BATMODEL
BETTER AGRI-FOOD TRADE MODELLING FOR POLICY ANALYSIS

Trade policy and the cost of exporting for Agricultural Firms in Selected EU countries

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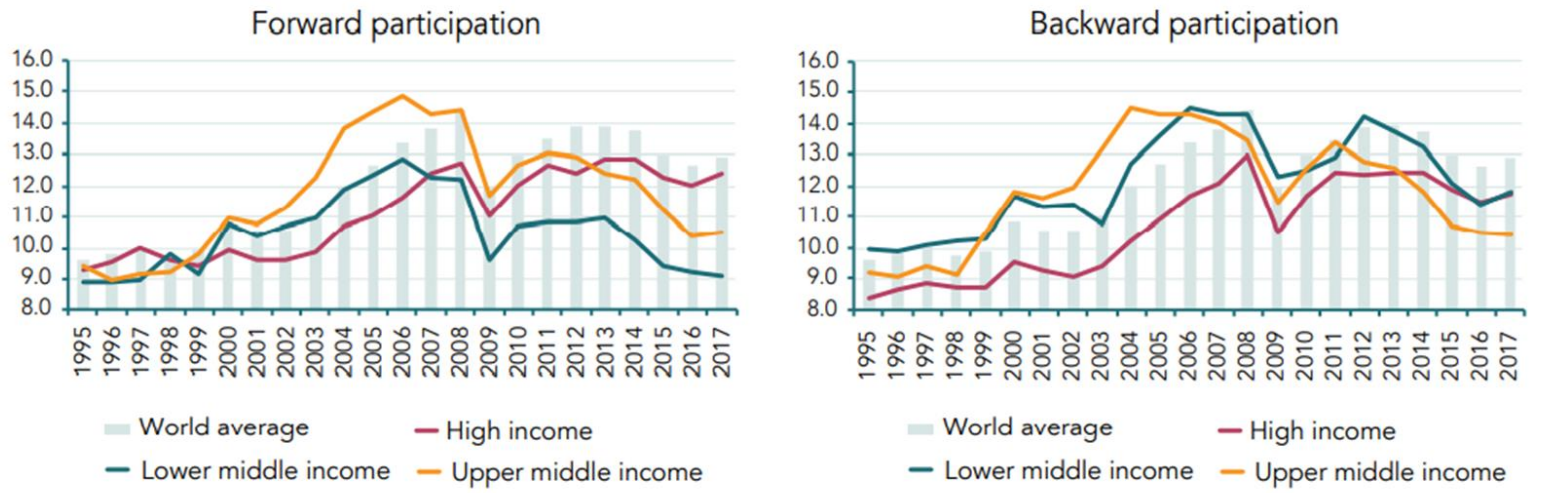
Introduction

- Global value chains (GVCs): a nothing really new phenomenon?

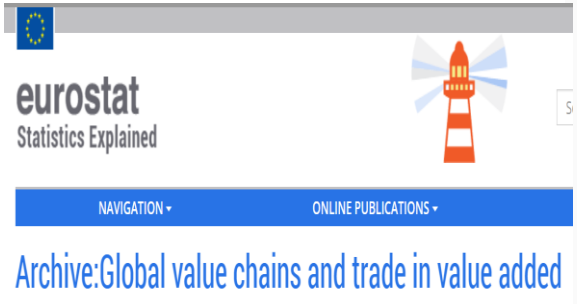
GVC DR 2019 The changing intensity of GVC participation by income groups, 1995-2017

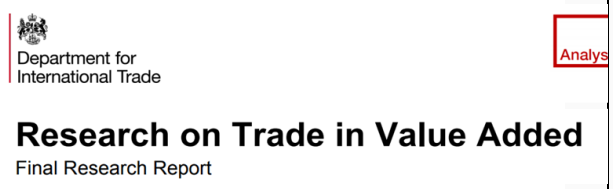


Source: The UIBE GVC indexes derived from the WIOD and ADB 2018 ICIO tables. In particular, the data from 1995 to 2011 derived from the WIOD, and the data from 2012-2017 derived from ADB.

- The great expansion of GVCs has changed the conceptual framework to analyze trade.
- A new paradigm for trade: where is the value added (VA) created and how is it traded among countries/sectors?

A mainstream concept



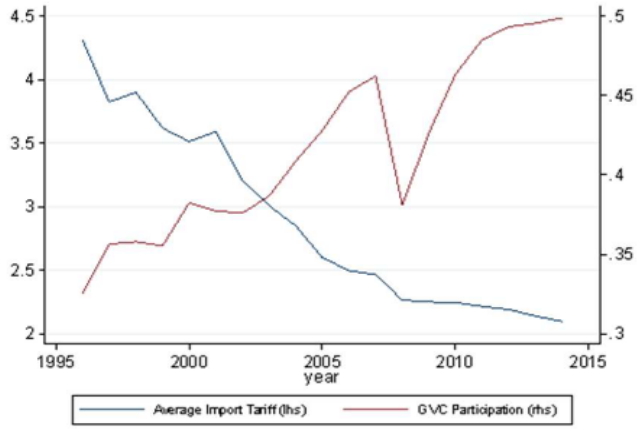


GVCs and trade policies

- GVC-related trade is particularly sensitive to border protection (e.g., Yi, 2003; Johnson and Noguera, 2017; Balié et al., 2019; Fusacchia 2021) :
  - **tariff amplification effects** (goods that cross national borders multiple times incur multiple tariff costs)
  - **'chain effects'** (protective measures against any country have knock-on effects on all its trading partners in the value chain)
- Global interdependences alter countries' incentives to impose import protection, since production of traded goods combines VA originated in different countries (DVA content of imports; Imports for exports) (Theoretically: Blanchard (2007, 2010); Ornelas and Turner (2008, 2012); Antràs and Staiger (2012); Raimondi et al., 2021. Empirically: Blanchard et al. (2017); Mayda et al. (2021); Blanchard and Matschke (2015); Jensen et al. (2015))

GVCs and trade policies

GVC Participation and Tariffs



Note: Weighted averages of tariffs and global value chain (GVC) participation (forward + backward). Value added weights were used for aggregation from country-sector level. Based on manufacturing sectors only and the 35 countries in our regression sample. Source: OECD, Tiva, author calculations.

- The decline in trade barriers and the rise GVCs are two of the most important trade-related developments in the decades preceding the Trump era

- Given the complex nature of (value added) trade flows, the evaluation of the impact of trade policies requires standard (gross) trade statistics to be complemented with trade metrics on a VA base in order to take into account the backward and forward linkages.

Literature

VALUE ADDED AND PROTECTION

- **EFFECTIVE RATE OF PROTECTION** with **multiple stages of production** (incorporating indirect consumption of intermediate inputs computed on global ICIO tables). (Diakantoni and Escaith, 2012; Chen et al., 2013)
- **XERP**, the effective rate of protection that applies to *exports* (Feenstra, 2016): measures the impact of domestic tariffs on imported inputs.
- **CUMULATIVE TARIFFS** give the total cost of **all tariffs incurred along the production process**. (Rouzet and Miroudot, 2013; Muradov, 2015; Ghodsi and Stehrer, 2016; Cappariello et al., 2108)
- Different tariff measures related to the VA (e.g., domestic protection, upstream tariffs, downstream tariffs and diversion tariffs; Eugster et al., 2022)

- Main point: protection on imports turns out to be taxes on exports
- Outcome measures, assessing the level of protection with GVCs

Literature

- Major issues in summary statistics in international trade policy: how to summarize different forms of trade policies (*conversion problem*) over thousands different tariff lines (*aggregation problem*) in a single figure. (Cipollina and Salvatici, 2007)
- Weighting schemes suffer from an **endogeneity bias**
  - Highly taxed imports tend not to be imported (zero weight in the index).
  - Tariffs have greater effect on trade volume for imports in relative elastic demand (but it is precisely these goods whose weights fall fastest)

❖ *Equivalence measures* assess how much the variable of interest changes as a result of protection

❖ They use a theoretical-based aggregation procedure, defining an ideal aggregator with respect to a well-defined economic question (Anderson and Neary, 2005).

➢ Main idea: give a uniform tariff equivalent of a non-uniform tariff structure yielding the same value in terms of a specific variable (welfare, imports, output, ...)

This work

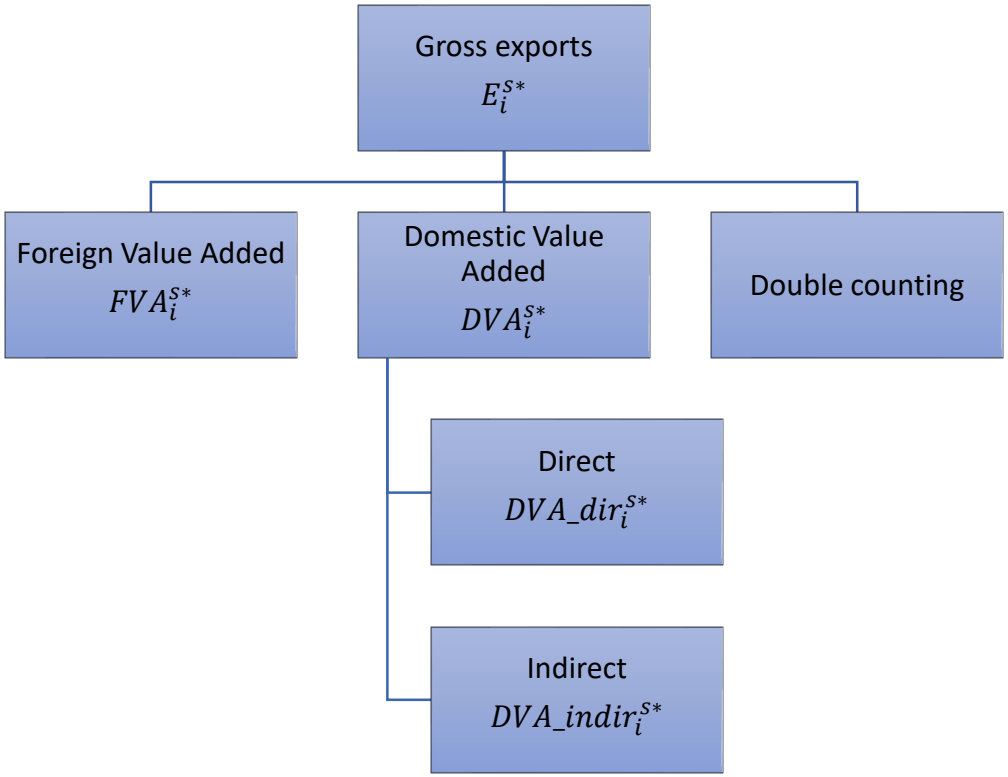
- Synthetic measures of trade protection based on the VA in trade, capturing the effects that the tariff structure has on the income-generating role of exports for the agricultural sector

- The index, defined in a general equilibrium framework, and operationalized by using the Global Trade Analysis Project (GTAP) computable general equilibrium model, including a decomposition of trade in VA (GTAP-VA) .

- The index is used to investigate the effects of the European Union tariffs on the Italian, French and German agriculture export competitiveness.

Methodology

- A model integrated global input-output framework to decompose gross trade



Methodology

❑ Uniform tariff keeping constant the different trade components:

initially distorted prices

int'l prices (function of the tariff vector)

equilibrium at the point of reference

factors prices

- ***Gross exports:***

$$\boldsymbol{x\_tri_i^s}: E_i^{s*}\left[\left(1+\tau^{(\mu)ts}\right)p^I(T), b^0, \omega\right] = E_i^{s*}[p^0, p^I(T), b^0, \omega]$$

- ***Total DVA:***

$$\boldsymbol{dvat\_tri_i^s}: DVA_i^{s*}\left[\left(1+\tau^{(\mu)ts}\right)p^I(T), b^0, \omega\right] = DVA_i^{s*}[p^0, p^I(T), b^0, \omega]$$

- ***Direct DVA:***

$$\boldsymbol{dvad\_tri_i^s}: DVA\_dir_i^{s*}\left[\left(1+\tau^{(\mu)ts}\right)p^I(T), b^0, \omega\right] = DVA\_dir_i^{s*}[p^0, p^I(T), b^0, \omega]$$

- ***Indirect DVA:***

$$\boldsymbol{dvai\_tri_i^s}: DVA\_indir_i^{s*}\left[\left(1+\tau^{(\mu)ts}\right)p^I(T), b^0, \omega\right] = DVA\_indir_i^{s*}[p^0, p^I(T), b^0, \omega]$$

- RHS: the values at the initial non-uniform tariffs.
- LHS: maintains the same values when applying a uniform (product-generic) tariff ($\tau^{(\mu)}$).

Methodology

❖**GTAP-VA model** (Antimiani et al., 2018) of global trade

❖Main features:

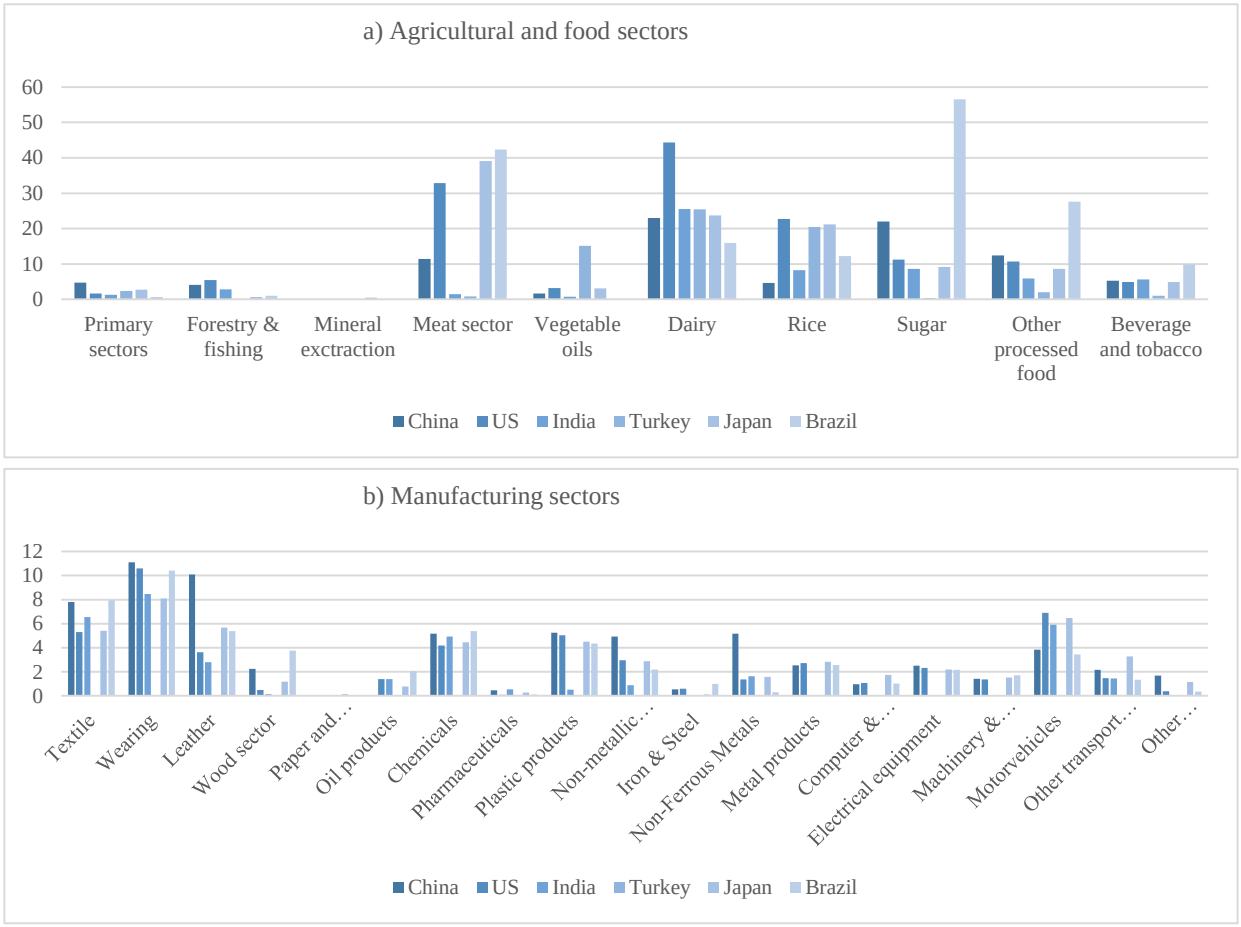
- ❑ Demand: CDE _ price and income elasticities from literature
- ❑ Production: CES for primary factors and intermediates, Leontief for the upper nest
  - o A positive value for the elasticity of substitution among intermediates (0.425) (Antimiani and Cernat, 2018)
- ❑ Trade: Armington assumption differentiates products by origin
- ❑ **Trade in VA**: reallocate the VA generated in the production of goods and services back to the countries in which that income is generated
  - o Import demand for each specific agent is linked to the sourcing country/sector
  - o VA multipliers are obtained from the cost structure of firms.
- ❑ A new variable, $tr(r,s)$, as the product-generic tariff levied on imports from region r into region s.

Data

- GTAP 10 Data Base (MRIO): 121 countries and 20 aggregate regions for 65 commodities.
- **Bilateral trade at the agent level** using UNSD concordances and **BEC-informed shares** (Aguiar et al., 2006; Liapis and Tsigas, 2014; Walmsley et al., 2014; Carrico et al., 2020).
- Aggregation: **13 countries and regions** (more than 50% of extra-EU Italy's imports), **30 sectors** (keeping all agricultural sectors aggregated to properly account for direct and indirect composition).

Data_Tariffs

Figure 1. EU's tariffs (%, 2014)



Source: GTAP 10 Data Base.

Descriptive statistics

Table 1. VA composition of exports, selected EU countries (2014, USD million)

a) Italy

	Agriculture	Food	Other goods	Services	VA exports
Agriculture	5.212	1.906	342	146	7.606
Food	297	10.732	819	412	12.260
Other goods	446	1.545	184.623	3.780	190.393
Services	1.541	11.994	115.817	76.653	206.005
FVA	1.211	10.686	145.663	9.427	
DDC	8	85	1.659	75	
Gross exports	8.715	36.863	447.263	90.417	

b) France

	Agriculture	Food	Other goods	Services	VA exports
Agriculture	10.040	3.537	523	173	14.273
Food	598	20.780	2.216	817	24.411
Other goods	696	2.303	179.859	3.967	186.826
Services	2.685	15.373	103.108	137.139	258.305
FVA	3.524	12.747	179.517	18.888	
DDC	39	147	2.647	199	
Gross exports	17.583	54.739	465.223	160.985	

c) Germany

	Agriculture	Food	Other goods	Services	VA exports
Agriculture	6.416	4.949	513	155	12.033
Food	247	19.668	1.445	415	21.776
Other goods	403	3.042	541.892	7.006	552.342
Services	3.424	22.217	263.578	195.951	485.170
FVA	2.294	21.815	460.753	28.541	
DDC	74	563	19.609	693	
Gross exports	12.859	71.692	1.268.181	232.068	

Source: Authors' simulations using the GTAP-VA model

- Columns: exporting sectors
  1. direct DVA, i.e. agricultural income generated by agricultural exports;
  2. indirect DVA, i.e. non-agricultural income generated by agricultural exports through the purchase of domestic intermediate inputs;
  3. FVA, i.e. foreign income generated by agricultural exports through the purchase of imported intermediate inputs.
- Rows: sector of origin of the VA
  1. direct DVA
  2. indirect DVA, i.e. agricultural income exported through other domestic sectors;

- Gross exports→ direct DVA in agriculture between 60% (Italy) and 50% (Germany)

- Agriculture is relatively less intensive of foreign inputs (FVA between 14% for Italy and 20% for France) other goods on average 36%

- Relevance of value created within agriculture and (indirectly) exported by the other sectors, mostly food products: 47% for Germany; more than 30% in the case of France and Italy.

Simulation

- We keep constant exports of agricultural goods in gross and VA terms (direct and indirect)
- Uniform tariff equivalents are obtained by setting bilateral tariffs to zero and replacing them with the **uniform tariff that keeps constant agricultural exports either in gross value or in VA**.

(Preliminary) results

Uniform tariff equivalents (%, ad valorem rate)

	x_tri	dva_tri	dvad_tri	dvai_tri
Italy	2,86	2,70	2,86	2,41
France	1,49	1,29	1,49	0,97
Germany	5,73	4,63	5,73	3,60

Source: Authors' simulations using the GTAP-VA model

- CET does impact agricultural VA income linked to exports.
- $x\_tri = dvad\_tri \rightarrow$ intermediate inputs used by Agricolture mostly involves Services (not affected by tariff protection): direct DVA and FVA play a complementary role and the same tariff equivalent would apply to both gross exports and direct exports of agricultural VA.
- From a 'mercantilistic' point of view to a 'political economy' point of view: what matters is the size of the sectoral income exported in total, that is considering all exports as export channels
- $dva\_tri < x\_tri \rightarrow$ lower protection faced by downstream exports
- $dvai\_tri < dvad\_tri \rightarrow$ the agricultural factors of production are less negatively affected by the CET if we take into account their role as input providers to other sectors.
- A differential impact: Germany is the most impacted country showing the highest index in both gross and VA terms (5.73% and 4.63%, respectively), while France seems to be the less affected (1.49% for gross exports and 1.29% for domestic VA).

Conclusions

- The indexes represent a useful addition to the tools available for policy analysis since it takes into account how cross-border multi-stage production affects the transmission of trade policy to national welfare
- **Caveat**: standard assumptions of the model (comparative static, no dynamic effects such as the effects on productivity and growth, unemployment and migration)
- **Take away messages**:
  - EU tariff structure impacts the export performance of the EU countries under examination.
  - The impact of the same EU trade policy is heterogeneous across member countries, depending on the structural characteristics of exporting economies.
  - Germany is the most impacted country showing the highest index in both gross and value-added terms, while France seems to be the less affected.
  - In all the cases under examination, the impact is lower for indirect exports of agricultural value-added, that is the agricultural value-added embedded in other sectors' exports.

Next steps:

1. Computation of the indexes for various sectors to provide a comparison between agriculture and food as well as between agri-food and manufacturing sectors.
2. Quantification of the contribution of different tariffs to the overall indexes (role played by agri-food tariffs in the protection faced by each sector + the role played by non-agri-food tariffs in the protection by agricultural exports).
3. Computation of the indexes distinguishing intra and extra-EU exports to assess whether the CET has a differentiated impact on export competitiveness according to the export destination.
4. Include NTMs

Thank you for your attention!

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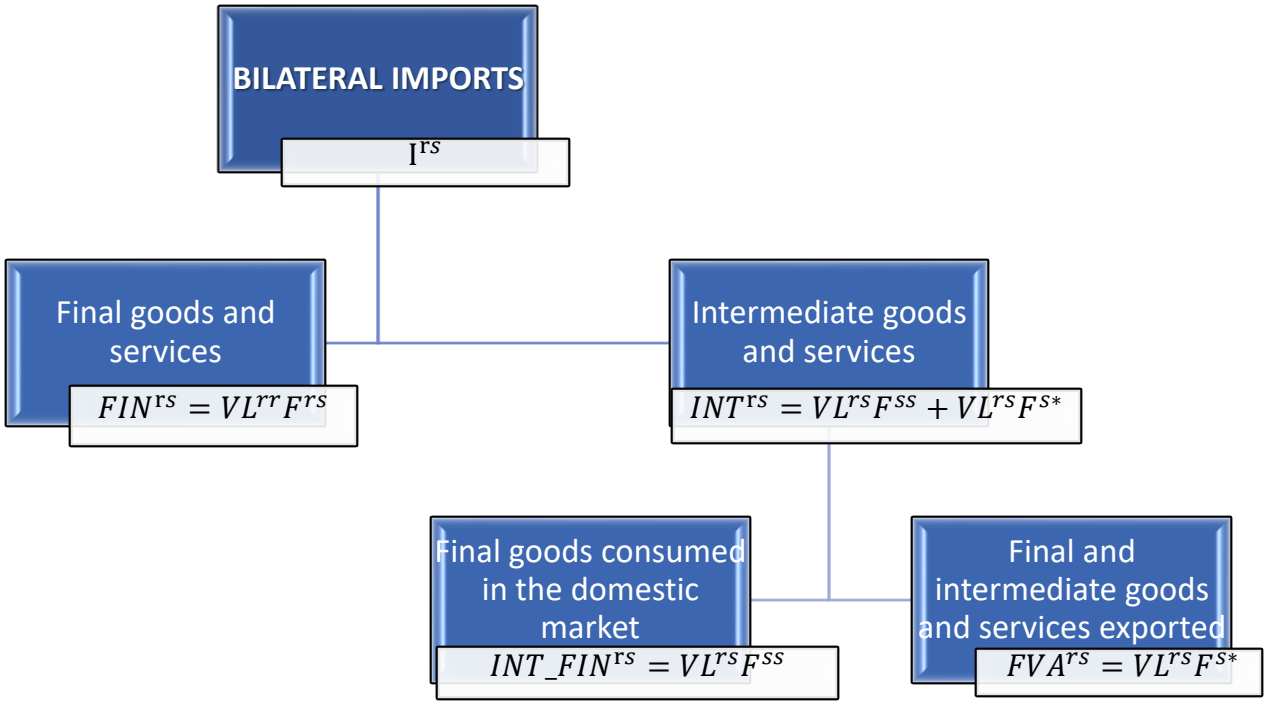
Methodology

- A global input-output framework to decompose gross imports and exports MODEL INTEGATED



Methodology

❑ *Exports:*

$$E_j^{s*} = \sum_i \sum_t \hat{V}_i^t L_{ij}^{ts} * E_j^{s*} = \underbrace{\sum_i \hat{V}_i^s LOC_{ij}^{ss} * E_j^{s*}}_{DVA_j^{s*}} + \underbrace{\sum_i \sum_{t \neq s} \hat{V}_i^t L_{ij}^{ts} * E_j^{s*}}_{FVA_j^{s*}} + \underbrace{\sum_i \hat{V}_i^s (L_{ij}^{ss} - LOC_{ij}^{ss}) * E_j^{s*}}_{DDC_j^{s*}}$$

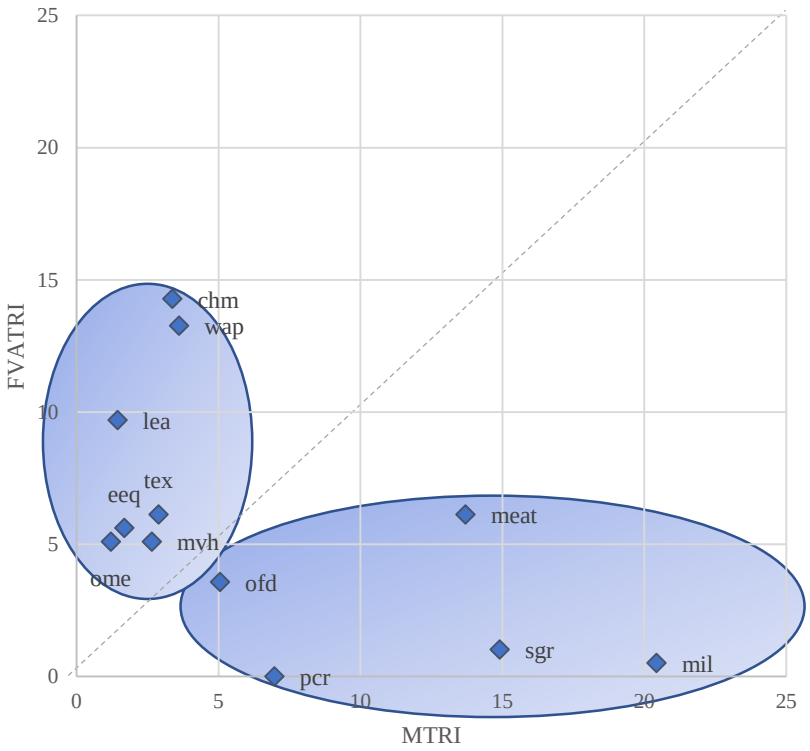
$$\sum_j DVA_j^{s*} = \underbrace{\sum_i \hat{V}_i^s LOC_{ii}^{ss} * E_i^{s*}}_{DVA\_dir_i^{s*}} + \underbrace{\sum_i \sum_{j \neq i} \hat{V}_i^s LOC_{ij}^{ss} * E_j^{s*}}_{DVA\_indir_i^{s*}}$$

❑ *Imports:*

$$\mathbf{I_j^{rs}} = \underbrace{\sum_i \hat{V}_i^r L_{ij}^{rr} * F_j^{rs} + \sum_i \hat{V}_i^r L_{ij}^{rs} * F_j^{ss}}_{FIN} + \underbrace{\sum_i \hat{V}_i^r L_{ij}^{rs} * E_j^{s*}}_{FVA}$$

Results

Figure 2. Sector shares on the trade restrictiveness indexes for Italy (2014)



Blue dots represent sectors' weights (percentage of the total index). Only sectors with a weight above 5% are presented.
Source: Authors' simulations using the GTAP-VA model

Results

Table 1bis. Uniform tariff equivalent rates

Italy

	MTRI	FVATRI
Total import	**4,2**	**2,0**
Exporter:		
China	4,1	3,2
US	2,2	1,7
India	3,2	1,8
Japan	3,6	2,7
Brazil	13,9	1,8

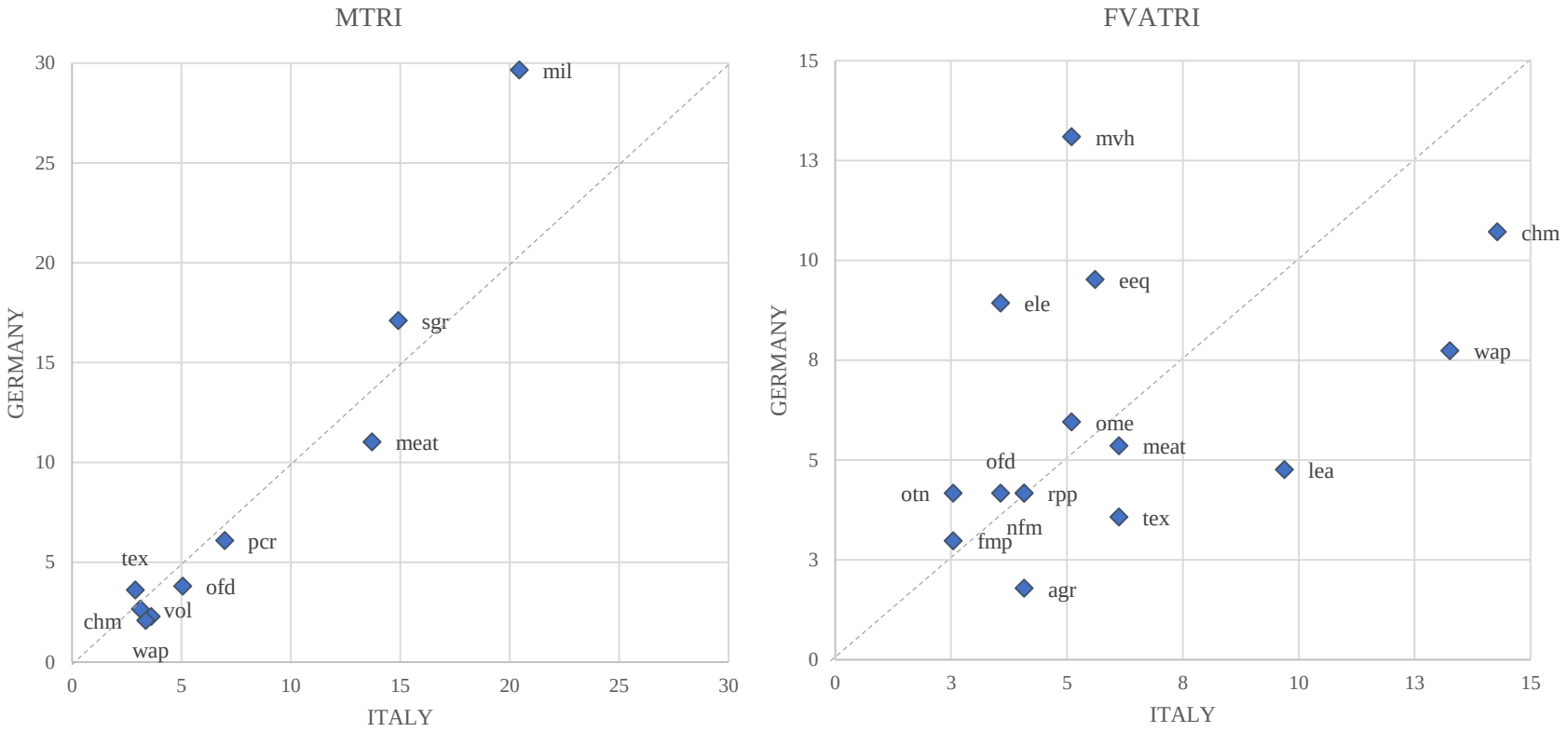
Germany

	MTRI	FVATRI
Total import	**5,3**	**1,7**
Exporter:		
China	3,4	2,6
US	2,8	2,0
India	3,7	1,5
Japan	2,1	2,1
Brazil	11,3	1,3

Source: Authors' simulations using the GTAP-VA model

Results

Figure 3. Sector decomposition od indexes for Italy and Germany (2014).




TRADE
POLICY
GROWTH
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OF GVCs