$$

Under this tax regime, the EU customers pay $p^{k,\prime}_{i,\mathrm{eu}} = p^k_{i,\mathrm{eu}} + \tau^k \zeta^k_i$ each unit of imported products instead of $p^k_{i,\mathrm{eu}}$. Using (13), it follows that

$$\hat{p}^k_{i,\mathrm{eu}} = \frac{p^k_{i,\mathrm{eu}} + \tau^k \zeta^k_i}{p^k_{i,\mathrm{eu}}} = 1 + \frac{p^k_{\mathrm{eu}}}{p^k_{i,\mathrm{eu}}} \frac{\zeta^k_i}{\zeta^k_{\mathrm{eu}}} \left(\hat{p}^k_{\mathrm{eu}} - 1\right) \tag{14}$$

Calibration. We simulate a 50% reduction in pesticide use within EU agricultural production. We consider the case where all EU farmers adopt new technologies by changing the pesticide application rate. We focus on three crops: corn, soybeans and wheat and calibrate the model by combining different data sources. As to the crop-specific Armington elasticities of substitutions, we use the estimates provided by Taheripour and Tyner (2018). More specifically, we choose the following calibration: $\eta = [4.93,\ 4.90,\ 8.90]$ and $\sigma = [2.46,\ 2.45,\ 4.45]$ for corn, soybeans and wheat, respectively.

Changes in yield, costs and application rates are obtained from the 2010 USDA ARMS[8], a survey collecting detailed information about the production practices and costs and including a subsample of organic producers. Table 3A summarizes this information.

Table 3A: Yield, Cost and Application Rate Changes

	Corn	Soybeans	Wheat
$\hat{y}$	0.76	0.65	0.70
$\hat{c}$	0.98	1.17	0.95
$\hat{\zeta}$	0.01	0.01	0.10

---

[8] For further details, see https://www.ers.usda.gov/data-products/commodity-costs-and-returns/organic-costs-and-returns .

The benefit of utilizing information from USDA ARMS is that it is specific to both crops and farming type (i.e., conventional and organic). As a robustness check, we also compare these measures with the information provided by FADN[9].

Production and trade data are obtained from the FAOStat database. Information is provided for both quantities (tonnes) and values (dollars). The amount of pesticide per unit of product is defined as the total quantity of glyphosate-equivalent active substances used to produce one unit of crop. We compute these rates according to the methodology described in section A1.

A3: Other policy instruments

Maximum Residue Levels (MRLs). The EU's approach to MRLs illustrates both the potential and limitations of product-based regulations. While WTO rules clearly acknowledge the legitimacy of regulations on product-related production processes, MRLs face significant technical limitations. They can only detect pesticides that leave residues on the final product. Hazardous pesticides used during cultivation may not necessarily persist until harvest or may degrade during transportation. This creates a regulatory blind spot where products grown with intensive pesticide use might still comply with MRL standards simply because the chemicals are no longer detectable. This is where mirror measures could be required.

Mirror Measures. Mirror measures aim to guarantee that imported products are produced under the same conditions as those imposed on domestic products. It is the first-best solution to level the playing field. However, WTO does not provide clear rules on production methods that do not affect the physical characteristics of final products. The challenges of implementing mirror measures are well illustrated by the recent controversy over the traceability and control of hormones - the use of which is banned in the EU - in Brazilian beef exports (European Commission, 2024). There is also a lack of relevant international standards on non-product-related production methods. The internationalization of mandatory standards is challenging due to differences across countries in societal preferences.

Vertical Targeting. The flow of pesticides and agricultural products may be targeted across different stages of production and distribution. It has been documented that the EU (and the UK) account for a significant share of the global production of pesticides – some of those already prohibited for use within the EU (BASIC, 2021). Due to growing public concern voiced by NGOs and the United Nations, France recently took steps to restrict pesticide exports. However, the policy's effectiveness was limited since it targeted final pesticide formulations rather than their active ingredients. This created a loophole where chemical companies could still export the active ingredients, which

---

[9] FADN (https://agridata.ec.europa.eu/extensions/OrganicFarmsReport/OrganicFarmsReport.html) provides information on conventional and organic farming for few crops. In particular, yields differences (t/ha) are available for corn and wheat; cost differences are available only at the aggregated level.

could then be formulated into pesticides in other countries. The experience shows the importance of the design of export controls. Additionally, even comprehensive bans may have limited impact if other countries continue to produce or start exporting these substances. Firms producing phytosanitary products are indeed large multinational corporations. Syngenta, producer of paraquat, was acquired by ChemChina, who merged in 2021 with Sinochem creating the giant conglomerate Sinochem Holdings Corporation. Similarly, other major agrochemical companies like Bayer, BASF, and Corteva have production facilities and affiliates across the globe. That Brazil has become one of the largest importers of Chinese pesticides reduces the leverage of the European Union which accounts for approximately 20% of global pesticide production only. Overall, vertical targeting may have some (modest) effects in the short-run and a border-adjustment approach seems indispensable.

References (Appendix)

BASIC (2021). Analyse de la création de valeur et des coûts cachés des produits phytosanitaires de synthèse [Analysis of value creation and hidden costs of synthetic phytosanitary products]. Research Report. Retrieved from https://lebasic.com/v2/content/uploads/2021/11/Pesticides-un-modele-qui-nous-est-cher_Rapport-complet.pdf

Bruckner, M., Wood, R., Moran, D., Kuschnig, N., Wieland, H., Maus, V., & Börner, J. (2019). FABIO—the construction of the food and agriculture biomass input–output model. *Environmental science & technology*, *53*(19), 11302-11312.

European Commission, DG for Health and Food Safety. (2024). Final report of an audit of Brazil carried out from 27 May to 14 June 2024 to evaluate controls on residues of pharmacologically active substances, pesticides and contaminants in animals and animal products 2024-8087.

Lewis, K.A., Tzilivakis, J., Warner, D. and Green, A. (2016) An international database for pesticide risk assessments and management. *Human and Ecological Risk Assessment: An International Journal*, 22(4), 1050-1064.

Maggi F., F. H. M. Tang, D. la Cecilia, and A. McBratney (2019). PEST-CHEMGRIDS, global gridded maps of the top 20 crop-specific pesticide application rates from 2015 to 2025. Scientific Data 6(170).

Taheripour, F., Tyner, W. (2018). Impacts of Possible Chinese Protection on US Soybeans (GTAP Working Paper No. 83). Purdue University, West Lafayette, IN: Global Trade Analysis Project (GTAP).