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Fabio Gaetano Santeramo - University of Foggia

Victor Martinez-Gomez - Universitat Politècnica de València

Laura Márquez-Ramos - University of Adelaide & Universitat Jaume I

Emilia Lamonaca - University of Foggia

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Fabio Gaetano Santeramo[a1], Victor Martinez-Gomez[b], Laura Márquez-Ramos[c], Emilia Lamonaca[a]

[a] University of Foggia
[b] Universitat Politècnica de València
[c] University of Adelaide and Universitat Jaume I

Abstract

The complexity of the trade policy environment in the European fruit and vegetables (F&Vs) market is mostly due to the Entry Price System (EPS), a non-tariff measure that regulates imports. We investigate the trade effects of the EPS by estimating a structural gravity model of trade flows from major European suppliers of apples, lemons, oranges, peaches, pears, table grapes and tomatoes. We assess how imports react to EPS overshoots and to volatility in Standard Import Values (SIVs). The EPS limits imports of low-priced F&Vs, but marked differences exist across products. In particular, while the efficacy of the EPS is valid for all products, its effectiveness is greater for less perishable F&Vs.

JEL classification: F13, Q17, Q18.
Keywords: Non-tariff measure; Price dynamics; EU agriculture; Fruit and vegetables.

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[1] *Corresponding author: Fabio G. Santeramo. University of Foggia, Via Napoli 25, 71122, Foggia (Italy)*
Email: fabio.santeramo@unifg.it

1. Introduction

The reduction of tariffs witnessed in the agri-food sector since the mid-1990s has been balanced out by the proliferation of non-tariff measures, particularly in policy-sensitive sectors such as fruit and vegetables (F&Vs). The complexity of the trade policy environment is particularly evident for the European F&V market: domestic production and trade are heavily regulated. European Union (EU) countries are both major producers and top importers of F&Vs: in 2016, the EU accounted for 7% of world production and 32% of world imports. EU imports of F&Vs are regulated by a complex system of interventions, among which the Entry Price System (EPS)—the efficacy of which has been called into question—deserves attention. This border protection mechanism sets a minimum price threshold for imported F&Vs, below which an extra duty is applied. The EPS is comparable to the import regime for the Japanese pork market, which is protected by domestic support, several border measures, and a Gate Price System (GPS). According to Bergen and Kawaguchi (2004), the GPS is the major obstacle to Japanese imports of pork. The EPS and the GPS are analogous in that both systems apply a charge determined by comparing the import values with a threshold price[2]. However, the limited coverage of the GPS (applied only to pork imports) and the constant level of the price threshold in the GPS makes it possible to predict its effectiveness. The EPS, on the other hand, is more complex: it is applied to numerous products and combines quotas and seasonally-varying entry prices. While the main function of the EPS is to act as a price stabiliser, by preventing imports of low-priced F&Vs, the EPS may contribute to shaping trade flows.

A specific strand of literature has examined the relevance and efficacy of the EPS in terms of price stabilisation and trade effects: the relevance of the EPS seems to vary across products, suppliers, and periods (e.g. Goetz and Grethe, 2009; Emlinger et al., 2010); the ability of the EPS as price stabiliser is rather limited (e.g. Cioffi et al., 2011; Santeramo and Cioffi, 2012); conversely, the impacts of the EPS on trade are still not well established, in part due to a lack of transparency of this mechanism of protection (e.g. Cioffi and dell'Aquila, 2004). The trade effects have often been evaluated jointly with other trade policy phenomena, such as tariff protection (e.g. Emlinger et al., 2008), non-tariff measures (e.g. Kareem et al., 2017), and preferential agreements (Cardamone, 2011), with conflicting conclusions. The existing evidence is highly dependent on the products and countries under

[2] A detailed comparison between the EPS and the GPS is provided in the appendix.

study, and on the proxies used to capture the functioning of the EPS. In addition, previous studies have neglected the issue of endogeneity between the EPS and trade, which tends to lead to biased results: low Standard Import Values (SIVs) activate the mechanism of protection and reduce imports, which in turn influences the process of determining the SIVs.

Our focus is primarily on quantifying the role of the EPS in shaping imports of F&Vs. We use monthly data on EU imports of seven products under the EPS, originating from 12 non-EU trading countries. We adopt novel indicators capable of capturing the operation of the EPS and the dynamics of SIVs. More precisely, the indicators provide information on how long SIVs stay below the entry price threshold, and on the level and variability of the SIVs. The empirical specification, a gravity-based model, controls for the functioning of the EPS, as well as for omitted variables bias, the endogeneity of the mechanism of protection, and heteroskedasticity. Our contribution is twofold: we quantify and compare the impacts of the EPS for a large set of countries and products, so as to complement the existing strand of literature, which is mostly composed of product- and country-specific studies; moreover, we emphasise how the dynamics of SIVs may provide information on the effects of the EPS. Our research allow us to draw conclusions regarding the trade effects of applying extra duties and the potential strategic behaviour of suppliers attempting to circumvent higher tariffs (e.g. Cioffi and dell'Aquila, 2004; Santeramo and Cioffi, 2012).

The rest of the paper is structured as follows. In Section 2, we review the existing evidence on the EPS that is related to our research. In Section 3, we explain the estimation process, that is, we introduce the theoretical framework, the empirical setting, and we describe the data used. In section 4, we present and discuss the results obtained. Lastly, in Section 5, we conclude and discuss the policy implications of our findings.

2. Existing evidence on the Entry Price System

Early studies on EPS have analysed its functioning (e.g. Swinbank and Ritson, 1995; Grethe and Tangermann, 1999) and highlighted its flexibility and lesser degree of protectiveness compared to its predecessor, the Reference Price System.

More recently, Goetz and Grethe (2009) have examined the impact of the EPS on 15 products, concluding that the EPS has the greatest influence on artichokes, courgettes, cucumbers, lemons, plums, and tomatoes, and on the countries closest to the EU. Similar assessments of the EPS have been carried out by Cioffi and dell'Aquila (2004), focusing on apples, oranges, and tomatoes from countries of the Southern Hemisphere, and by Goetz and Grethe (2010) on pears and apples from China. To sum up, the influence of the EPS varies on a case-by-case basis.

As for the role of the EPS in price stabilisation, the main function of the mechanism of protection, the report by Agrosynergie (2008) concludes that the EPS acts as a stabiliser in certain cases (tomatoes from Morocco, apples from China, lemons from Turkey). Similarly, Cioffi et al. (2011) and Santeramo and Cioffi (2012) conclude that the EPS has limited price stabilisation effects.

The role of the EPS in trade flows, a side effect of the EPS, has been analysed as well. García-Álvarez-Coque et al. (2010) assess the trade effects of phasing out the supplementary tariff related to the entry price (EP) for tomatoes, cucumbers, clementines and table grapes, and conclude that the EPS has an effect only in specific periods and for few products: eliminating the EPS would increase exports of clementines (in December), Moroccan exports of cucumbers (in March and November) and tomatoes (from November to May). Similarly, the analysis by Agrosynergie (2008) on tomatoes, cucumbers, table grapes and clementines reveals that the trade effects are limited to a few months and products (e.g. November for tomatoes).

Emlinger et al. (2008) use a gravity-based approach to evaluate the sensitiveness to the EU tariffs of F&V exports from Mediterranean countries. They find that for products under the EPS, the tariffs hinder exports from Mediterranean countries, with heterogeneous impacts across exporters and periods of the year: Israel is more sensitive than Morocco to tariffs, Turkey is not sensitive to tariffs, Egypt is sensitive to tariffs only between March and October. A limitation of the study is that it does not disentangle the effects of the EPS from those of the tariffs.

Cardamone (2011) assesses the effect of different preferential trade agreements granted by the EU on imports of fresh grapes, pears, apples, oranges and mandarins, showing that the preferential EP has a positive effect on imports of oranges, but is not relevant for the other products. Kareem et al. (2017) investigate the impact of pesticide standards and of the EPS on African exports of tomatoes, oranges, limes and lemons, and show that the EPS reduces the extensive margin of trade for tomatoes, but has no effect on trade of oranges, limes, and lemons.

To sum up, while the existing literature agrees on the heterogeneous relevance of the EPS across products and exporters, and on the limited ability of the EPS to act as price stabiliser, current knowledge on the trade impacts of the EPS seems limited to few product- and country-specific cases, with contrasting evidence. For instance, Cardamone (2011) suggests the relevance of the EPS for the trade of oranges, in contrast to Kareem et al. (2017), who find no effects for the same product. It is plausible that the inference regarding the trade effects may be influenced by the type (and pros and cons) of the proxies used for the EPS. For instance, a dummy variable can capture the existence of preferential EP (e.g. Cardamone, 2011), but does not provide information about cases in which the mechanism of protection effectively works; the gap between SIVs and the EP (e.g. Kareem et al., 2017) captures the accumulation of SIVs slightly below the EP, but cannot explain the dynamics of prices over time; the tariffication of the EPS (e.g. Emlinger et al., 2008) does not capture the pricing behaviour of exporters.

A further limitation of the literature on trade effects of the EPS is that it does not take into account the issue of endogeneity between SIVs and imports. Trefler (1993) argues that treating a mechanism of protection as exogenous tends to bias the estimated impacts on imports. In the EPS, low SIVs activate the mechanism of protection and reduce imports, which in turn influences the price determination process of the SIVs: as a result, imports and SIVs are likely to be endogenous, a characteristic that we recognise and model in our empirical analysis.

3. Estimating the trade effects of the Entry Price System

3.1 Theoretical framework

Evaluations of trade policy measures frequently rely on gravity models, which explain how bilateral trade reacts to changes in income, country-specific characteristics of importers and exporters, and country-pair specific determinants of trade (Mayer et al., 2019). In line with Peterson et al. (2013) who assess the impact of phytosanitary measures on imports of F&Vs, we use a product-level gravity model to evaluate how the EPS affects F&V imports of the EU countries (i) from non-EU countries (j). We assume that all varieties of F&Vs are differentiated by their source (i and j) and are imperfect substitutes. Accordingly, consumer preferences in i are weakly separable and can be represented by a Constant Elasticity of Substitution (CES) function, with ρ being the elasticity of substitution between all varieties. We also assume perfect competition among all varieties in i and j (i.e. prices are marginal cost of production). The structural form of the gravity model is as follows[3]:

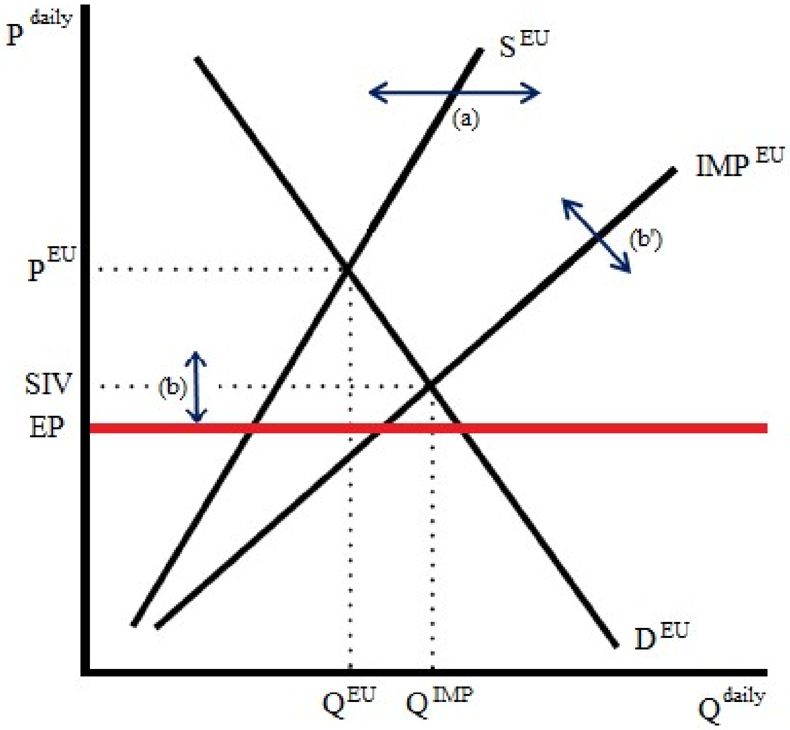
$$X_{ij} = \frac{E_i}{\Phi_i^{1-\rho}} \frac{Y_j}{\Omega_j} \theta_{ij}^{1-\rho} \qquad (1)$$

where imports of i from j (X_{ij}) depend on the total expenditure of i on imports from all J exporting countries ($E_i = \sum_J X_{ij}$), on the value of production of j ($Y_j = \sum_I X_{ij}$), on the relative price index in i ($\Phi_i^{1-\rho}$) and j (Ω_j) based on market clearing conditions (i.e. multilateral resistance terms), and on country-pair determinants of trade ($\theta_{ij}^{1-\rho}$) capturing time-invariant (e.g. distance, common language, contiguity) and time-varying factors, such as trade policy measures (i.e. EPS).

The relationship between protection and imports may be endogenously determined (Trefler 1993): low SIVs activate the mechanism of protection and reduce imports, which in turn influences the price determination process of the SIVs. Let us assume that the EU countries are price makers while non-EU countries are price takers, and the daily process of price determination in the EU market for F&Vs under the EPS occurs as shown in figure 1. The EU daily domestic supply (S^{EU}) is less elastic than the imported supply (IMP^{EU}). The EU sets a threshold entry price (EP)[4] that serves as a benchmark to establish the duty to levy on imports according to their price, the SIV[5]. When the SIVs are above the EP, the EU applies an *ad valorem* duty, whereas when SIVs are lower than the EP, the EU applies an extra duty (i.e. the difference between the EP and the SIV), augmented to the maximum tariff equivalent (MTE) when SIVs fall below 92% of the EP.

[3] Time period (t) and product (k) subscripts are initially suppressed for ease of notation.
[4] The EP, set by the EU, is a minimum import price, varying according to seasonality, product, and origin.
[5] Product- and origin-specific SIVs, a proxy of import prices, are computed daily by the European Commission (EC). The SIV is an index built as weighted average of representative prices, collected from the EU import markets.

Figure 1. The daily import price determination process under the Entry Price System.



Notes: Acronyms are domestic demand (D^{EU}), domestic supply (S^{EU}), imported supply (IMP^{EU}), domestic production (Q^{EU}), imported quantity (Q^{IMP}), entry price (EP), Standard Import Value (SIV), domestic price (P^{EU}). (a) indicates a rightward/leftward shift of domestic supply, (b') indicates a downward/upward shift of imported supply, (b) indicates a change in SIVs.

As stylised in the graph, the SIVs are influenced by the domestic price (P^{EU}), in turn determined by domestic supply and demand. Movements (figure 1,a) of the domestic supply (S^{EU}) alter the domestic price and, indirectly, influence the SIVs (figure 1,b). The SIVs (figure 1,b) are also influenced by movements (figure 1,b') of the imported supply (IMP^{EU}) that, in turn, depends on the level of the SIVs with respect to the Entry Price threshold (EP).

To sum up, the mechanism of protection is activated by the dynamics of SIVs, which are determined by the level of imports. Conversely, the level of imports depends on the dynamics of SIVs, whose position with respect to the EP may trigger the mechanism of protection.

3.2 Indexes capturing the functioning of the Entry Price System

The existing literature has proposed several approaches to investigate the functioning of the EPS. The indicators that have been adopted in recent empirical studies are summarised in table 1.

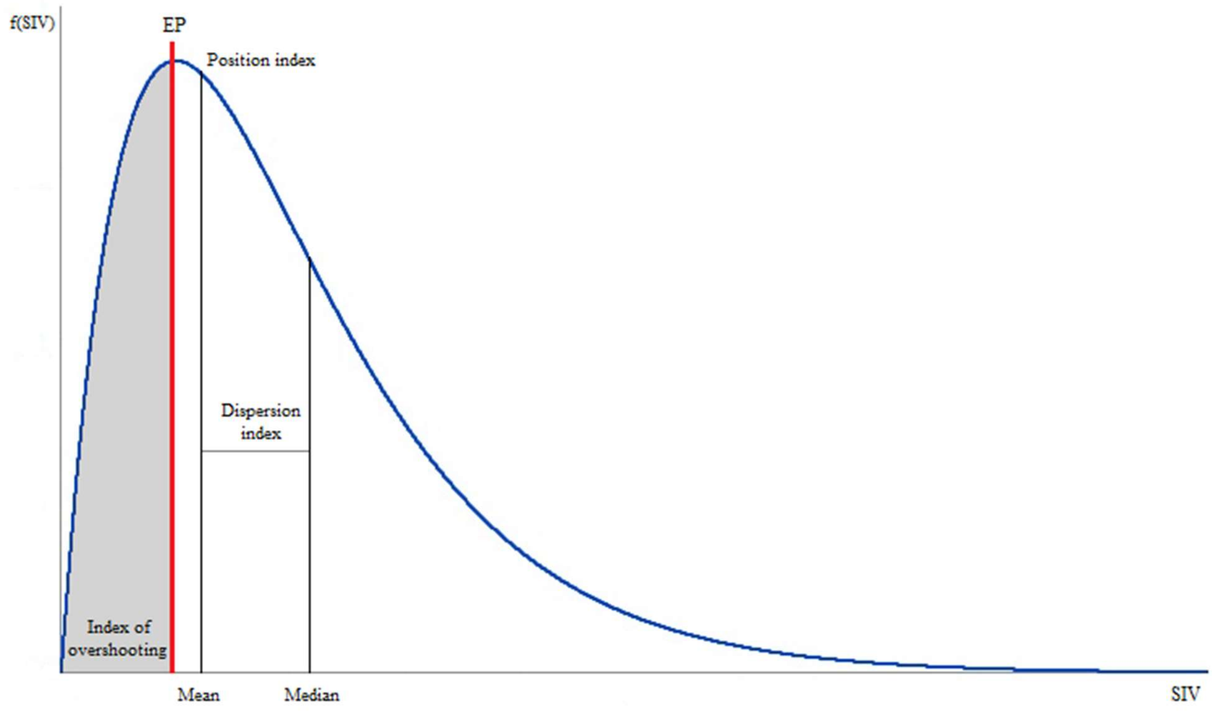
Table 1. Indexes used in the literature to capture the functioning of the Entry Price System.

Indicator	Description	References
Ad valorem equivalent (AVE)	$ad\ valorem\ tax + \frac{specific\ duty}{import\ price}$	Emlinger et al. (2008, 2010)
Dummy	1 with EP (0 otherwise)	Agrosynergie (2008), Cardamone (2011)
Share of negative gap	$\frac{GAP_{<0}}{GAP_{tot}}$	Goetz and Grethe (2009, 2010)
Distribution's 0.05-quantile of positive gap	$\ln\left(\frac{Q_{0.05}}{sd(GAP)}\right)$	
Relative gap	$-5\% \leq \frac{SIV - EP}{EP} \leq +5\%$	García Álvarez-Coque et al. (2010)
Absolute gap	$SIV - EP$	Kareem et al. (2017)

Emlinger et al. (2008, 2010) and Kareem et al. (2017) consider specific duties of the EPS and compute a global measure of tariff protection, without focusing on the pricing strategies of exporters. Agrosynergie (2008) and Cardamone (2011) use dummy variables to model the EPS, hence focusing on the relevance of the system, rather than on its effectiveness and efficacy. Goetz and Grethe (2009, 2010) and García Álvarez-Coque et al. (2010) compute the shares of negative gaps, defined as the difference between the SIV and the EP, and draw conclusions regarding the relevance of the EPS, and the accumulation of SIVs (closely) above the EP. Kareem et al. (2017) also focus on gaps to examine the pricing strategies of exporters. The literature lacks an analysis of the impacts of the EPS on import flows.

We use three indicators, based on the empirical distribution of SIVs, to draw conclusions about the functioning of the EPS (figure 2). These indicators are the number of overshoots, the position of the distribution, and the dispersion of the distribution.

Figure 2. Three indexes to capture the functioning of the Entry Price System



Notes: Acronyms are Standard Import Value (SIV) and entry price (EP).

The overshoot index is the sum of days in a month in which the SIVs are below the EP, thus representing a proxy of the number of days in which the extra duty may have been applied to imports. The position of the distribution of the SIVs provides information on the likelihood of observing SIVs below the EP: our approach extends that adopted by Cioffi and dell'Aquila (2004). The dispersion index provides information on the variability of the distribution of SIVs: *ceteris paribus*, the higher the variability, the higher the likelihood of observing SIVs below the EP.

Following the standard approach of assuming prices to be log-normally distributed with positive skewness, the first and the second moment of the distribution are enough to characterise the entire distribution of the SIVs (Goodwin and Ker, 2002). As a result, the three indicators computed are the sum of days in a month in which the SIVs are below the EP, the mean of the empirical distribution of the SIVs, and the standard deviation of the empirical distribution of the SIVs.

3.3 Empirical setting

Model (1) is estimated in its log-linearized form. In order to address the endogeneity of SIVs and imports, we estimate equation (2) for the indicators of the EPS and equation (3) for the imports (Trefler, 1993):

$$EPS'_{ij} = e^{\{\boldsymbol{\beta}_{it}+\boldsymbol{\beta}_{jt}+\boldsymbol{\beta}_{ij}+\boldsymbol{\beta}_{kt}+X_{ij}\boldsymbol{\gamma}\}} \tag{2}$$

$$X_{ij} = e^{\{\overbrace{\boldsymbol{\beta}_{it}}^{\frac{E_i}{\Phi_i^{1-\rho}}} + \overbrace{\boldsymbol{\beta}_{jt}}^{\frac{Y_j}{\Omega_j}} + \overbrace{\boldsymbol{\beta}_{ij}+\widehat{EPS}'_{ij}\boldsymbol{\delta}}^{\theta_{ij}^{1-\rho}}\}}\eta_{ij} \tag{3}$$

Equation (2) captures the effects of imports on the functioning of the EPS: the dependent variables are, alternately, the overshoot index, the position index, and the dispersion index. In particular, we use the number of days in a month in which SIVs are below the EP (‘$SIV < EP$’), the monthly average (‘$\overline{SIV}$’) of the empirical distribution of SIVs as position index, and the difference between the monthly mean and median of the SIVs (‘$\frac{\overline{SIV}-Me(SIV)}{\overline{SIV}}$’) as dispersion index. The indexes (EPS'_{ij}) are regressed against time-varying importer, exporter, and product fixed effects ($\boldsymbol{\beta}_{it}$, $\boldsymbol{\beta}_{jt}$, and $\boldsymbol{\beta}_{kt}$), country-pair fixed effects ($\boldsymbol{\beta}_{ij}$), and bilateral imports of F&Vs (X_{ij}). The regressors control for the strategic trading decisions made by importers (e.g. to avoid imports of low-priced F&Vs) and exporters (e.g. to circumvent EPS duties), for product characteristics (e.g. perishability, seasonality), and for country-pair factors (e.g. quotas, preferential EP, trade agreements).

Equation (3) captures the effects of the functioning of the EPS on imports: the dependent variable is the logarithm of imports of the *i*-th EU importer from the *j*-th non-EU exporter in a period (X_{ij}). We include time-varying importer and exporter fixed effects ($\boldsymbol{\beta}_{it}$ and $\boldsymbol{\beta}_{jt}$) to remove cross-section and time series correlation (Baldwin and Taglioni 2006), and time-invariant country-pair fixed effects ($\boldsymbol{\beta}_{ij}$) to remove the correlation between observed determinants of trade (i.e. proxies of the functioning of the EPS) and other unobserved, pair-specific determinants of trade (Mayer et al. 2019). The vector $\boldsymbol{\delta}$ contains the parameters of interest, while η_{ij} stands for an error term assumed to be independently and identically distributed.

3.4 Sensitivity analyses

Equations (2) and (3) allow us to establish the protectionist effect on imports of the EPS when the mechanism of protection is triggered. In order to separate this effect from the overall effect on imports of the EPS, specifications (2) and (3) are estimated by interacting the indexes with the number of overshoots (i.e. number of days in which SIVs are below the EP).

In order to test the robustness of our results, we use three proxies for the position index: monthly average ('$\overline{SIV}$', the baseline), monthly median value ('$Me(SIV)$'), and monthly minimum value ('$Min\{SIV\}$'). The rationale is that the higher the average (or median or minimum), the higher the likelihood that the SIVs are above the EP. We use three dispersion indexes to proxy the monthly variability of the SIVs: we compute the relative difference between the mean and the median ('$\frac{\overline{SIV}-M\ \ (SIV)}{\overline{SIV}}$', the baseline), between the mean and the minimum ('$\frac{\overline{SIV}-Min\{SIV\}}{\overline{SIV}}$'), and between the median and the minimum ('$\frac{Me(SIV)-Min\{SIV\}}{Me(SIV)}$'). The second and third dispersion indexes are more variable due to their dependence on extreme values of the distribution.

All specifications are estimated using Ordinary Least Squares (OLS). However, under heteroskedasticity, the parameters of log-linearised models estimated by OLS may lead to biased estimates of the true elasticities. Silva and Tenreyro (2006) suggest using the Poisson Pseudo-Maximum-Likelihood (PPML) estimator, which is robust to heteroskedastic errors. In a sensitivity analysis, we use the PPML estimator and compute the marginal effects for '$EPS_{ij}^{'}$' as follows: $\frac{\partial X}{\partial EP} = \left(e^{\delta} - 1\right) * 100$. Lastly, in order to identify potential heterogeneity in trade effects, we perform product-specific, country-specific and product-country-specific analyses.

3.5 Data description

The analysis includes seven out of the fifteen F&Vs covered by the EPS (apples, lemons, peaches, pears, oranges, table grapes, tomatoes), imported by direct competitors of the EU domestic production (Cioffi and dell'Aquila, 2004). We consider Southern Mediterranean countries (Egypt, Israel, Morocco, Tunisia, Turkey), emerging exporters of the Southern Hemisphere (Argentina, Brazil, Chile, New Zealand, South Africa, Uruguay), and the top global producer of F&Vs (China). By adopting a wide-ranging set of suppliers, we are able to gain a deeper understanding of the functioning of the EPS: the majority of previous studies focus on few countries, such as Southern Mediterranean countries (Emlinger et al., 2008), or African countries (Kareem et al., 2017).

We use monthly data from January 2000 to December 2014 to account for seasonality. Bilateral data are collected from Comext. Monthly average, median, and minimum values for SIVs are computed from data on daily SIVs. The descriptive statistics for the main variables are presented in table 2.

Table 2. Descriptive statistics for variables of interest, classified by product and origin.

	EU imports (€)	EP quotas (100 kg)	SIV<EP (days per month)	$\overline{SIV}$ (€/100 kg)	$\frac{\overline{SIV} - Me(SIV)}{\overline{SIV}}$
Apples					
ARG	501,276 ± (679,161)	519 ± (55)	0 ± (1)	93 ± (32)	0.006 ± (0.067)
BRA	650,189 ± (745,704)	516 ± (55)	0 ± (2)	79 ± (13)	0.002 ± (0.045)
CHL	1,993,435 ± (2,537,220)	512 ± (56)	0 ± (1)	91 ± (18)	-0.003 ± (0.042)
CHN	267,156 ± (344,729)	517 ± (55)	1 ± (2)	88 ± (23)	0.008 ± (0.063)
NZL	2,874,365 ± (5,078,921)	500 ± (54)	0 ± (0)	106 ± (23)	-0.002 ± (0.026)
TUR	6,119 ± (3,948)	496 ± (53)	0 ± (1)	84 ± (21)	0.021 ± (0.061)
URY	94,629 ± (92,625)	537 ± (50)	1 ± (2)	74 ± (22)	-0.001 ± (0.053)
ZAF	2,725,572 ± (5,186,457)	508 ± (55)	0 ± (0)	98 ± (21)	0.002 ± (0.044)
Lemons					
ARG	2,453,705 ± (3,361,334)	0 ± (0)	4 ± (6)	68 ± (24)	0.002 ± (0.034)
BRA	62,250 ± (74,748)	0 ± (0)	3 ± (4)	69 ± (32)	-0.007 ± (0.024)
CHL	306,374 ± (436,856)	0 ± (0)	0 ± (1)	91 ± (32)	-0.004 ± (0.036)
EGY	31,082 ± (39,170)	0 ± (0)	1 ± (2)	62 ± (14)	0.021 ± (0.072)
ISR	57,401 ± (70,362)	0 ± (0)	0 ± (0)	81 ± (28)	0.007 ± (0.032)
MAR	60,730 ± (78,656)	0 ± (0)	2 ± (4)	69 ± (31)	0.003 ± (0.056)
TUR	274,223 ± (496,906)	0 ± (0)	1 ± (3)	68 ± (20)	0.006 ± (0.045)
URY	325,919 ± (277,878)	0 ± (0)	3 ± (5)	72 ± (25)	-0.006 ± (0.061)
ZAF	509,543 ± (845,028)	0 ± (0)	2 ± (4)	76 ± (23)	0.008 ± (0.036)
Peaches					

ISR	147,100 ± (204,873)	0 ± (0)	0 ± (1)	146 ± (48)	0.001 ± (0.046)
MAR	197,306 ± (294,909)	0 ± (0)	0 ± (0)	250 ± (118)	0.000 ± (0.000)
TUR	65,267 ± (133,013)	0 ± (0)	0 ± (0)	130 ± (24)	0.000 ± (0.018)
Pears					
ARG	2,212,978 ± (5,015,143)	523 ± (55)	0 ± (1)	95 ± (39)	0.008 ± (0.065)
CHL	738,424 ± (1,312,529)	522 ± (55)	0 ± (2)	92 ± (38)	0.010 ± (0.042)
CHN	53,150 ± (45,024)	534 ± (51)	2 ± (3)	68 ± (21)	0.022 ± (0.074)
NZL	57,714 ± (64,148)	479 ± (45)	0 ± (0)	145 ± (33)	-0.024 ± (0.039)
TUR	18,314 ± (15,352)	512 ± (56)	0 ± (0)	118 ± (30)	-0.005 ± (0.036)
URY	204,197 ± (267,332)	568 ± (0)	0 ± (1)	74 ± (25)	-0.013 ± (0.031)
ZAF	1,111,728 ± (1,318,015)	517 ± (55)	0 ± (0)	94 ± (20)	-0.0001 ± (0.029)
Oranges					
BRA	894 ± (1,627)	0 ± (0)	2 ± (4)	35 ± (15)	-0.002 ± (0.020)
EGY	1,144,593 ± (1,855,518)	349,200 ± (11,290)	0 ± (1)	49 ± (8)	0.002 ± (0.042)
ISR	301,390 ± (459,475)	2,000,000 ± (0)	0 ± (0)	68 ± (11)	0.001 ± (0.027)
MAR	682,989 ± (743,840)	3,001,789 ± (10,914)	0 ± (0)	56 ± (12)	0.004 ± (0.051)
TUN	1,411,363 ± (1,409,098)	0 ± (0)	0 ± (1)	54 ± (11)	0.019 ± (0.038)
TUR	156,334 ± (419,188)	0 ± (0)	0 ± (1)	62 ± (8)	-0.008 ± (0.044)
ZAF	176,227 ± (525,223)	0 ± (0)	1 ± (2)	56 ± (15)	0.005 ± (0.063)
Table grapes					
BRA	3,175,246 ± (5,012,636)	0 ± (0)	0 ± (0)	224 ± (82)	-0.002 ± (0.054)
CHL	88,049 ± (84,212)	0 ± (0)	1 ± (1)	104 ± (46)	0.020 ± (0.073)
EGY	1,261,256 ± (3,353,810)	0 ± (0)	0 ± (0)	145 ± (35)	0.007 ± (0.065)
ISR	465,410 ± (726,704)	0 ± (0)	0 ± (0)	148 ± (29)	0.005 ± (0.045)
MAR	1,058,288 ± (1,096,498)	0 ± (0)	0 ± (0)	147 ± (38)	0.006 ± (0.060)
TUN	56,345 ± (94,766)	0 ± (0)	0 ± (0)	189 ± (45)	-0.008 ± (0.016)
TUR	376,704 ± (631,111)	0 ± (0)	0 ± (0)	120 ± (27)	0.003 ± (0.035)
ZAF	509,490 ± (686,255)	0 ± (0)	0 ± (0)	138 ± (106)	-0.009 ± (0.035)
Tomatoes					
BRA	3,101 ± (231)	0 ± (0)	3 ± (2)	32 ± (0)	0.000 ± (0.000)
ISR	486,679 ± (738,819)	0 ± (0)	1 ± (2)	129 ± (41)	0.013 ± (0.095)

MAR	5,385,051 ± (9,730,080)	248,545 ± (108,470)	5 ± (6)	64 ± (20)	0.020 ± (0.061)
TUN	467,422 ± (555,870)	0 ± (0)	2 ± (4)	112 ± (24)	0.002 ± (0.053)
TUR	143,386 ± (233,845)	0 ± (0)	4 ± (5)	88 ± (24)	0.016 ± (0.047)

Notes: Standard deviations are in parentheses. Acronyms: Argentina (ARG), Brazil (BRA), Chile (CHL), China (CHN), Egypt (EGY), Israel (ISR), Morocco (MAR), New Zealand (NZL), South Africa (ZAF), Tunisia (TUN), Turkey (TUR), Uruguay (URY).

4. Results

Table 3 presents the results for equation (3) and allows us to disentangle the benchmark effects due to the number of days in which the SIVs are below the EP (overshoots) from those specific to the level and variability of SIVs, interacted with the number of overshoots. The results of the EPS equation in (2), simultaneously estimated with the import equation in (3), are reported in the appendix.

Table 3. Standard import values (SIVs) below entry price (EP) reduces imports; imports increase with higher level of SIVs, and decrease with variable SIVs.

Variables	Overshoots	Level of SIVs	Variability of SIVs
Overshoot index ($SIV < EP$)	-0.180 ***	-0.261 ***	0.0003
	(0.059)	(0.063)	(0.059)
Position index ($(SIV < EP) * \overline{SIV}$)		0.015 ***	
		(0.004)	
Dispersion index ($(SIV < EP) * \frac{\overline{SIV} - Me(SIV)}{SIV}$)			-9.391 ***
			(0.557)
Time-varying importer f.e.	Yes	Yes	Yes
Time-varying exporter f.e.	Yes	Yes	Yes
Country-pair f.e.	Yes	Yes	Yes
Constant	12.460 ***	12.530 ***	12.240 ***
	(0.475)	(0.475)	(0.465)
Observations	6,485	6,485	6,485
R-squared	0.369	0.371	0.397

Notes: Standard errors are in parentheses. *** indicates statistical significance at 1%.

The overshoot index has a negative effect on imports: the more days in which SIVs are below the EP, the lower the imports, with a marginal reduction of 0.2 percent for a 1 percent increase in the number of days. The position index, proxying the level of SIVs, is positively correlated with imports: the larger the values of SIVs, the larger the imports. The dispersion index is negatively correlated with imports: the greater the variability of SIVs, the lower the imports.

The EPS acts as a barrier to F&V imports from non-EU countries when it effectively works; that is when SIVs falls below the EP and the extra duty is applied. In particular, the higher the SIVs, the lower the likelihood of having SIVs below the EP, and the higher the imports; the more variable the SIVs, the higher the likelihood of having SIVs below the EP, and the lower the imports.

In line with Trefler (1993), who suggests that treating mechanisms of protection as exogenously-set policy instruments yields downward-biased estimates of the impact of protection on imports, estimating the import equation in (3) as a single equation leads to lower estimated coefficients. For instance, the coefficient estimated for the dispersion index in a single equation is much lower than the same coefficient estimated simultaneously with the EPS equation (see appendix for further details).

In order to control for heteroskedasticity, we estimate the import equation in (3) through a PPML estimator (Silva and Tenreyro, 2006), and report the results in the appendix. The OLS and the PPML estimates are similar in terms of signs and statistical significance, but the RESET test indicates the presence of heteroskedasticity.

In order to draw conclusions regarding the overall effect on imports of the EPS, and regarding the protectionist effect on imports, when the EPS is triggered, we simultaneously estimate the EPS equation in (2) and the import equation in (3) by interacting the indexes with the number of overshoots. A comparison with results shown in table 3 is available in the appendix. The overshoots reduce imports: a 1 percent increase in the number of days in which SIVs are below the EP reduces imports by 0.3 percent. By interacting the indexes with the number of overshoots, we find lower estimates: a 1 percent increase in average SIVs increases imports by 0.015 percent. When the analysis is not controlling for the number of overshoots, the equivalent increase is 1.059 percent. Similarly, the higher the variability of SIVs, the lower the imports: the equivalent marginal reduction is 9 percent by interacting the indexes with the number of overshoots, and 19 percent without interaction term.

Our results are robust to different econometric specifications that control for alternative measures of the level and the variability of SIVs. The results, omitted for brevity, are reported in the appendix. As for the level of SIVs, the greatest coefficients are estimated for the position indexes proxied by minimum SIV: a 1 percent increase in the minimum value of SIVs raises imports by 0.017 (1.253) percent in periods in which the SIVs are below the EP (not limited to periods in which SIVs are below the EP). It is plausible to suppose that the higher the minimum value of SIVs, the higher the likelihood that SIVs will be above the EP. As for the variability of SIVs, the greatest impacts are found for the dispersion index computed as relative difference between the mean and the median: the marginal decrease in imports is 9 percent in periods in which SIVs are below the EP, and 19 percent without interacting the variable with the number of overshoots. Notably, the relative difference between the mean and the median is a better proxy for skewness than the dispersion index computed as relative difference between the mean and the minimum: the larger the difference between average and median SIVs, the greater the likelihood of having (frequent) low-priced imports. Higher values for the dispersion indexes indicate higher volatility of SIVs, which are more likely to fall below the EP.

The results of analyses by products, reported in table 4[6], show the regularity of the trade effects of the EPS.

[6] The results of analyses by countries and different combinations of product and country are omitted for brevity, but are available in the appendix.

Table 4. Product-specific analysis: Standard import values (SIVs) lower than entry price (EP) reduces imports; if SIVs are below EP, imports decrease with higher and more variable SIVs.

	Overshoots		Level		Variability	
Variables	$SIV < EP$		$(SIV < EP) * \overline{SIV}$		$(SIV < EP) * \frac{\overline{SIV} - Me(SIV)}{\overline{SIV}}$	
Apples	-0.280	***	-0.145	***	-51.300	***
	(0.085)		(0.018)		(1.488)	
Lemons	-0.339	***	-0.017	***	-34.320	***
	(0.084)		(0.005)		(1.085)	
Peaches	-1.075	***	0.024		-27.320	***
	(0.146)		(0.090)		(4.643)	
Pears	-0.507	***	-0.100	***	-92.070	***
	(0.096)		(0.049)		(4.728)	
Oranges	-0.274	***	0.002		-13.930	***
	(0.082)		(0.020)		(1.127)	
Table grapes	-0.039		-0.054	**	-19.140	***
	(0.077)		(0.021)		(1.512)	
Tomatoes	0.140	*	0.042	***	-3.083	***
	(0.074)		(0.005)		(0.533)	
$SIV < EP$	No		-0.235	***	-0.170	***
			(0.067)		(0.054)	
Time-varying importer f.e.	Yes		Yes		Yes	
Time-varying exporter f.e.	Yes		Yes		Yes	
Country-pair f.e.	Yes		Yes		Yes	
Constant	12.540	***	12.500	***	12.320	***
	(0.473)		(0.470)		(0.419)	
Observations	6,485		6,485		6,485	
R-squared	0.382		0.385		0.511	

Notes: Standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

The coefficients estimated for the overshoot index are negative in all but one case (tomatoes, for which imports are positively correlated with the regressor). Put differently, in all but one specific case, the higher the number of days in which SIVs are low (below the trigger), the lower the imports of low-priced F&Vs from non-EU countries. The EPS is relevant for peaches, apples, pears, lemons, and oranges. Our results are in line with Goetz and Grethe (2009), who highlight the relevance of the EPS for apples, pears, and oranges. However, our findings differ from the evidence provided by Cioffi and dell'Aquila (2004), who find no relevance of the EPS for oranges, and by Cardamone (2011), who suggest a positive effect of the EPS on imports of oranges. The divergences are partly due to the differences in the methodological approaches: Cioffi and dell'Aquila (2004) limit their analysis to descriptive statistics and conclude that the EPS is not effective for oranges as the imports occur in periods in which the EPS is not working (late spring and summer); Cardamone (2011) uses a dummy variable approach that may oversimplify the complexity of the policy intervention.

The higher the level of the SIVs, the lower the imports, with the exception of tomatoes (+ 0.042%). We observe that higher SIVs boost the negative effects of the EPS for imports of less perishable F&Vs (e.g. apples, pears, oranges). Our findings are in line with previous studies: Emlinger et al. (2008, 2010) suggest that the relevance of the EPS depends on the perishability of the products in question. These patterns point to the existence of strategic behaviour: when the SIVs are below the EP, importers may delay imports of less perishable F&Vs until SIVs once again rise above the EP, a strategy that deprives the EPS of its efficacy (Goetz and Grethe, 2009; Cioffi et al., 2011).

In all cases, we found that large variability of SIVs hinders imports of F&Vs: these results are in line with the overall effect of the variability of SIVs (see table 3).

To sum up, the EPS is a barrier to trade of F&Vs: low-priced imports decrease when SIVs are below the EP, with the strongest effects observed on imports of less perishable F&Vs.

4. Concluding remarks and policy implications

The European fruit and vegetables (F&Vs) market is governed by a complex and widely-debated set of regulations. In particular, the Entry Price System (EPS), which attempts to control imports by setting a minimum price for imported goods, has been under the spotlight due to its doubtful effectiveness in limiting trade and stabilising the domestic market. The intervention requires daily monitoring of the SIVs in representative markets: this procedure makes the EPS expensive, complex, and of questionable usefulness (Goetz and Grethe, 2009; Santeramo and Cioffi, 2012). We investigated the extent to which the EPS affects imports of F&Vs from major suppliers, focusing on novel indicators: the frequency of overshoots, the level of the SIVs, and the variability of the SIVs.

We found the EPS to be an effective trade barrier that contributes to limiting imports of low-priced F&Vs. On average, for each day of overshoot, imports decrease by 0.2 percent. The imports of less perishable F&Vs (e.g. apples, pears, and oranges) are the most affected. The negative relationships we found between imports and the level (and variability) of SIVs suggest that suppliers may tend to adopt strategic behaviours in order to (temporarily) reduce imports, until SIVs once again rise above the threshold EP. While these strategies have been hypothesised in previous studies (García Álvarez-Coque et al., 2010; Cioffi et al., 2011), our analysis quantifies their impact in terms of trade values.

The barrier effect of the EPS for imports of F&Vs, revealed by our analysis, calls attention to the effectiveness of this measure and the usefulness of keeping it in force. This is particularly relevant for regional trade negotiations involving the EU. For example, Márquez-Ramos and Martinez-Gomez (2018) recently pointed out that Australian producers may be left out in the cold in the Australia-EU Free Trade Agreement if they do not benefit from preferences similar to those granted to other exporters (e.g. EU preferential partners located in North Africa and the Middle East). A notable feature of the ongoing Australia-EU and New Zealand-EU trade negotiations is that the respective growing seasons do not coincide; as such, there is certain market potential for negotiating trade preferences in less perishable F&Vs. Our findings support the bilateral negotiations of agricultural trade preferences. As for multilateral trade integrations, the fact that the Gate Price System (GPS) in Japan and the EPS in the EU are similar protection mechanisms may provide some fodder for discussion within the T20 Task Force on "Trade, Investment and Globalisation" during the Japanese G20 Presidency in 2019. Topics in this Task Force include advising policy-makers to take informed decisions that strengthen and improve the world trade system. The G20 can help to drive progress in the multilateral trade agenda (Cheng, 2018), which may include better worldwide market access in agriculture. Importantly, this research has implications related to the trade facilitation literature. The Trade Facilitation Agreement of the World Trade Organisation (WTO) entered into force in February 2017, but further policy discussion on agricultural trade facilitation is needed. Wilson et al. (2005) have examined the benefits of trade facilitation, while Márquez-Ramos et al. (2012) have shown that, as with trade in manufacturing sectors, trade impediments for agri-food products have a strong negative effect on international trade. However, many more procedures and barriers that hinder trade among countries persist in agri-food than in manufacturing sectors. Therefore, gaining a better understanding of the overall consequences of a non-tariff barrier such as the EPS for agricultural trade among countries, which has been the main aim of this research, is of great policy relevance.

Further related research might focus on the analysis of the dynamics of the SIVs mechanism over time. In addition, access to firm-level and transaction data might shed light on other interesting issues, such as the strategy of the exporters, who can wait for a higher SIV to enter into the European market.

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Appendix

Table A.1. The Entry Price System (EPS) vs. the Gate Price System (GPS).

	EPS	GPS
Area of implementation	EU	Japan
Markets	Fruit and vegetables	Meat
Commodity	Apples, apricots, cherries, clementines, lemons, mandarins, oranges, peaches (including nectarines), pears, plums, table grapes, artichokes, courgettes, cucumbers, tomatoes	Pork
Entry into force	1995	1971
Previous regime	Reference Price System	Quota system
Import value	Standard Import Value (SIV): proxy of import price, computed daily by the European Commission	Standard Import Price (SIP): 482.5 yen/kg, fixed by the government as the arithmetic average between upper stabilisation price (515 yen/kg) and lower stabilisation price (450 yen/kg)
Threshold price	Entry Price (EP): set by the government, variable according to product, supplier, seasonality	Gate Price (GP): Fixed SIP/1.05 = 459.5 yen/kg
Import tariff	Variable: *ad valorem* tariff with SIVs<EP *ad valorem* tariff + (EP-SIV) with EP<SIVs<0.92EP *ad valorem* tariff + MTE with SIVs<0.92EP	Mixed: 5% *ad valorem* tariff Variable levy = GP – CIF price

Source: Cioffi and dell'Aquila (2004) and Godo (2014).

Table A.2. Ordinary Least Squares (OLS) estimation of the EPS equation: a rise in imports lowers the variability of the Standard Import Values (SIVs).

Variables	Overshoots	Level	Variability	
Log of imports	-0.010	-0.085	-0.007	***
	(0.015)	(0.075)	(0.001)	
Time-varying importer f.e.	Yes	Yes	Yes	
Time-varying exporter f.e.	Yes	Yes	Yes	
Country-pair f.e.	Yes	Yes	Yes	
Time-varying product f.e.	Yes	Yes	Yes	
Constant	0.946	1.027	0.074	
	(0.581)	(2.882)	(0.055)	
Observations	1,346	6,485	6,485	
R-squared	0.533	0.464	0.132	

Notes: Standard errors are in parentheses. *** indicates statistical significance at 1%.

Table A.3. Ordinary Least Squares (OLS) estimation of the import equation in a single equation.

Variables	1		2		3	
Overshoot Index $(SIV < EP)$	-0.001		-0.197		0.051	
	(0.059)		(0.131)		(0.060)	
Position index $((SIV < EP) * \overline{SIV})$			0.010	*		
			(0.006)			
Dispersion index $((SIV < EP) * \frac{\overline{SIV} - Me(SIV)}{\overline{SIV}})$					-0.418	***
					(0.109)	
Time-varying importer f.e.	Yes		Yes		Yes	
Time-varying exporter f.e.	Yes		Yes		Yes	
Country-pair f.e.	Yes		Yes		Yes	
Constant	8.851	***	8.880	***	8.644	***
	(1.191)		(1.190)		(1.185)	
Observations	1,346		1,346		1,346	
R-squared	0.654		0.655		0.659	

Notes: Standard errors are in parentheses. *** and * indicate statistical significance at 1% and 10%.

Table A.4. Poisson Pseudo-Maximum Likelihood (PPML) estimation of the import equation in a single equation.

Variables	1			2			3		
Overshoot Index $(SIV < EP)$	-0.014	***	[-1.39%]	-0.021	***	[-2.08%]	0.001		
	(0.005)			(0.006)			(0.005)		
Position index $((SIV < EP) * \overline{SIV})$				0.001	***	[0.10%]			
				(0.0003)					
Dispersion index $((SIV < EP) * \frac{\overline{SIV} - Me(SIV)}{\overline{SIV}})$							-0.796	***	[-54.89%]
							(0.059)		
Time-varying importer f.e.	Yes			Yes			Yes		
Time-varying exporter f.e.	Yes			Yes			Yes		
Country-pair f.e.	Yes			Yes			Yes		
Constant	2.514	***		2.520	***		2.495	***	
	(0.024)			(0.024)			(0.023)		
Observations	6,483			6,483			6,483		
R-squared	0.370			0.372			0.397		

Notes: Robust standard errors are in parentheses. *** indicates statistical significance at 1%. Marginal effects are in brackets

Table A.5. Ordinary Least Squares (OLS) estimation of the EPS equation without (and with) interacting the variable with the number of overshoots.

Variables	Level of SIVs		Variability of SIVs	
	Without interaction term	With interaction term	Without interaction term	With interaction term
Log of imports	0.008 ***	-0.085	-0.0005	-0.007 ***
	(0.002)	(0.075)	(0.0003)	(0.001)
Time-varying importer f.e.	Yes	Yes	Yes	Yes
Time-varying exporter f.e.	Yes	Yes	Yes	Yes
Country-pair f.e.	Yes	Yes	Yes	Yes
Time-varying product f.e.	Yes	Yes	Yes	Yes
Constant	4.387 ***	1.027	-0.002	0.074
	(0.059)	(2.882)	(0.012)	(0.055)
Observations	6,485	6,485	6,485	6,485
R-squared	0.684	0.464	0.133	0.132

Notes: Standard errors are in parentheses. *** indicates statistical significance at 1%.

Table A.6. Ordinary Least Squares (OLS) estimation of the import equation: the estimated effects of the level and the variability of Standard Import Values (SIVs) are lower when the estimation is limited to periods in which SIVs are below the entry price (EP) than when the estimation is not limited.

Variables	Level of SIVs				Variability of SIVs			
	Without interaction term		With interaction term		Without interaction term		With interaction term	
Index of overshoots $(SIV < EP)$	-0.315	***	-0.261	***	-0.196	***	0.0003	
	(0.061)		(0.063)		(0.059)		(0.059)	
Position index $(\overline{SIV})$	1.059	***						
	(0.110)							
Position index $((SIV < EP) * \overline{SIV})$			0.015	***				
			(0.004)					
Dispersion index $(\frac{\overline{SIV} - Me(SIV)}{\overline{SIV}})$					-19.120	***		
					(3.019)			
Dispersion index $((SIV < EP) * \frac{\overline{SIV} - Me(SIV)}{\overline{SIV}})$							-9.391	***
							(0.557)	
Time-varying importer f.e.	Yes		Yes		Yes		Yes	
Time-varying exporter f.e.	Yes		Yes		Yes		Yes	
Country-pair f.e.	Yes		Yes		Yes		Yes	
Constant	7.809	***	12.530	***	12.320	***	12.240	***
	(0.676)		(0.475)		(0.474)		(0.465)	
Observations	6,485		6,485		6,485		6,485	
R-squared	0.379		0.371		0.373		0.397	

Notes: Standard errors are in parentheses. *** indicates statistical significance at 1%.

Table A.7. Ordinary Least Squares (OLS) estimation of the EPS equation, using different position indexes.

Variables	Without interaction term			With interaction term		
	$\overline{SIV}$	$Me(SIV)$	$Min\{SIV\}$	$(SIV < EP) * \overline{SIV}$	$(SIV < EP) * Me(SIV)$	$(SIV < EP) * Min\{SIV\}$
Log of imports	0.008 ***	0.009	0.014 ***	-0.085	-0.077	-0.064
	(0.002)	(0.002)	(0.002)	(0.075)	(0.075)	(0.070)
Time-varying importer f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time-varying exporter f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time-varying product f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.387 ***	4.386 ***	4.206 ***	1.027	0.944	0.748
	(0.059)	(0.062)	(0.068)	(2.882)	(2.867)	(2.706)
Observations	6,485	6,485	6,485	6,485	6,485	6,485
R-squared	0.684	0.664	0.657	0.464	0.465	0.461

Notes: Standard errors are in parentheses. *** indicates statistical significance at 1%.

Table A.8. Ordinary Least Squares (OLS) estimation of the import equation, using different position indexes

Variables	Without interaction term			With interaction term		
	$\overline{SIV}$	$Me(SIV)$	$Min\{SIV\}$	$(SIV < EP) * \overline{SIV}$	$(SIV < EP) * Me(SIV)$	$(SIV < EP) * Min\{SIV\}$
$SIV < EP$	-0.315 ***	-0.321 ***	-0.305 ***	-0.261 ***	-0.264 ***	-0.268 ***
	(0.061)	(0.061)	(0.060)	(0.063)	(0.063)	(0.063)
$\overline{SIV}$	1.059 ***					
	(0.110)					
$Me(SIV)$		1.102 ***				
		(0.110)				
$Min\{SIV\}$			1.253 ***			
			(0.105)			
$(SIV < EP) * \overline{SIV}$				0.015 ***		
				(0.004)		
$(SIV < EP) * Me(SIV)$					0.016 ***	
					(0.004)	
$(SIV < EP) * Min\{SIV\}$						0.017 ***
						(0.004)
Time-varying importer f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time-varying exporter f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.809 ***	7.609 ***	7.056 ***	12.530 ***	12.530 ***	12.540 ***

	(0.676)	(0.677)	(0.653)	(0.475)	(0.475)	(0.475)
Observations	6,485	6,485	6,485	6,485	6,485	6,485
R-squared	0.379	0.379	0.383	0.371	0.371	0.371

Notes: Standard errors are in parentheses. *** indicates statistical significance at 1%.

Table A.9. Ordinary Least Squares (OLS) estimation of the EPS equation, using different dispersion indexes.

	Without interaction term			With interaction term		
Variables	$\frac{\overline{SIV}-Me(SIV)}{\overline{SIV}}$	$\frac{\overline{SIV}-Min\{SIV\}}{\overline{SIV}}$	$\frac{Me(SIV)-Min\{SIV\}}{Me(SIV)}$	$(SIV<EP)*\frac{\overline{SIV}-Me(SIV)}{\overline{SIV}}$	$(SIV<EP)*\frac{\overline{SIV}-Min\{SIV\}}{\overline{SIV}}$	$(SIV<EP)*\frac{Me(SIV)-Min\{SIV\}}{Me(SIV)}$
Log of imports	-0.0005	-0.003 ***	-0.003 ***	-0.007 ***	-0.014 ***	-0.008 *
	(0.0003)	(0.001)	(0.001)	(0.001)	(0.005)	(0.004)
Time-varying importer f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time-varying exporter f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time-varying product f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.002	0.145 ***	0.143 ***	0.074	0.199	0.137
	(0.012)	(0.028)	(0.030)	(0.055)	(0.181)	(0.172)
Observations	6,485	6,485	6,485	6,485	6,485	6,485
R-squared	0.133	0.283	0.255	0.132	0.438	0.436

Notes: Standard errors are in parentheses. *** and * indicate statistical significance at 1% and 10%.

Table A.10. Ordinary Least Squares (OLS) estimation of the import equation, using different dispersion indexes

	Without interaction term			With interaction term		
Variables	$\frac{\overline{SIV}-Me(SIV)}{\overline{SIV}}$	$\frac{\overline{SIV}-Min\{SIV\}}{\overline{SIV}}$	$\frac{Me(SIV)-Min\{SIV\}}{Me(SIV)}$	$(SIV < EP) * \frac{\overline{SIV}-Me(SIV)}{\overline{SIV}}$	$(SIV < EP) * \frac{\overline{SIV}-Min\{SIV\}}{\overline{SIV}}$	$(SIV < EP) * \frac{Me(SIV)-Min\{SIV\}}{Me(SIV)}$
$SIV < EP$	-0.196 ***	-0.053	-0.087	0.0003	-0.183 ***	-0.226 ***
	(0.059)	(0.061)	(0.062)	(0.059)	(0.064)	(0.064)
$\frac{\overline{SIV}-Me(SIV)}{\overline{SIV}}$	-19.120 ***					
	(3.019)					
$\frac{\overline{SIV}-Min\{SIV\}}{\overline{SIV}}$		-5.958 ***				
		(0.735)				
$\frac{Me(SIV)-Min\{SIV\}}{Me(SIV)}$			-4.256 ***			
			(0.754)			
$(SIV < EP) * \frac{\overline{SIV}-Me(SIV)}{\overline{SIV}}$				-9.391 ***		
				(0.557)		
$(SIV < EP) * \frac{\overline{SIV}-Min\{SIV\}}{\overline{SIV}}$					0.009	
					(0.071)	
$(SIV < EP) * \frac{Me(SIV)-Min\{SIV\}}{Me(SIV)}$						0.155 **
						(0.076)
Time-varying importer f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time-varying exporter f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Constant	12.320 ***	12.950 ***	12.840 ***	12.240 ***	12.460 ***	12.490 ***
	(0.474)	(0.476)	(0.479)	(0.465)	(0.475)	(0.475)

Observations	6,485	6,485	6,485	6,485	6,485	6,485
R-squared	0.373	0.376	0.373	0.397	0.369	0.370

Notes: Standard errors are in parentheses. *** and ** indicate statistical significance at 1% and 5%.

Table A.11. Country-specific analysis: in most cases, Standard Import Values (SIVs) lower than entry price (EP) reduce imports; if SIVs are below EP, imports decrease with higher and more variable SIVs.

	Overshoot index		Level		Variability	
Variables	$SIV < EP$		$(SIV < EP) * \overline{SIV}$		$(SIV < EP) * \frac{\overline{SIV} - Me(SIV)}{\overline{SIV}}$	
ARG	0.167		0.037	***	-37.590	***
	(0.161)		(0.009)		(2.723)	
BRA	-0.549	***	-0.074	***	-54.700	***
	(0.200)		(0.024)		(3.398)	
CHL	-0.844	***	-0.573	***	-81.550	***
	(0.221)		(0.058)		(3.943)	
CHN	-0.212		-0.200	*	-94.500	***
	(0.261)		(0.105)		(7.123)	
EGY	1.610	***	-0.362	***	-49.310	***
	(0.301)		(0.042)		(3.364)	
ISR	0.069		0.053	***	-0.077	
	(0.255)		(0.012)		(1.350)	
MAR	0.613	***	0.092	***	3.480	***
	(0.185)		(0.009)		(1.005)	
NZL	-2.706	***	-0.659	***	-122.700	***
	(0.677)		(0.157)		(6.406)	
ZAF	-0.711	***	-0.057	***	-40.550	***
	(0.133)		(0.008)		(2.111)	
TUN	-0.737		-0.028		-9.153	***
	(0.451)		(0.018)		(1.981)	
TUR	-0.357	***	0.016	**	-5.587	***
	(0.121)		(0.008)		(0.756)	
URY	0.662	**	0.047	***	-20.540	***
	(0.269)		(0.013)		(4.135)	
$SIV < EP$	No		-0.233	***	-0.088	*

			(0.063)		(0.053)	
Time-varying importer f.e.	Yes		Yes		Yes	
Time-varying exporter f.e.	Yes		Yes		Yes	
Country-pair f.e.	Yes		Yes		Yes	
Constant	12.160	***	12.560	***	11.990	***
	(0.488)		(0.461)		(0.416)	
Observations	6,485		6,485		6,485	
R-squared	0.381		0.409		0.519	

Notes: Standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10%. Acronyms are: Argentina (ARG), Brazil (BRA), Chile (CHL), China (CHN), Egypt (EGY), Israel (ISR), Morocco (MAR), New Zealand (NZL), South Africa (ZAF), Tunisia (TUN), Turkey (TUR), Uruguay (URY).

Table A.12. Analysis by different combinations of products and countries: Standard Import Values (SIVs) lower than entry price (EP) reduces imports; if SIVs are below EP, imports decrease with higher and more variable SIVs.

	Overshoot index	Level	Variability
Variables	$SIV < EP$	$(SIV < EP) * \overline{SIV}$	$(SIV < EP) * \frac{\overline{SIV} - Me(SIV)}{\overline{SIV}}$
ARG (apples)	-0.089	-0.143 *	-58.630 ***
	(0.173)	(0.081)	(3.772)
BRA (apples)	-0.164	-0.212 *	-71.850 ***
	(0.290)	(0.118)	(4.838)
CHL (apples)	-0.595 **	-0.732 ***	-117.700 ***
	(0.246)	(0.141)	(4.866)
CHN (apples)	-0.152	-0.479 ***	-100.000 ***
	(0.403)	(0.148)	(7.122)
NZL (apples)	-1.061	-0.509 ***	-123.700 ***
	(0.840)	(0.168)	(6.191)
ZAF (apples)	-0.639 ***	-0.143 ***	-31.860 ***
	(0.153)	(0.043)	(3.259)
TUR (apples)	0.047	0.166 ***	12.350
	(0.498)	(0.043)	(9.906)
URY (apples)	0.246	-0.038	-25.800 ***
	(0.299)	(0.042)	(4.192)
ARG (lemons)	0.349 **	-0.005	-35.060 ***
	(0.162)	(0.021)	(2.591)
BRA (lemons)	-1.723 *	-0.045	-88.790 ***
	(0.961)	(0.050)	(13.910)
CHL (lemons)	-2.172 ***	-0.774 ***	-36.590 ***
	(0.354)	(0.103)	(6.843)
EGY (lemons)	-2.693 ***	-0.423 ***	-58.900 ***
	(0.498	(0.043)	(3.385)
ISR (lemons)	-0.013	-0.297 ***	-13.560 ***

	(0.439)		(0.087)		(4.227)	
MAR (lemons)	-4.010	***	-0.241	***	-29.150	***
	(0.379)		(0.062)		(2.920)	
ZAF (lemons)	-1.345	***	-0.041	***	-52.560	***
	(0.177)		(0.010)		(3.553)	
TUR (lemons)	0.087		0.006		-35.500	***
	(0.198)		(0.020)		(2.888)	
URY (lemons)	0.815	***	0.032	**	-21.150	***
	(0.264)		(0.015)		(3.898)	
ISR (peaches)	-0.638		0.273	**	19.000	**
	(0.518)		(0.115)		(7.976)	
MAR (peaches)	-2.796	***	-0.641	*	-40.530	***
	(0.574)		(0.328)		(7.366)	
TUR (peaches)	-1.080	***	-0.450	***	-49.860	***
	(0.172)		(0.157)		(7.479)	
ARG (pears)	0.035		-0.067		-84.490	***
	(0.196)		(0.226)		(9.194)	
CHL (pears)	-1.123	***	-0.517	***	-126.300	***
	(0.256)		(0.169)		(10.980)	
CHN (pears)	-0.221		-0.284	***	-104.000	***
	(0.245)		(0.109)		(8.566)	
NZL (pears)	-2.690	***	-2.035	***	-164.600	***
	(0.636)		(0.443)		(27.500)	
ZAF (pears)	0.127		0.848	***	-144.700	***
	(0.204)		(0.207)		(13.700)	
TUR (pears)	-1.436	***	-0.260		-105.000	***
	(0.222)		(0.170)		(11.670)	
URY (pears)	0.067		0.343		-53.540	
	(0.615)		(0.835)		(55.550)	
BRA (oranges)	-7.967	***	-0.699	***	-76.610	***
	(0.662)		(0.220)		(14.540)	
EGY (oranges)	-0.150		0.019		-93.160	***

	(0.362)		(0.116)		(6.704)	
ISR (oranges)	-0.136		0.035		2.193	
	(0.290)		(0.063)		(1.751)	
MAR (oranges)	-0.861	***	0.095	**	-15.990	***
	(0.224)		(0.046)		(2.646)	
ZAF (oranges)	-1.674	***	-0.247	**	-24.580	***
	(0.190)		(0.097)		(4.629)	
TUN (oranges)	-0.689		-0.066	**	-9.659	***
	(0.424)		(0.032)		(2.790)	
TUR (oranges)	-0.541	***	-0.083		-24.300	***
	(0.182)		(0.058)		(3.135)	
ARG (table grapes)	-0.790		-0.324		-80.440	*
	(0.554)		(0.222)		(44.920)	
BRA (table grapes)	-0.114		-0.025		-48.270	***
	(0.194)		(0.038)		(5.331)	
CHL (table grapes)	-1.483	***	-0.358	***	-32.990	***
	(0.445)		(0.090)		(8.109)	
EGY (table grapes)	-0.246		0.124		-77.750	***
	(0.329)		(0.124)		(5.718)	
ISR (table grapes)	-0.211		-0.033		-1.150	
	(0.299)		(0.040)		(2.469)	
MAR (table grapes)	-0.396	*	0.126	**	-13.550	***
	(0.229)		(0.059)		(3.221)	
ZAF (table grapes)	-1.501	***	-0.189		-50.160	***
	(0.270)		(0.155)		(8.708)	
TUN (table grapes)	-1.901	***	-0.413	***	-16.930	*
	(0.560)		(0.119)		(8.844)	
TUR (table grapes)	0.165		-0.120		-29.210	***
	(0.147)		(0.087)		(3.859)	
BRA (tomatoes)	-2.830	*	-0.136	*	-11.890	
	(1.605)		(0.081)		(8.022)	
ISR (tomatoes)	0.522	*	0.085	***	-1.791	

	(0.267)		(0.021)		(1.930)	
MAR (tomatoes)	0.154		0.090	***	-2.303	**
	(0.178)		(0.009)		(1.122)	
TUN (tomatoes)	-0.959	**	-0.031	*	-7.884	***
	(0.446)		(0.017)		(2.528)	
TUR (tomatoes)	-0.162		0.007		-3.543	***
	(0.127)		(0.008)		(0.730)	
$SIV < EP$	No		-0.310	***	-0.227	***
			(0.073)		(0.052)	
Time-varying importer f.e.	Yes		Yes		Yes	
Time-varying exporter f.e.	Yes		Yes		Yes	
Country-pair f.e.	Yes		Yes		Yes	
Constant	12.400	***	12.600	***	12.110	***
	(0.463)		(0.456)		(0.390)	
Observations	6,485		6,485		6,485	
R-squared	0.457		0.429		0.579	

Notes: Standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10%. Acronyms are: Argentina (ARG), Brazil (BRA), Chile (CHL), China (CHN), Egypt (EGY), Israel (ISR), Morocco (MAR), New Zealand (NZL), South Africa (ZAF), Tunisia (TUN), Turkey (TUR), Uruguay (URY).