How does foreign demand activate domestic value added? A dashboard for the Italian economy

by Rita Cappariello and Alberto Felettigh

Abstract

Global value chains pose measurement challenges to the evaluation of a country's exposure to foreign shocks. As intermediates travel to their final destination by an indirect, possibly multi-country route, it becomes more complex to associate a country's exports and their "domestic-value-added content" with the final demand that activated them. We use the global input-output database WIOD and the approach developed by Koopman et al. (2012) in order to trace out how final internal demand around the world is diffused along global value chains and ultimately affects the creation of domestic value added across Italian sectors and the ranking among its sources (countries, sectors, components of demand).

Keywords: global value chains, final internal demand, domestic value added activation.

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1. Introduction

The propagation of global value chains has contributed to the growth of international trade in intermediate inputs, as sequential stages of production ("tasks") are often performed at several locations all over the world before assembly into the final product. As production becomes more and more internationally fragmented, conventional indicators based on gross exports alone are no longer informative and measurement challenges are posed to a full evaluation of a country's exposure to foreign shocks.

Firstly, in many countries exports are the demand component with the largest import content. While national accounts analysts are accustomed with the issue and usually focus on the contribution of net exports to GDP growth, many commentators indulge on the export performance of a country taken in isolation and disregarding the import side. However, focussing on the net-export dimension alone mixes the dynamics of world demand driving exports and the possibly independent, at least in the short term, evolution of internal demand driving imports. The rapidly evolving import content of export, due to the diffusion of global value chains, on turn, requires new tools of analysis to be developed and implemented, starting with the awareness that part of a country's exports are activated by its own internal demand.[1]

Secondly, the development of multi-country production linkages has made more difficult to associate a country's production with the final demand that activated it since intermediates produced in one country can be processed in many other locations before they are ultimately exported and consumed (or invested) in the final destination country.

Thirdly, traditional gross trade statistics are increasingly affected by the well-known "double counting" problem since intermediates crossing the border back and forth as they are being processed get recorded multiple times in aggregate and bilateral trade statistics.

The main purpose of this paper is to use new indicators in order to map out the economic relations that underlie Italian trade with the rest of the world. In particular, **our objective is to measure the impact on Italian GDP of a shock on foreign demand and to disentangle individual contributions both along a geographical dimension and a sectoral one.** When looking at the rest of the world as a whole, it is immaterial whether one focuses on world GDP or on world internal demand. Since we want to consider country-specific shocks, however, the difference does matter: GDP growth in a given country depends on internal demand as well as external demand, which drives exports. External demand, in turn, is internal demand in some other country, and here composition matters too, since exports to some destination may contain more domestic value added relative to other outlets. Put differently, the question "how would faster GDP growth in Germany (or any other country) affect the expansion of Italian exports and GDP?" is ill-posed, since the answer is conditional on which component of demand (internal *vs* external) is driving German growth. For these reasons, **we focus on partner countries' internal demand, which is less prone to ambiguity**.

Our objective requires we go beyond the information set provided by standard trade statistics. These would provide, for instance, the share of Germany on Italian exports, with details on sectoral composition. Italian exports to Germany, however, are once again driven only in part by internal demand in Germany. To complete the puzzle, one needs additional information so as to dissect German exports according to the partner countries' internal demand that activates them.

[1] Via imports of foreign goods (and services) that embody intermediates produced in Italy.

We use global input-output tables as published by WIOD, which indeed provide this kind of information. Essentially, WIOD tables match national input-output (supply and use) tables so that the foreign sector in each national table is broken down among partner countries both on the export (use) and on the import (supply) side. The outcome is a global input-output table where productive sectors are distinguished by their "country of residence". **The paper by Koopman et al. (2012) sets out the appropriate algebra** in order to trace out the contributions of final internal demand in each country to the activation of Italian exports and the value added contained therein.

In essence, we will be estimating the (static) elasticity of Italian GDP to final internal demand around the world. Our analysis is subject to the **usual caveats that are intrinsic to relying uniquely on data taken from input-output tables**. These provide a fixed set of "structural" parameters (technical production coefficients, market shares and so on) which indeed change from one year to the other, but are held constant when a positive shock to foreign demand is considered and all else expands in proportion.

Other studies have analysed the development of international outsourcing in European countries by applying a similar methodology to the same data used here (Rahman and Zhao, 2013). We are however, to our knowledge, the first ones to evaluate a country exposure to specific foreign shocks by taking into account the interconnectedness of the domestic economy in global value chains. Outsourcing is limited to the supply side; we investigate the globalization of the Italian economy also from the demand side. For these reasons, the paper provides a compass to the opportunities and the challenges of economic integration at the global and at the European regional level from a policy perspective.

We are not the first ones to measure the domestic value added content of Italian exports, either. Previous attempts include Breda and Cappariello (2010), who relied on national input-output tables. **Our approach extensively improves their measurement**: thanks to the Koopman methodology and to the use of a global input-output table, we properly address the "double counting" problem and engage in a bilateral analysis that is not possible with national input-output tables.

The paper is organized as follows. The conceptual framework proposed by Koopman and his co-authors is presented in Section 2 below and is implemented in Section 3, where Italian exports are broken down into domestic value added, foreign value added and a residual component associated with double-counting. To our knowledge, this is the first time that the "Koopman decomposition" is applied to Italian data.

From Section 4 onwards, we focus exclusively on domestic value added embodied in Italian exports, starting with a comparison between standard trade statistics and the information contained in WIOD tables.

Our main results begin in Section 5, where the impact on Italian GDP of a shock on foreign demand is estimated. We start with a shock on world demand (**global shock**) and then analyse **geographical effects**, i.e. what happens when final internal demand increases in each country in turn (**country shocks**). We interpret our results with the help of some considerations on the sectoral composition of exports.

Section 6 begins the analysis of **sectoral effects**. We introduce an additional dimension: **the domestic-sector origin of the domestic value added** embodied in exports. Final internal demand around the world activates exports by each sector of the Italian economy. In turn, exports of any given sector contain domestic value added that has been created, directly or indirectly, in all domestic sectors (at least in principle). We briefly comment on these inter-sectoral linkages.

In Section 7 we change the nature of the shock impacting on Italian GDP: we move from country shocks to **sectoral shocks**. That is, we consider foreign sectors and keep track of the impact on Italian exports and GDP when final internal demand in a given sector increases simultaneously in all countries of the world.

In Section 8, we come back to the global shock whereby demand increases simultaneously in all countries (and in all sectors) and distinguish among **demand components**: private consumption, government consumption, gross fixed capital formation.

Section 9 summarizes our main findings and concludes.

2. Conceptual framework and data

We use the framework proposed by Koopman et al. (2012), who are the first in the vertical specialization literature **to develop a fully coherent accounting identity** that breaks up a country's gross exports into value-added components by source. The authors' methodology, an improvement upon the seminal idea of Johnson and Noguera (2012), decomposes **gross exports into three main terms: domestic value added, foreign value added, double-counted value added**. We focus on Italy and label the first item **GDPX,** namely **the Italian GDP embodied in Italian gross exports**. The second component consists of foreign value added embodied (via imports of intermediate inputs) in Italian gross exports. The last component is connected with goods that cross borders multiple times and it consists of value added, Italian or foreign, that is embodied in Italian gross exports and has already been recorded by Italian trade statistics despite it contributes only once to Italian GDP.[2,3]

Koopman et al. (2012) further decompose each of these three components into categories depending on the use (final *vs* intermediate) of the exported goods and services and on the geographical origin (foreign *vs* domestic) of the final demand that activated them. A total of nine sub-components is obtained (see the Appendix for the algebraic details). In this paper we focus on domestic value added and follow the author's **decomposition of GDPX into** the first **five sub-components** as indicated in Figure 1,[4] which clarifies that a country's GDP is embodied into exports of:

1. final goods and services.

[2] A simple example clarifies. Suppose that Italy exports an intermediate good ("good A") to Germany worth €100 and embodying, for simplicity, only Italian domestic value added. The intermediate good get assembled by a German firm, together with €20 of German value added, into a second intermediate good that is exported to Italy. Italy imports the good ("good B") for €120 and assembles it, together with €10 of domestic value added, into a final product ("good C") that is exported for €130. Italian gross exports are thus recorded as €100+€130=€230. The Italian value added contained therein is €100+€10=€110, whereas the German value added content is €20. The difference between Italian gross exports (€230) and the sum of Italian and German value added (€110+€20=€130) is indeed the value of good A, which has been exported twice by Italy: after the initial shipping to Germany, it returns home embodied into good B and is exported again embodied into good C. Koopman et al. (2013) correctly identify the value of good A (€100) as value added that is double-counted by Italian trade statistics.

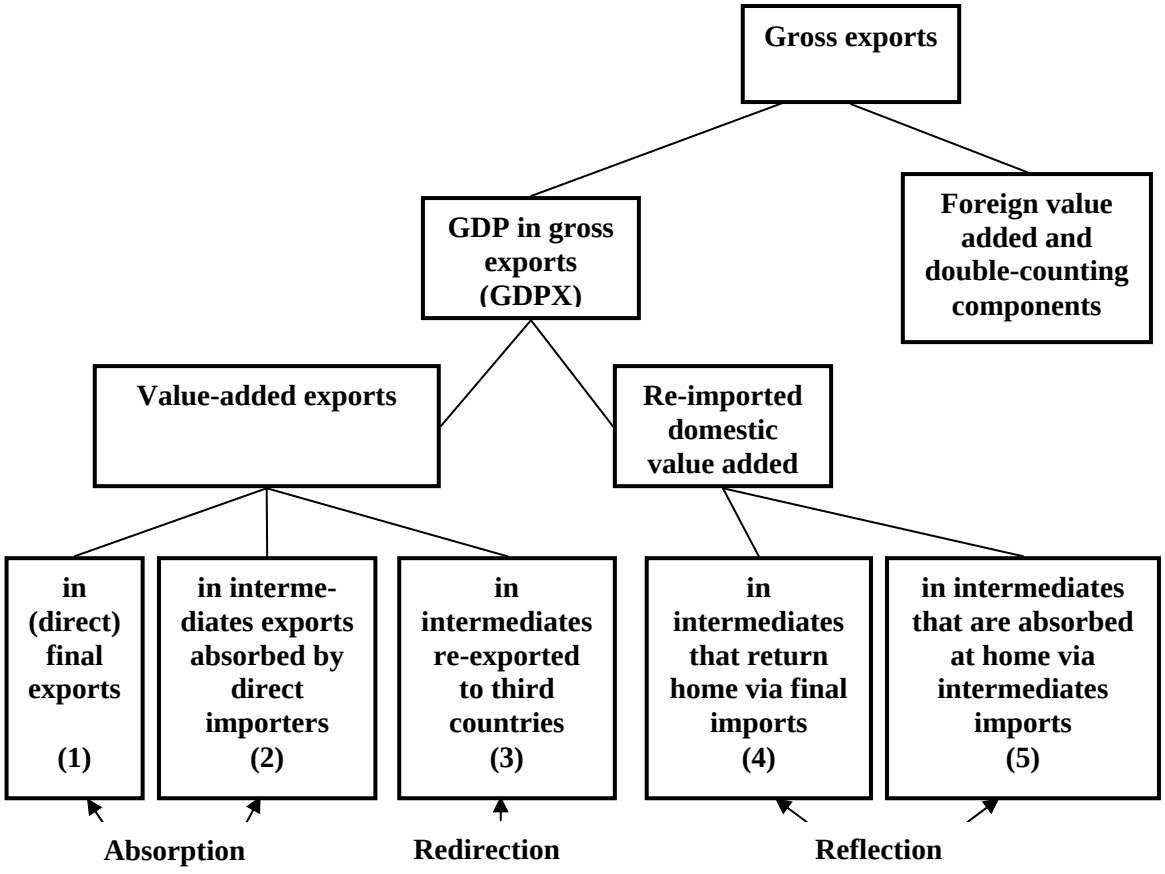
[3] Trade statistics all over the world record flows on a gross basis, so that double-counting is intrinsic to their mandate.

[4] The figure is a simplified version of Figure 1 in Koopman et al. (2012); the labels "absorption", "redirection" and "reflection" are taken from Johnson and Noguera (2012).

2. Intermediates that are absorbed by the direct importer, i.e. that are used by the direct importer to produce final goods and services to be consumed in the country itself. The sum of components 1 and 2 is labelled "**absorption**", to indicate domestic value added that is absorbed abroad by the direct (first) importer.
3. Intermediates that the direct (initial) importer embodies into other goods and services (final or intermediate), which then are exported to third countries. This component is labelled "**redirection**", to indicate domestic value added that is absorbed abroad by countries other than the direct (initial) importer.
4. Intermediates that are ultimately absorbed at home (i.e. in Italy in this paper), embodied in imports of final goods and services.
5. Intermediates that are ultimately absorbed at home, embodied in imports of intermediate goods and services (used to produce final goods and services for domestic consumption). The sum of components 4 and 5 is labelled "**reflection**", to indicate domestic value added that is exported but is ultimately absorbed at home. Another label would be "export content of imports", mirroring the more familiar phrase "import content of exports". Whatever the name, this component measures the contribution of a country's internal demand to the activation of its own exports.[5]

Figure 1

Main components of value added in gross exports: concepts



[5] We do not address the import side in this paper, but it may be useful to point out that (i) the "export content of imports" contributes to double-counted value added in import trade statistics; (ii) internal demand clearly is more effective in activating imports than exports.

Notice that the Koopman decomposition focuses on GDP and hence does not consider the case of a firm off-shoring its entire production (and sales); in such a case no exports are recorded by the home economy and even profit repatriation would not contribute to its GDP (though it would contribute to GNP through the income account).

We embrace the metric proposed by Rahman and Zhao (2013) whereby sub-components 1 and 2 (absorption) tell us "how much of a country's exports is created as stand-alone exports, i.e. outside any supply chain". The remainder, which consists of **domestic value added sub-components 3 to 5 together with foreign value added and the double-counting component (see Figure 1), measures exports generated due to the participation in global value chains ("international fragmentation of production" hereafter)**.

Koopman et al. (2012) and Rahman and Zhao (2013) entertain the notion that countries for which the share in gross exports of sub-components 3, 4 and 5 (intermediates that are further processed abroad for ultimate absorption in a country rather than the first importer) is relatively large tend to be specialized in **upstream activities**. Vice-versa, a relatively large share of foreign value added in gross exports tends to signal that the country is specialized in **downstream (or assembling) activities**. As we shall make some reference to these categories, it is important to keep in mind that **they refer to sequential production stages, not to the allocation of value added among the players in a global value chain**. For instance, oil extraction and water bottling are upstream activities, respectively, relative to gasoline sale at the pump and running a restaurant (downstream activities). One would expect the value-added-intense activities to be the upstream one in the gasoline case, the downstream one in the water case.

One notable feature of the "Koopman decomposition" is that, for each source country, export flows are traced back to the final internal demands (one vector for each partner country) **that activated them.** One final example clarifies. Assume that cars are produced in France using Italian engines. Final internal demand in Germany then spurs imports of French cars which activate Italian GDP via the redirection component 3: the Koopman decomposition signals that Italian GDP has been activated by final internal demand in Germany. Similarly, final internal demand in Italy spurs imports of French cars which activate Italian GDP via the reflection component 4: in this case, the Koopman decomposition signals that Italian GDP has been activated, via export activity, by final internal demand in Italy itself.

As a last remark, **the Koopman decomposition** for a given origin country (Italy in this paper) **only holds for overall export flows**, that is for sales abroad summed over all sectors and destinations. **We extend the Koopman decomposition** so that we are also able to compute the Italian value added embodied in Italian exports of a specific sector to any given country (say exports of machinery to Germany). Our extension, however, only applies to the sum of the five components listed above, without telling apart absorption, redirection and reflection.

The Koopman decomposition encompasses previous attempts proposed in the literature, notably Hummels, Ishii and Yi (2001) and Johnson and Noguera (2012). Rahman and Zhao (2013) use a preliminary and incomplete version of the Koopman decomposition to investigate the role of vertical supply links for the export performance of European countries.

We use current-price data from the World input-output database (WIOD) updated to the September 2012 release; we focus on the period 1999-2009.[6] WIOD tables are input-output tables for the global economy, disaggregated into 41 areas and 35 sectors. All data collected form national sources are converted into US dollars. For a more detailed presentation of the WIOD database, see Timmer (2012). It is important to point out that **exports of goods and services connected to international tourism are in fact absent from our analysis** since these flows are recorded in WIOD tables as a separate entry ("Purchases on the domestic territory by non-residents"), a sort of memo item that cannot be treated as a separate 36th sector due to missing pieces of information.

A final caveat on the "proportionality assumption". National input-output tables do not have information on the allocation of imported intermediates across domestic industries. This is estimated using the "proportionality assumption" (also named "import comparability" assumption; see for example Feenstra et al., 2010, and Feenstra and Jensen, 2012): the imported share of intermediates used by an industry is proxied by the share of imports in total supply as computed for the overall economy. In other words, an industry's import of each (intermediate) input, relative to its total demand for that input, is computed as the economy-wide imports of that good/service as a share of total domestic demand for it. **WIOD supply and use tables improve upon the standard "proportionality assumption" by resorting to bilateral trade data on import flows disaggregated according to the Broad Economic Categories (BEC) classification**, which assigns each good to a use category (intermediates, final consumption or investment) depending on its prevalent use. The proportionality assumption is then applied within the use category of intermediates. As a final step, bilateral trade data are used to associate imported intermediate inputs with countries of origin. See Timmer (2012), pp.7-9 for the algebraic details.

3. Decomposing gross exports

Table 1 provides the breakdown of the domestic value added content of Italian exports of goods and services (as a percentage of total gross exports) from 1999 to 2009, as obtained from the Koopman decomposition.[7] By looking at averages over the 1999-2009 period, **a few structural characteristics of the Italian economy can be assessed (and measured):**

- **78.2 percent of Italian gross exports is domestic value added** and 16.7 percent is foreign value added. **Double counting inflates exports by** the remaining **5.1 percent**.[8]
- **Re-imported domestic value added is flat at 1.0 percent**: virtually all Italian GDPX is absorbed abroad.
- **Intermediates account for around 53 percent of both Italian exports and the domestic value added contained therein**, a larger share than the one computed from Italian trade statistics, a point we clarify at the end of this section**.**
- According to the Rahman-Zhao metric, **31.6 percent of Italian exports is generated via international fragmentation of production**. This leaves 68.4 percent to "stand-alone" exports.

[6] Data are only available for the period 1995-2009; we disregard the years before the introduction of the euro.
[7] The complete Koopman decomposition with the nine value-added and double-counted components is presented in Table A1 in the Appendix.
[8] Double-counting affects both export and import trade statistics, although we focus here only on the former.

- **International fragmentation of production is structural, it displays an increasing trend, but is also affected by the business cycle** (it is procyclical)**.** As it experienced a significant (34.9 percent) drop with the onset of the Great Recession, fragmentation accounts for half of the contraction experienced by Italian nominal gross exports between 2008 and 2009.

Table 1

Decomposition of Italian exports of goods and services

(in percentage of total gross exports, except otherwise indicated)

		Gross exports								Memo item:
		GDP in gross exports (GDPX)						Foreign value added	Double counting	
		Value added exports			Re-imported domestic value added					
Year	Gross exports (in millions of dollars)	in direct final exports	in inter-mediates exports absorbed by direct importers	in inter-mediates re-exported to third countries	in inter-mediates that return home via final imports	in inter-mediates that are absorbe d abroad via inter-mediates imports				Interna-tional fragmenta-tion of production"
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1999	267,446	39.7	33.2	8.2	0.6	0.4	82.1	14.3	3.6	27.1
2000	271,817	37.4	32.0	8.5	0.6	0.4	78.9	16.4	4.6	30.5
2001	278,623	38.1	31.6	8.8	0.6	0.4	79.5	16.0	4.6	30.3
2002	289,677	38.9	31.6	8.8	0.6	0.4	80.3	15.3	4.3	29.5
2003	341,425	38.8	31.5	8.9	0.6	0.4	80.2	15.4	4.4	29.7
2004	405,297	36.2	32.6	9.2	0.6	0.4	79.1	15.9	5.0	31.2
2005	428,302	35.1	32.3	9.1	0.6	0.4	77.6	16.9	5.5	32.6
2006	481,657	33.4	31.7	9.0	0.6	0.4	75.2	18.5	6.3	34.8
2007	574,778	33.2	31.4	9.0	0.5	0.4	74.6	18.8	6.6	35.4
2008	620,446	34.0	30.6	8.7	0.5	0.4	74.1	19.4	6.5	35.4
2009	467,639	37.6	31.8	8.2	0.5	0.4	78.4	16.8	4.7	30.6
Memo item: mean (1999-2009)		36.6	31.9	8.8	0.6	0.4	78.2	16.7	5.1	31.6

Source: authors' calculations on WIOD data.

Notes: columns (1) to (5) correspond to terms (1) to (5) in Figure 1; column (6) is the sum of columns (1) to (5); columns (6), (7) and (8) add up to 100, consistently with Figure 1; international fragmentation of production in column (9) is measured as the sum of columns (3), (4), (5), (7) and (8).

More generally, temporary fluctuations around 2002, together with sharp movements in 2009, indicate that the majority of the aggregates presented in Table 1 are sensitive to the business cycle:

- **the share of GDPX in gross exports** ("GDPX-intensity",[9] column (6) in the table) **is countercyclical**;[10]
- as for the complementary share, **both foreign value added and double-counting are procyclical** (columns (7) and (8), respectively);
- since columns (1) and (2) constitute the greater part of GDPX, the complementary share (**international fragmentation of production**) **is procyclical**.

One corollary of the GDPX-intensity being countercyclical is that **the change in gross exports is not a sufficient statistic in order to determine their contribution to GDP growth**, despite it being a usual assumption in business cycle analysis. Year 2009 is a striking example; according to WIOD data, gross exports contributed for 7.0 percentage points to the 2009 contraction of nominal GDP.[11] The correct computation uses the domestic value added content of exports (GDPX) in the place of gross exports, thus also exploiting the information in column (6), and results in a negative contribution to GDP growth worth 4.2 percentage points only.

The double-counting component prevents foreign value added in exports to be the mirror image of GDPX: Table 1 reveals that **the growth in the foreign-value-added-content of exports between 1999 and 2007 only explains less than two thirds of the corresponding drop in GDPX**.

Although it is not the focus of our work, **the great trade collapse** in 2009 deserves a few words. Table 1 shows that **international fragmentation of production accounted for half of the drop experienced by Italian nominal gross exports** between 2008 and 2009 (24.6 percent). The contraction in Italian GDPX was contained to 20.3 percent, thanks to the increase in GDPX-intensity. The latter (4.3 percentage points) was mainly mirrored in a reduction of the foreign value added embodied in gross exports (2.6 percentage points from column (7) in Table 1). This is consistent with Italian exporters adjusting their production function in favour of relatively inflexible inputs (domestic labour and capital) and at the disadvantage of more flexible inputs such as imported intermediates (and inventories thereof). Part of the explanation is also the sharp contraction in prices of imported oil and other raw materials.

More generally, the **sharp fluctuations of commodity prices in the 1999-2009 period** are expected to bear a **non-negligible effect on the foreign-value-added-content of Italian exports** measured, as we do here, at current prices. Although a precise evaluation of this effect is beyond the scope of this paper and is left to future research, we do attempt to gauge its magnitude. A rough measure can be obtained by assuming that Italian imports of raw materials and gasoline are a hundred percent foreign value added, which is likely to be only a small overestimation. As these inputs are used to produce, on the use side, all components of demand, further assume that the raw-material intensity of Italian exports, relative to the other components of demand, is constant through time. Under these assumptions, we compute that the portion of the foreign-value-added-content of Italian exports that can be traced back to imported raw materials and gasoline increased from 1.5 percent of gross exports in 1999 to 4.1 percent in 2008 and fell to 2.9 percent in 2009. That

[9] The Italian-GDP content of one dollar of exports: in Table 1 it is presented as a percentage, although in the following we typically express it as a fraction.
[10] As noticed for the majority of countries within the European Union by Amador et al. (2013).
[11] Italian nominal GDP in 2008 was 2198173.8 USD million according to WIOD data.

is to say, raw materials and gasoline accounted for half (2.6 percentage points) of the increase recorded between 1999 and 2008 in the foreign-value-added-content of Italian exports (5.1 percentage points, from 14.3 percent to 19.4; Table 1). It is very plausible that such contribution stemmed almost entirely from a price effect associated with the steep increase in commodity prices, the implicit assumption being that the raw-materials intensity of the Italian production function remained roughly constant in the period under exam.

A related concern deals with the likely sensitivity of the computations presented in Table 1 to fluctuations in the exchange rate of the euro. It is fair to assume that a large fraction of Italian exports and imports are quite independent of the exchange rate of the euro vis-à-vis the US dollar; for instance, all trade with the euro-area partners. This being the case, these transactions fluctuate with the exchange rate as WIOD tables convert them from euros to US dollars for international comparison. The sensitivity to the exchange rate affects both exports and imports, in different proportions depending on composition, and consequently, in loose terms, also the split of Italian exports between domestic and (imported) foreign value added. However, we do not expect our results to be greatly affected, as we express value added contents in percentage of exports and given our tentative estimates on the role of imported raw materials, which are the main cause of composition mismatch between Italian exports and imports.

During the pre-crisis period, the share of Italian GDPX declined over time, dropping from 82.1 to 74.1 percent between 1999 and 2008, and only rebounded to 78.4 in 2009. The pattern indicates **an increasing use of intermediates produced abroad, thus suggesting a strengthening of Italian producers' position as assemblers in downstream activities**[12] (as defined in the previous Section)**.**

On the other side, Italy held a stable position in the upstream stages of global production networks: the share of GDPX that can be traced back to exports of intermediates which, after some processing abroad, are later exported to third countries or re-imported home (the sum of columns (3), (4) and (5) in Table 1) increased from 9.1 percent in 1999 to 10.0 percent in 2007, and was back to 9.1 percent in 2009.

One final remark from Table 1, on intermediates that are exported to be processed abroad, then re-imported in Italy and finally used as inputs to produce goods and services which can either be consumed at home or exported. In the first case (domestic consumption), the domestic value added content of the initial intermediate export ends up in the fifth term of the Koopman decomposition and it contributes to Italian GDP. Its relevance is modest, accounting for only 0.4 percent of gross exports (column (5) in Table 1). In the second case (re-export), the same domestic value added content ends up in the double-counting component and its relevance is even smaller (between 0.2 and 0.3 percent of gross exports, a minor part of the last column in Table 1; see Table A1 in the Appendix).

We conclude this section with a note of caution on what is meant here with the term “exports for intermediate uses”, which we borrow from national accounts jargon, as opposed to the label “exports of intermediate goods” used by trade statistics. In order to illustrate the point, consider that according to Italian trade statistics for year 2007, exports of intermediate goods represented 38.2 percent of overall exports of goods;[13] according to WIOD tables, in 2007 exports of goods for intermediate uses represented 52.4 percent of overall exports of

[12] A similar pattern emerges for the European Union and, even more markedly, for the Euro area (Amador et al., 2013).

[13] Including energy products; classification by Main Industrial Groupings (MIGs), defined by a regulation of the European Commission.

goods,[14] a figure that is close to the share of intermediates in total exports of goods (49.7 percent) as computed from Eurostat data based on a different product classification (BECs, Broad Economic Categories).

National trade statistics have no information, in principle, on how exports are used abroad, so that each product is assigned to a use (intermediate *vs* final) according to an *a priori* assessment based on prevalence. For instance, "Manufacture of milk and dairy products" is assigned to final uses (non-durable consumption, classification by MIGs), without the possibility of distinguishing between a milk carton to be consumed by households and a tank of milk being delivered to a firm that produces cheese. National accounts have no information, either, on how exports are used abroad, whereas input-output tables do have details on how imports are used domestically. The global WIOD database, by combining national input-output tables on the use side and trade statistics on the supply side, provides valuable information towards the estimation of "exports for intermediate uses". We conclude that according to elaborations on WIOD data, Italian trade statistics greatly underestimate the share pertaining to exports of intermediate goods.

4. About misleading trade shares

We now dwell on **two distinct versions of the geographical composition of Italian exports**. Standard shares computed from trade statistics capture the weight of overall demand in, say, Germany, in activating Italian exports. As clarified below, some of those sales are indeed indirect exports to third countries (intermediates shipped to Germany to be embodied in final goods sold in, say, China), and our final-demand approach dictates their geographical allocation is redefined accordingly. The main message of this section will be that **the geographical composition of Italian exports as determined by each country's overall demand (the familiar trade share) does not coincide with the geographical composition as determined by the sole final internal demand component, which is the one that matters for our results.**

Our **measurement exercise** will asses the relevance of indirect exports and support the interpretation that **Italy is strongly integrated in the European production chains of intermediates, whereas the final internal demand served by Italian exporters, both directly and indirectly, has increasingly stemmed from outside the Euro area and the EU.** Also, as we extend the geographical analysis to the domestic value added content of exports, evidence begins to emerge in this section on the **negligible role of composition effects in determining GDPX**, a point discussed at length in section 5.

Figures 2 addresses geographical composition by plotting, for each partner country considered here,[15] three shares in Italian gross exports. The first one is labelled **"trade share"** and it is the standard share of country *j* in Italian exports to the rest of the world. The numerator of this share considers Italian gross exports to country *j*, which are activated by final internal demand in country *j* as well as by country *j's* exports. The share of Italy in Italian exports is zero by definition, since no country exports to itself.

[14] The corresponding share for services is even higher: 74.6 percent.

[15] We have re-organized the 41 geographical entities considered in WIOD matrices into a smaller number of countries and areas: see the Appendix for definitions.

The second share is labelled **"absorption share in gross exports"**. It measures the share, on Italian total exports, of "exports activated by country *j*", namely sales abroad that are ultimately activated by final internal demand in country *j*, no matter where they are shipped to by Italian exporters. It includes two components: final exports to country *j* and exports of intermediate inputs to all other destinations where they are embodied into products that are ultimately shipped, either directly or indirectly via third countries, to country *j* in order to satisfy country *j's* final internal demand. Also final internal demand in Italy contributes to activate Italian exports (the reflection components in Figure 1).

Comparing traditional "trade shares" and "absorption shares in gross exports" reveals interesting information on Italian production-sharing relations. Intermediate goods can travel to their final destination by an indirect route (triangular processing trade). For example, intermediates may be produced in Italy and shipped to Germany for assembly into a final good which is ultimately consumed in the US. In this case, the US "absorption share in Italian gross exports" includes Italian exports of intermediates to a third country (Germany) and embodied in German's exports to the US. On the contrary, these Italian exports of intermediates to Germany are not included in the German "absorption share in Italian gross exports", since they are finally absorbed in the US.

After these clarifications, it is safe to adopt for the rest of the paper the shorter term **"final demand" to indicate "final internal demand"**.

The third share in Figure 2 is labelled **"absorption share in GDPX"** and it measures the contribution of final demand in country *j* in activating Italian GDP through exports. The numerator of this share is just the Italian value added contained in the numerator of the "absorption share in gross exports".

For any fixed *j*, country-*j* "absorption shares" in gross exports and in GDPX can be thought of as the (static) elasticity of Italian exports and of Italian GDPX, respectively, to a 100 percent increase in final demand in country *j*. Figures 2 show the two "absorption shares" vary a lot across counterparts *j*, but are almost identical for any fixed country *j*. The reason is that **the Italian-GDP content of one dollar (the GDPX-intensity) of exports activated by final demand in country *j* does not differ a lot across counterparts *j***. In turn, **this is the result of the sectoral composition of exports not varying enough across counterparts *j* for significant composition effects to arise**. We postpone details on this issue to Section 5 in order to focus on the main message of Figures 2.

In general, standard trade shares are only an imprecise indicator of the ability of countries around the world in activating Italian exports and GDP.

In any given year, trade shares tend to overestimate absorption shares for the EU countries, signalling that **the role played by the EU in activating Italian exports is larger than the weight that final demand in the EU carries in activating Italian domestic value added**. **This is especially due to the Eurozone**, a result which in turn is driven by France and, most of all, Germany. This is a clear implication of the strong "regional integration of production" among Euro-area economies (Amador et al. 2013): **a relevant part of Italian intra-area exports are intermediates used to produce goods and services to be exported for final consumption/investment outside the Euro area.**

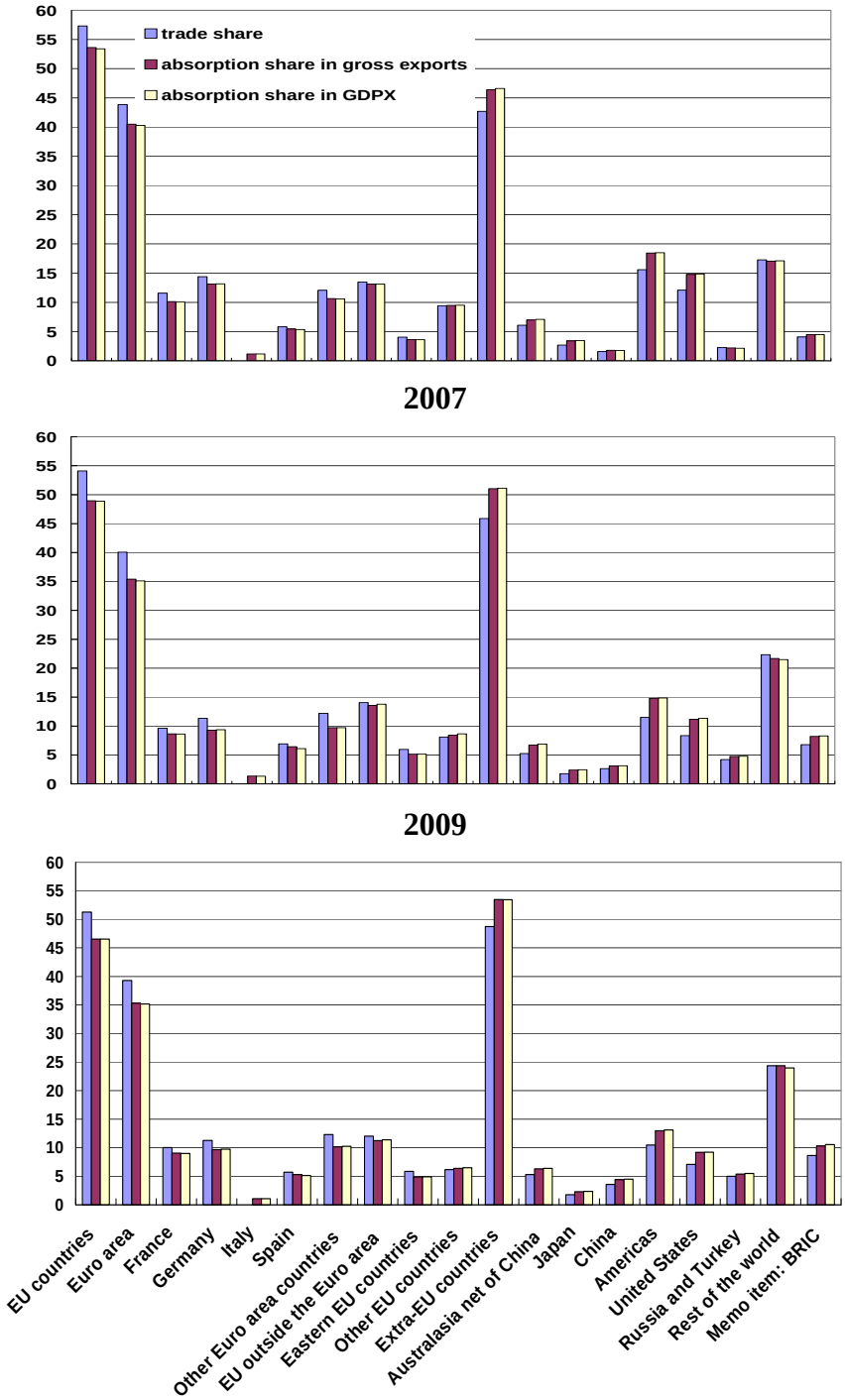
Vice-versa, final demand from **countries outside the EU** activates more Italian exports and GDP than it would appear from trade shares, especially due to the contributions of the US and Japan (plus China in recent years). **The relevance of extra-EU countries has relentlessly increased over time, slightly faster than trade shares indicate, and it overcame the weight of the EU already in 2006**, an occurrence that has not yet taken place on the basis of trade shares.

Figures 2a, 2b and 2c

Partner countries' share in Italian gross exports: "trade share", "absorption share in gross exports" and "absorption share in GDPX".

(in percentage of overall gross exports; percentage points)

1999 **2a**



2007 **2b**

2009 **2c**

Source: authors' calculations on WIOD data.
Notes: see the Appendix for the definition of the geographical entities listed in the figures.

Taking the US as an example, the finding that their absorption share in Italian gross exports is larger than their share in Italian gross exports does not warrant the policy implication that Italian exporters should increase their efforts at serving the US market directly. Rather, the difference between the two shares reveals the extent to which other countries' exports to the US rely on intermediates produced in Italy, which may indeed be regarded as indirect Italian exports to the US.

5. Bilateral results

We now focus on "absorption shares" and their relevance for Italian GDP. We want to address the following question: **how does final demand in the various countries contribute, via the Italian exports they activate, to Italian GDP?**

Answering the question simply means analyzing how different countries contribute to Italian GDPX. In fact, we propose a **comparative statics exercise**. Specifically, we rephrase the question as: given the snapshot of technical coefficients and international organization of production as represented by the WIOD matrix in a given year, **what is the percentage increase in Italian GDP if final (internal) demand in country j increases by 10 percent, everything else equal?** We stress that this is a partial equilibrium comparative statics exercise; in particular, **no second-round effects are considered**: final demand increases in country *j*, global value chains are activated around the world in order to meet that demand, but final demand in all other countries remains unchanged.

In essence, we set off to estimate the (static) elasticity of Italian GDP to final internal demand around the world[16] by relying uniquely on data taken from WIOD input-output tables. These provide a fixed set of "structural" parameters (technical production coefficients, market shares, absorption shares, export composition and so on) which indeed change from one year to the other, but are held constant when **a positive shock to foreign demand is considered and all else expands in proportion**.

In particular, **we assume a unit elasticity of exports to world GDP**; recent studies focussing on world trade have estimated its elasticity to world GDP to be either around 2.0-2.5 (Cheung and Guichard, 2009) or larger than 3 (Freund, 2009).

Be reminded that we trace the **effect on Italian nominal GDP neglecting exports of travel services associated with tourism**: these amounted to 2.1 percent of GDP on average in the period under exam (1999-2009).

5.1. A premise on world demand

Table 2 presents the impact (first-round effect only) on Italian gross exports and value added (both as a share of GDP) when world final demand increases by 10 percent.[17] The last column is the ratio of the first two, namely the GDPX-intensity (the Italian-GDP content of one dollar of exports).

A 10 percent increase in world final demand in 1999 led to an increase of Italian gross exports worth 2.36 percentage points of GDP whereas GDP itself grew by 1.93 percent. This is consistent with the fact that, in 1999, Italian gross exports represented 23.6 percent of GDP and their GDPX-intensity was 0.821.

[16] Felettigh and Federico (2010) had a similar objective but relied on import demand elasticities.
[17] That is, when demand increases by 10 percent in all countries of the world (including Italy itself).

The same shock in 2007 determined an increase of Italian gross exports worth 2.85 percentage points of GDP, whereas GDP itself grew by 2.13 percent (the GDPX-intensity was 0.746). The snapshot for 2009 resembles a step back to 1999: the increase of Italian gross exports was worth 2.32 percentage points of GDP, with GDPX-intensity at 0.784 and GDP growth at 1.82 percent.

Table 2

Impact on the Italian economy of a 10 percent increase in world final internal demand (including Italy itself).

(in percentage of GDP, except for GDPX-intensity[(1)])

Year	Impact on:		Memo item:
	Gross exports	GDP	GDPX-intensity
1999	2.36	1.93	0.821
2000	2.61	2.06	0.789
2001	2.62	2.08	0.795
2002	2.49	2.00	0.803
2003	2.38	1.91	0.802
2004	2.46	1.95	0.791
2005	2.53	1.96	0.776
2006	2.72	2.05	0.752
2007	2.85	2.13	0.746
2008	2.82	2.09	0.741
2009	2.32	1.82	0.784
Memo item: mean (1999-2009)	2.56	2.00	0.782

Source: authors' calculations on WIOD data.
(1) GDPX-intensity is a unitless fraction.

Overall, the impact of world demand on Italian GDP looks stationary, with the downward-sloping trend in GDPX-intensity being compensated by the upward-sloping trend in the impact of foreign demand on Italian gross exports.[18]

The importance of foreign demand for the creation of Italian value added (the second column in Table 2) **evolved in a pro-cyclical fashion**: it grew between 1999 and 2007 and it fell sharply in 2009 with the great trade collapse. This is the net effect of two factors: **a moderately volatile counter-cyclical GDPX-intensity** (the third column in Table 2) **is dominated by a twice as volatile pro-cyclical trade openness** (the first column).

As for the latter, this is defined as the ratio between gross exports (net of tourism) and GDP. Until the great trade collapse, the numerator ran faster than the denominator for two reasons. On the one side, Italian internal demand grew slower than global demand.[19] On the other side, the increasing relevance of double-counting (last column in Table 1) testifies to multilateral ("triangular") production sharing having been an independent source of gross

[18] The latter impact is expressed as a share of GDP, so that stagnant growth in Italy contributed to the upward trend mentioned in the text.
[19] In loose terms, internal demand mainly affects the denominator (GDP), whereas global demand affects the numerator (exports) one-to-one and the denominator less than one-to-one.

export growth for Italy, with goods crossing the Italian border multiple times during stages of production before final export. [20]

As for GDPX-intensity, its evolution is common to the majority of the European countries and it is a mirror image of the pro-cyclical pattern in the use of imported inputs (Amador et al., 2013), driven by firms' attempt at reducing variable costs.

GDPX-intensities are diffusedly countercyclical also at the sectoral level; Table 7 below will provide details on the matter.

5.2. Bilateral results: major countries and areas

Table 3 considers a 10 percent increase in final demand in each country in turn and tracks the response of Italian exports and value added (both as a share of GDP). It is a complement to Table 2 but adds little information relative to Figure 2. It shows how **Italy has become more and more dependent on final demand outside the EU, with emerging economies such as China, Russia and Turkey gaining importance in this respect at the expenses of major advanced economies such as the US and Japan**.

Table 3

Impact on Italian exports and GDPX of a 10 percent increase in selected areas' final internal demand

(in percentage of GDP, except for GDPX-intensities(1))

Countries and areas:	1999			2007			2009		
	Exports	GDPX	GDPX-intensity	Exports	GDPX	GDPX-intensity	Exports	GDPX	GDPX-intensity
EU countries	**1.26**	**1.03**	**0.817**	**1.40**	**1.04**	**0.744**	**1.08**	**0.85**	**0.785**
Euro area (EA)	0.95	0.78	0.816	1.01	0.75	0.739	0.82	0.64	0.782
of which: *France*	*0.24*	*0.19*	*0.815*	*0.25*	*0.18*	*0.742*	*0.21*	*0.16*	*0.780*
Germany	*0.31*	*0.25*	*0.823*	*0.26*	*0.20*	*0.751*	*0.22*	*0.18*	*0.790*
Italy	*0.03*	*0.02*	*0.813*	*0.04*	*0.03*	*0.733*	*0.03*	*0.02*	*0.777*
Spain	*0.13*	*0.10*	*0.804*	*0.18*	*0.13*	*0.707*	*0.12*	*0.09*	*0.757*
EU countries not in the EA	0.31	0.25	0.820	0.39	0.29	0.758	0.26	0.21	0.793
Eastern EU countries	0.09	0.07	0.817	0.15	0.11	0.746	0.11	0.09	0.787
Other EU countries	0.22	0.18	0.822	0.24	0.18	0.765	0.15	0.12	0.798
Extra-EU countries	**1.09**	**0.90**	**0.824**	**1.46**	**1.09**	**0.747**	**1.24**	**0.97**	**0.784**
Australasia net of China	0.16	0.14	0.833	0.19	0.15	0.765	0.15	0.12	0.794
of which: *Japan*	*0.08*	*0.07*	*0.831*	*0.07*	*0.05*	*0.768*	*0.05*	*0.04*	*0.801*
China	0.04	0.03	0.818	0.09	0.07	0.750	0.10	0.08	0.797
Americas	0.43	0.36	0.824	0.42	0.32	0.749	0.30	0.24	0.791
of which: *USA*	*0.35*	*0.29*	*0.826*	*0.32*	*0.24*	*0.755*	*0.21*	*0.17*	*0.788*
Russia and Turkey	0.05	0.04	0.808	0.14	0.10	0.750	0.12	0.10	0.804
Rest of the world	0.40	0.33	0.824	0.62	0.46	0.740	0.57	0.44	0.771
Total	**2.36**	**1.93**	**0.821**	**2.85**	**2.13**	**0.746**	**2.32**	**1.82**	**0.784**
Memo item: BRIC	0.11	0.09	0.816	0.23	0.18	0.755	0.24	0.19	0.804

Source: authors' calculations on WIOD data.
Notes: see the Appendix for the definition of the geographical entities listed in the table.
(1) GDPX-intensities are unitless fractions.

[20] The trade openness indicator in Table 2 (first column) moved from 2.36 percentage points of GDP in 1999 to 2.85 in 2009; the growth of the double-counting component accounted for 0.10 p.p. of this increase.

On the contrary, between 1999 and 2007 the contribution of EU countries to Italian GDP remained quite stagnant, with the increasing weight of Eastern EU economies making up for the weakening role of the Euro area. Eastern EU countries, while still a target for offshoring activities to exploit lower costs of production, are becoming also attractive markets for the absorption of Italian exports.

With the crisis in 2009, the impact of foreign demand on the Italian economy decreased across the board. The setback was however less pronounced for demand outside the EU, enabling these countries to become the major source of GDP activation for Italy.

Table 3 also shows **GDPX-intensities by country of activation**: these **tend to be fairly similar across countries at any point in time**. The distribution is especially tight in 1999: it lies between 0.804 and 0.833. **The reason lies in the lack of significant composition effects**, as we discuss in the next section.

5.3. Bilateral results: final and intermediate uses

Table 3 has summarized the response of Italian exports and value added. The impact can be further split into the components due to exports for final uses and to exports for intermediate uses, a point we now discuss and exploit to investigate composition effects.

Let ΔGX_j indicate the increase in Italian exports to country j and all other destinations activated by a 10 percent increase in final internal demand in country j, and let $\Delta GDPX_j$ be the Italian value added embodied in ΔGX_j. The associated GDPX-intensity is defined as

$$gdpx_j := \Delta GDPX_j / \Delta GX_j . \qquad [1]$$

In any given year, exports by each of the 35 sectors has a specific GDPX-intensity which depends on technical coefficients and as such is independent of where exports are shipped to and of their use (final vs intermediate). Consequently, the GDPX-intensity of Italian exports activated by a 10 percent increase in final internal demand in country j ($gdpx_j$) **varies with *j* because it depends on the specific sectoral composition of those exports.** It is intractable to keep track of 35 sectors in understanding the differences among countries in the figures below, so we simplify composition effects by splitting exports (activated by demand in country *j*) between final uses and intermediate uses. These two components differ in sectoral composition, thus having specific GDPX-intensities,[21] which enables us to get a grasp of (and expose) composition effects by looking at two determinants only. Specifically, we use the following decomposition:[22]

$$\Delta GDPX_j = \Delta GX \cdot s_j \cdot [s_j^{Fin} \cdot gdpx_j^{Fin} + s_j^{Int} \cdot gdpx_j^{Int}], \qquad [2]$$

where

- ΔGX is the increase in Italian exports when final internal demand increases by 10 percent in all countries, including Italy itself ("size of the global shock");
- s_j is the share of country *j* in total Italian exports to the rest of the world ("**relative size**");
- s_j^{Fin} (s_j^{Int}) is the share of exports for final (intermediate) uses in overall Italian exports activated by final internal demand in country *j* ($s_j^{Fin} + s_j^{Int} = 1$).

Notice that s_j is a "trade share"; s_j^{Fin} and s_j^{Int} are "absorption shares" as defined in Section 4.

The four variables in square brackets (**"composition variables"**) in equation (2) fully summarize the composition effects mentioned earlier. **In any given year, they do vary**

[21] These are defined as $gdpx_j^{Fin}$ and $gdpx_j^{Int}$ by applying equation [1] to the exports for final uses and to the exports for intermediate uses, respectively.

[22] See the Appendix for the derivation.

across countries, but too little for being relevant towards cross-sectional variability. **Consequently, the overall counterpart-specific GDPX-intensity $gdpx_j$ is fairly similar across countries at any point in time**, as Table 3 has shown.

Composition effects being modest, "relative size" is a sufficient statistic to determine each country's overall contribution to Italian GDPX and country ranking in Figures A1, A2 and A3 mimics the ordering in Figures 2, discussed earlier.

Composition effects being modest, also the split of GDPX between final and intermediate uses tends to mirror the corresponding composition in gross exports (see Figures A1, A2 and A3). Heterogeneity in the "composition variables" accounted at most for a one percentage point difference between the share of final uses in gross exports[23] and the share of final uses in GDPX.[24]

5.4. Composition variables: distribution and evolution

Table 4 summarizes the distribution of the composition variables appearing in equation [2] across counterpart countries and areas activating Italian exports via final demand. The last two rows report the column-wise minimum and maximum, respectively, after dropping Italy itself from the list of counterpart countries: Italian final demand only activates Italian global exports for intermediate uses.

We stress again that Table 4 refers to Italian exports activated by final demand in the countries listed in the left-most column, not to Italian exports to those countries.

The main message is that composition does not matter: the variability of the "composition variables" was very muted in 1999 and only shows a very moderate increasing trend, which once again is reversed in 2009.

For any fixed counterpart, **the GDPX-intensity of Italian exports for final uses** does move across time but **tends to be very close to the GDPX-intensity of exports for intermediate uses**, implying that the sectoral composition does not vary a lot across uses.

Exports for final uses tend to be more GDPX-intensive than the corresponding exports for intermediate uses. More precisely, in 2009 this was true for all counterparts presented here except Spain[25]; exceptions amounted to one third of the cases in 1999: **the GDPX-intensity of Italian exports for intermediate uses fell proportionately more than the GDPX-intensity of exports for final uses**.

At the same time, the majority of Italian exports are for intermediate uses. This configures **a mildly adverse "specialization pattern": Italian exports are specialized in intermediate uses, which are the least GDPX-intensive**.

The only three countries that, in all years considered here, activated mostly Italian exports for final uses were Japan, Germany and France. Restricting attention to 2007 and 2009, a fourth counterpart arises, the sum of Russia and Turkey, mainly thanks to the former: **by 2009 Russia became the country activating Italian exports for final uses in the highest proportion** (66.9 percent). At the other end, **China was the country that activated Italian exports for final uses in the lowest proportion**:[26] 39.1 percent, up from 26.1 in 2007, still lower than 1999 (42.7 percent).

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[23] The average share across all destinations was 44.1 percent.

[24] For instance, in 2007 final uses accounted for 51.6 percent of gross exports to Japan and for 52.6 percent of the Italian value added embodied in overall exports activated by final demand in Japan.

[25] Again, excluding Italy from the set of counterpart countries.

[26] Again, excluding Italy from the set of counterpart countries.

Table 4

Distribution across counterparts of the "composition variables" in 1999, 2007 and 2009

(s_j^{Fin} is a percentage, GDPX-intensities are unitless fractions)

Counterpart countries and areas:	1999			2007			2009		
		GDPX-intensities (1)			GDPX-intensities (1)			GDPX-intensities (1)	
	s_j^{Fin}	Final uses	Inter-mediate uses	s_j^{Fin}	Final uses	Inter-mediate uses	s_j^{Fin}	Final uses	Inter-mediate uses
EU countries	**51.4**	**0.818**	**0.817**	**47.5**	**0.748**	**0.741**	**48.8**	**0.788**	**0.781**
Euro area (EA)	51.9	0.818	0.815	47.6	0.744	0.735	48.9	0.785	0.779
of which: *France*	*55.1*	*0.814*	*0.815*	*52.5*	*0.747*	*0.737*	*53.0*	*0.787*	*0.773*
Germany	*55.0*	*0.826*	*0.819*	*51.8*	*0.761*	*0.740*	*55.1*	*0.796*	*0.783*
Italy	*0*	*0*	*0.813*	*0*	*0*	*0.733*	*0*	*0*	*0.777*
Spain	*51.9*	*0.804*	*0.805*	*46.5*	*0.706*	*0.708*	*44.1*	*0.749*	*0.763*
EU countries not in the EA	49.7	0.817	0.823	47.3	0.758	0.758	48.3	0.799	0.788
Eastern EU countries	48.8	0.816	0.819	48.7	0.753	0.739	47.4	0.795	0.780
Other EU countries	50.0	0.818	0.825	46.4	0.761	0.769	49.0	0.801	0.795
Extra-EU countries	**44.8**	**0.823**	**0.825**	**40.8**	**0.750**	**0.746**	**46.5**	**0.789**	**0.780**
Australasia net of China	50.9	0.834	0.832	44.1	0.775	0.757	46.7	0.806	0.784
of which: *Japan*	*60.5*	*0.835*	*0.824*	*51.6*	*0.783*	*0.752*	*55.0*	*0.812*	*0.787*
China	42.7	0.817	0.819	26.1	0.756	0.748	39.1	0.799	0.796
Americas	46.6	0.821	0.826	38.5	0.752	0.747	41.5	0.794	0.790
of which: *USA*	*47.1*	*0.823*	*0.828*	*38.5*	*0.759*	*0.753*	*42.0*	*0.791*	*0.786*
Russia and Turkey	46.5	0.812	0.804	54.0	0.764	0.735	62.8	0.813	0.789
Rest of the world	40.3	0.822	0.825	40.6	0.736	0.742	46.8	0.773	0.769
Total	**48.3**	**0.820**	**0.821**	**44.1**	**0.749**	**0.744**	**47.5**	**0.788**	**0.781**
Memo item: BRIC	42.5	0.814	0.817	38.7	0.767	0.748	47.1	0.808	0.799
Column-wise minimum:(2)	40.3	0.804	0.804	26.1	0.706	0.708	39.1	0.749	0.763
Column-wise maximum:(2)	60.5	0.835	0.832	54.0	0.783	0.769	62.8	0.813	0.796

Source: authors' calculations on WIOD data.
Notes: see the Appendix for the definition of the geographical entities listed in the table.
(1) In terms of the notation of equation [2]: $gdpx_j^{Fin}$ and $gdpx_j^{Int}$.
(2) Excluding Italy from the set of counterpart countries.

We have just mentioned that final internal demand in France and Germany mainly activates Italian exports (to France, Germany and all other countries) for final uses; instead, Italian exports to France and Germany, as recorded by trade statistics, mainly consist of intermediate goods and services and are activated (in principle) by demand in all countries of the world. Since exports for final uses are more GDPX-intensive than exports for intermediate uses, it follows that Italian exports to France and Germany have a higher GDPX-intensity than Italian exports activated by final internal demand in France and Germany. The difference is however tiny in practice, and the same holds for all other counterparts: see Table A2 in the Appendix.

5.5. Bilateral results: evolution over time

Consider a 10 percent increase in partner countries' final internal demand: how did the impact on Italian gross exports and GDPX change between 1999 and 2007? Figure 3 addresses this question, using information mainly taken from Table 3; the horizontal axis reports the change in the relevance of each country in activating Italian exports and the vertical axis reports the change in the relevance of each country in activating Italian GDP. The size of the bubbles is proportional to the importance of each country's demand in activating Italian exports (i.e. proportional to "absorption share in gross exports") in 1999.

All bubbles in Figure 3 lie below the 45-degree line, due to the fact that GDPX-intensities fell across the board between 1999 and 2007. Due to the consolidation of the single European market, **the role of the EU in activating Italian exports increased (albeit slightly). There was however no change in the activation of domestic value added, as the drop recorded for the Euro area was compensated by the increase brought about by the remaining member countries**.[27] In turn, the disappointing contribution of the Eurozone was driven by the stagnant role of France and the reduction in the activation by German demand. **The impact of foreign demand on Italian exports and GDP increased between 1999 and 2007 mainly thanks to the extra-EU component**;[28] **it fell in the subsequent two years (Figure 4) mainly due to foreign demand originated in the EU.**

Between 2007 and 2009 only final demand in Brazil and in China carried a positive contribution to the expansion of Italian gross exports and their domestic value added content. All bubbles in Figure 4 lie above the 45-degree line, as all GDPX-intensities increased between 2007 and 2009.

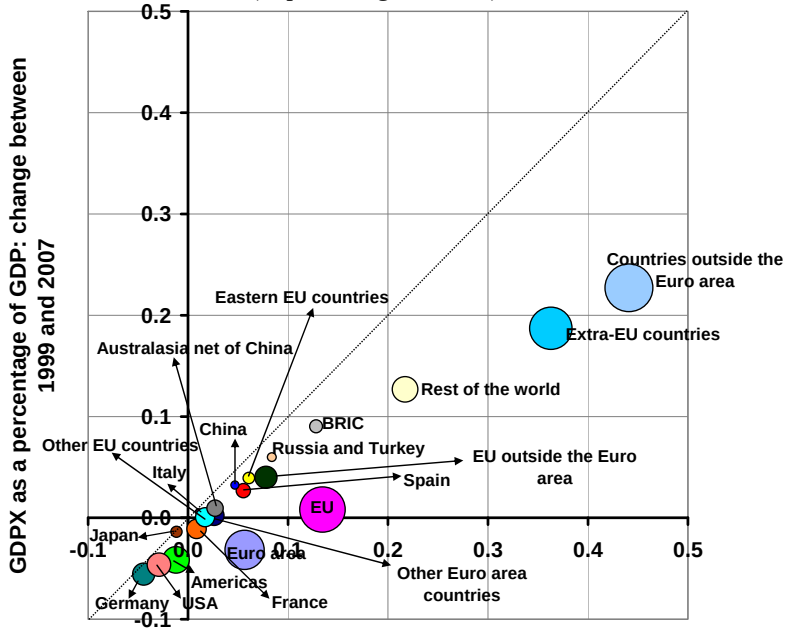
[27] In Figure 3, the EU is the vectorial sum of the sub-areas that partition it.

[28] Despite a negative contribution from the US, which in 1999 accounted for almost one third of Italian gross exports activated by final demand outside the EU.

Figure 3

Gross exports and GDPX activated by partner countries: change between 1999 and 2007

(in percentage of GDP)



Gross exports as a percentage of GDP: change between 1999 and 2007

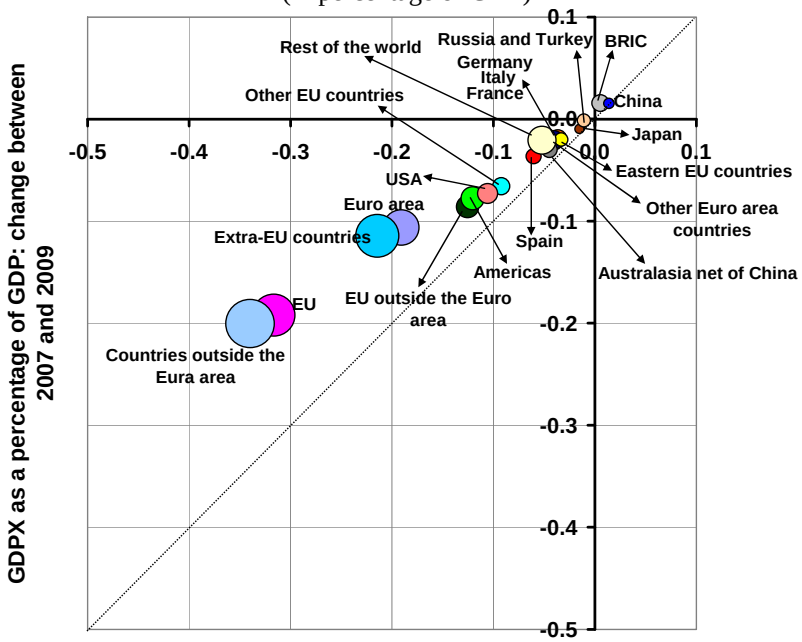
Source: authors' calculations on WIOD data.

Notes: The horizontal (vertical) axis reports the change in the ratio of gross exports (of GDPX) over GDP, as activated by final demand in each partner country. The size of the bubbles is proportional to the "absorption shares in gross exports" in the initial year. See the Appendix for the definition of the geographical entities.

Figure 4

Gross exports and GDPX activated by partner countries: change between 2007 and 2009

(in percentage of GDP)



Gross exports as a percentage of GDP: change between 2007 and 2009

Source: authors' calculations on WIOD data.

Notes: see previous figure.

6. Sectoral analysis of exports and GDPX

Final internal demand around the world activates exports by each sector of the Italian economy. In turn, exports of any given sector contain domestic value added that has been created, directly or indirectly, in all domestic sectors (in principle). These **domestic inter-sectoral linkages are indeed relevant in shaping the performance and the profitability of Italian exporting firms: around one third of the domestic value added contained in manufacturing exports originates in the service sector; vice-versa, around 90 per cent of the domestic value added contained in service exports originates in services**.

In order to assess these results, a brief methodological digression is in order. National Supply and Use Tables (SUTs) are not symmetric but rather classify suppliers according to products, and users according to main activity (industry). As a consequence, it would be hard to distinguish whether service inputs used by manufacturing were being supplied by firms in the service sector or by manufacturing firms.[29] The issue is related to the multi-product nature of firms and their so-called secondary production, and is a relevant one for Italy: Federico and Tosti (2012) estimated that in 2009 around one third of Italian service exports originated from manufacturing firms. However, a treatment of secondary products is applied to national SUTs before they are aggregated into symmetric (industry-by-industry) WIOD tables. The procedure that transforms national SUTs into symmetric tables might still introduce a bias; while a full disambiguation of the issue at hand is left for future research, we point out that preliminary conclusions might be drawn by substituting the matrix of technical coefficients for Italy, as computed from WIOD tables, with the corresponding matrix computed from the symmetric SUTs published by Istat at intervals of five years.

6.1. The big picture: four macro-sectors

Table 5 collapses the 35 sectors considered in WIOD tables into four aggregates (manufacturing, constructions, services and "raw materials and electricity") and traces the "sectoral" origin of the domestic value added content of Italian exports. Overall exports of goods and services are considered, together with a focus on manufacturing and services.[30]

Three main features are manifest in Table 5. Firstly, **exports of services are more effective in activating GDP than it appears from trade statistics since they are more GDPX-intensive than exports of manufactures**, the reason being that international fragmentation of production mainly concerns the making of goods. Taking 2009 as a benchmark, in every dollar of manufacturing exports there are 75.9 cents of domestic value added, whereas the cents are 89.5 for services. The difference is 13.6 percentage points (and was even higher in 2007 and 2008, around 16 percentage points). On the one hand the difference is significant: it is equivalent to imagining that services were as GDPX-intensive as manufactures, but "true" exports of services were 17.9 percent bigger than recorded by trade statistics. On the other hand, the difference is muted by relative size, in the following sense. According to WIOD data for 2009, exports of services are around one fifth of manufacturing exports, so that disregarding GDPX-intensities, one would estimate that a 1 percent increase in manufacturing exports has the same impact on GDP growth, everything

[29] More generally, a column for a particular industry in the Use table only provides the average production structure across all firms and all products in that industry. These structures may be rather different according to firms' characteristics (size, vertical integration, propensity to export); an aggregation bias is possibly introduced which calls for further evidence based on firm-level data (Koopman et al., 2012a).

[30] The sum of manufactures and services accounts for around 98 percent of overall exports in any year considered here.

else equal, as a 5 percent increase in service exports. The estimate only drops to 4.1 when correctly taking into account that services are more GDPX-intensive than manufactures.

Table 5

Domestic value added in Italian exports by macro-sector of origin

(in percentage of the corresponding sectoral gross exports unless otherwise indicated)

Exports of:	Year	Gross exports (millions of US dollars) (1)	GDPX as a percentage of sectoral gross exports (1) (2)	originated in raw materials and electricity sectors (3)	originated in manufacturing sector (4)	originated in construction sector (5)	originated in services sector (6)
Goods and services	1999	267446	82.1	4.8	40.7	1.0	35.5
	2000	271817	78.9	4.3	39.2	0.9	34.5
	2001	278623	79.5	4.4	38.2	1.0	35.8
	2002	289677	80.3	4.4	38.4	1.0	36.6
	2003	341425	80.2	4.4	37.9	1.0	36.9
	2004	405297	79.1	4.0	37.3	1.1	36.6
	2005	428302	77.6	4.0	36.6	1.1	35.9
	2006	481657	75.2	3.8	35.7	1.1	34.5
	2007	574778	74.6	3.8	35.7	1.1	34.0
	2008	620446	74.1	4.1	34.9	1.1	34.0
	2009	467639	78.4	4.2	35.6	1.2	37.4
Manufacturing	1999	220859	80.2	3.8	48.2	0.8	27.4
	2000	226124	76.8	3.5	46.2	0.8	26.4
	2001	228214	77.2	3.6	45.6	0.8	27.2
	2002	238745	78.2	3.6	45.6	0.8	28.3
	2003	281163	78.0	3.5	45.1	0.9	28.6
	2004	333041	76.8	3.3	44.4	0.9	28.2
	2005	351033	75.1	3.2	43.6	0.9	27.4
	2006	394813	72.4	3.1	42.6	0.9	25.9
	2007	474541	71.8	3.0	42.3	0.9	25.7
	2008	515486	71.4	3.2	41.1	0.9	26.2
	2009	379208	75.9	3.4	42.9	1.0	28.6
Services	1999	40976	90.7	1.8	5.2	1.4	82.3
	2000	40572	89.4	1.6	4.9	1.3	81.7
	2001	45000	89.7	1.7	4.8	1.3	81.9
	2002	45217	90.4	1.6	4.6	1.2	82.9
	2003	53384	90.7	1.6	4.6	1.3	83.2
	2004	64604	89.7	1.5	4.8	1.4	82.0
	2005	68818	89.0	1.5	4.7	1.5	81.3
	2006	77620	87.8	1.5	4.6	1.5	80.3
	2007	88948	87.9	1.4	4.5	1.5	80.4
	2008	91690	87.7	1.5	4.3	1.5	80.4
	2009	78019	89.5	1.5	3.9	1.6	82.5

Source: authors' calculations on WIOD data.

(1) This is just the GDPX-intensity presented in percentage terms rather than as a fraction.

Secondly, **around one third of the domestic value added contained in manufacturing exports originates in the production of services;**[31] **vice-versa, around 90 percent of the domestic value added contained in service exports originates in services**. This is due to the fact that manufacturing uses services (whoever is the supplier) as a relevant share of production inputs, whereas the vice-versa does not hold. With the above-mentioned caveats, we also see it as testimony that **an inefficient service sector can be detrimental for the performance and the profitability of manufacturing exports**.

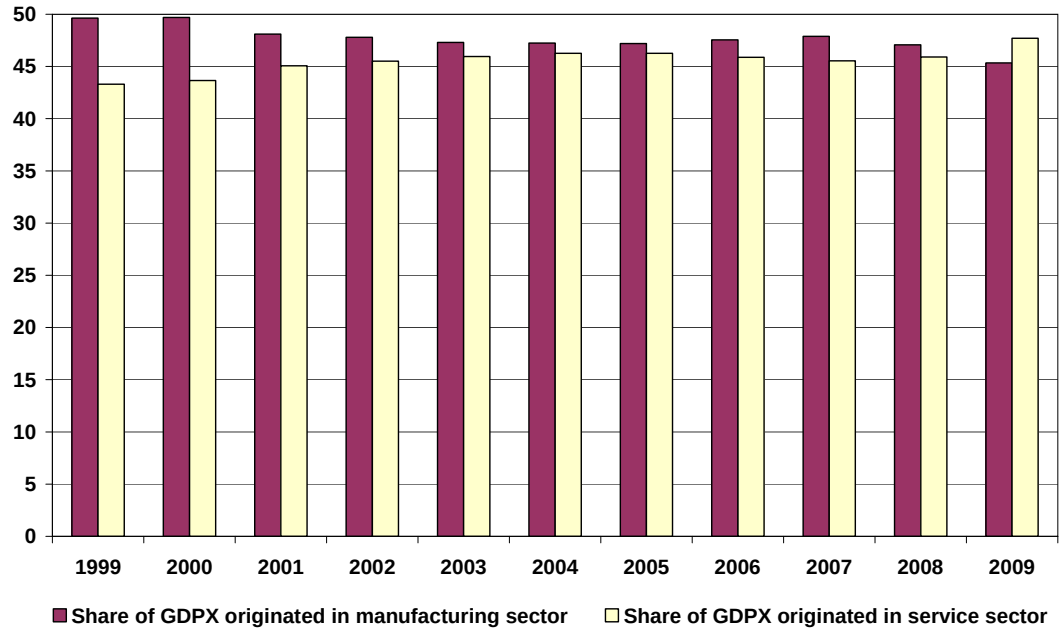
Thirdly, the shares of export-related domestic value added originated in the manufacturing sector on the one side and in the service sector on the other side evolved differently over time. As already mentioned in Section 5.1, the countercyclical behaviour of GDPX-intensities holds also for the breakdown between sectors of origin. **When looking at overall exports of goods and services** (upper portion of Table 5)**,** a decreasing trend emerged between 1999 and 2008, with 2009 witnessing a rebound: **the share of GDPX originated in services declined at a slower pace relative to manufacturing and recovered more strongly in 2009, to the point that the share itself was higher in 2009 than in 1999**. **When focussing on manufacturing exports only** (middle part of Table 5)**, the overall negative trend affecting the ability to activate domestic value added arises exclusively in the portion originating in the manufacturing sector itself.**

Table 5 reports shares in gross exports; in order to comment on the contribution of the four macro-sectors to the creation of domestic value added (through exports), it is more convenient to look at Figure 5, where shares are re-cast as a percentage of GDPX.[32]

Figure 5

Overall exports of goods and services: shares of GDPX by sector of origin

(percentage points)



Source: authors' calculations on WIOD data.

Notes: in order to obtain the time series plotted here from Table 5, one needs to divide columns (4) and (6), respectively, by column (2). In any given year, the two series together with the unreported share pertaining to raw materials and constructions sum to 100.

[31] That is, looking at the manufacturing portion of Table 5, column (6) is around one third of column (2).

[32] From Table 5, it suffices to divide columns (3) to (6) by column (2).

The weight of services as a source of domestic value added embodied in overall exports of goods and services grew over time and in 2009 it surpassed the weight of manufacturing. **This is due to the growing activation of services by manufacturing exports**, not to "direct" service exports growing faster; in fact, the percentage composition of manufactures and of services in total gross exports was stable throughout the period under examination (on average, 82.3 and 15.7 percent).

Summing up the evidence presented in this Section and in Table 1, a tendency emerges that was only mitigated by the great trade collapse in 2009; it is consistent with international fragmentation of production mostly characterizing the production of manufactures. Between 1999 and 2008, the ability of Italian exports in activating domestic value added evolved along a decreasing trend, whose origin laid almost entirely in the manufacturing sector, and which was mainly compensated by an increasing share of foreign value added (i.e. imported intermediates).

6.2. A finer sectoral disaggregation

We now entertain a finer disaggregation whereby the 35 sectors presented in WIOD tables are sorted into 14 ones. We build a two-way table (Table 6) where rows indicate the exporting sector and columns indicate the sector where the domestic value added content of those exports originated. As an example, the first numeric row of the table reveals that the sector "raw materials" exported $8450 million in 2009, with the associated domestic value added content worth 88.4 percent of such amount. As for sectoral origin, 70.3 percent of this 88.4 percent originated in the "raw materials" sector itself, 2.4 percent originated in the second sector and so on until the cumulative sum is 100 percent with the 14th sector. The last two columns are memory items, reporting the overall share of GDPX originated in manufacturing (sectors 2 to 7) and in the broad service sector (sectors 9 to 14).

Table 6 highlights three **structural characteristics of the Italian economy that appear to be unaffected by the business cycle**.[33] Firstly, there is quite some **variability in the GDPX-intensity across sectors, more so within manufacturing than within services** (column "GDPX as a percentage of gross exports"). At the top end, 96.1 percent of exports by sector "financial services and real estate" is Italian domestic value added; at the lower end, the GDP content of exports by sector "refined oil and electricity" is only 18.1 percent.[34] **Italian major specialization sectors, that is "traditional sectors" and "machinery and electrical equipment" display the highest GDPX-intensities among manufactures** (82.5 and 79.4 percent, respectively). These results are consistent with those presented in Cappariello (2012).

Secondly, **exports by any sector tend to generate domestic value added mainly within the sector itself**, as indicated by the main diagonal of Table 6 (gray shading). While this may be obvious, that there are exceptions and sharp differences due to diversity in the technological characteristics and in the organizational structure of each industry's production process. The most interconnected sector is "transport equipment", with only 36.6 percent of its GDPX originated in the sector itself; at the other extreme, 86.2 percent of the GDPX of "financial services and real estate" is created "in house".

[33] Table 6 refers to 2009; see the Appendix for years 1999 and 2007.

[34] The percentage decreased over time with the growth in oil prices, a point we come back to in the next section.

Thirdly, we mentioned earlier that manufacturing uses services as production inputs in abundance, while the vice-versa does not hold. According to Table 6, **the value added activated by manufacturing exports and originating in the service sub-sector comes mostly from "trade" (retail and wholesale)**, followed by "renting of machinery and equipment and other business activities", "financial services and real estate" and "transport services".[35] **Among manufacturing, exports of "transport equipment" contain the highest share (42.1 percent) of domestic value added originated in the service sectors**.

[35] WIOD tables distinguish between inland transport, water transport and air transport. The first component is the predominant one.

Table 6

Domestic value added in Italian exports by sector of origin: 2009

(units as indicated)

Sector identifier:	Exporting sector:	Gross exports (millions of US dollars)	GDPX as a percentage of gross exports	Percentage distribution of GDPX across internal origin sectors (percentage points) Sector identifier (as defined in the first column of the table): 1	2	3	4	5	6	7	8	9	10	11	12	13	14	MM	SS
1	Raw materials	8450	88.4	70.3	2.4	3.4	0.8	0.5	0.4	0.2	0.8	7.0	3.2	4.7	4.2	1.2	0.9	7.7	21.2
2	Refined oil and electricity	14018	18.2	8.2	58.4	1.8	1.9	0.7	1.1	0.1	1.1	6.4	3.5	6.1	6.4	2.3	2.0	64.0	26.7
3	Traditional sectors	108170	82.5	4.3	2.9	48.6	1.4	1.5	0.9	0.2	1.4	12.6	5.6	7.4	9.0	2.3	1.9	55.5	38.8
4	Chemicals, rubber and plastics	55886	71.6	1.1	3.9	3.8	47.9	1.4	1.4	0.3	1.3	12.4	5.7	6.8	9.7	2.3	2.0	58.6	39.0
5	Metal products	48220	76.1	0.7	2.6	3.5	1.1	53.6	1.7	0.3	1.2	10.2	4.5	7.5	9.4	2.2	1.6	62.6	35.4
6	Machinery and electrical equipment	112620	79.4	0.5	2.2	2.5	1.4	7.2	48.9	0.3	1.3	9.9	4.5	7.4	9.8	2.6	1.4	62.6	35.7
7	Transport equipment	40974	74.3	0.6	2.3	3.4	1.9	7.2	4.4	36.6	1.3	12.7	6.2	7.2	11.7	2.5	1.7	56.0	42.1
8	Construction	1282	88.1	1.2	1.2	5.2	0.7	2.9	1.2	0.2	59.3	6.3	3.6	6.3	8.1	2.3	1.4	11.4	28.0
9	Trade	24429	88.7	0.9	1.5	2.8	0.6	0.7	0.9	0.2	1.6	57.5	5.0	10.8	12.8	2.9	1.8	6.7	90.8
10	Transport services	17909	84.0	0.8	1.5	2.7	0.6	0.9	1.0	0.9	2.3	7.9	55.7	8.1	11.8	4.0	1.6	7.6	89.2
11	Financial services and real estate	9663	96.1	0.1	0.5	0.6	0.1	0.2	0.2	0.0	0.8	1.3	0.9	86.2	6.6	2.0	0.6	1.6	97.5
12	Renting of machinery and equipment	20551	91.5	0.3	1.0	1.4	0.4	0.4	0.7	0.1	1.7	3.2	2.6	7.3	76.2	3.1	1.5	4.1	93.9
13	Other “private” services	2926	91.3	0.3	1.3	1.7	0.4	0.5	1.4	0.2	4.2	3.5	2.8	6.4	10.7	64.7	1.9	5.5	90.0
14	Public administration and “public” services	2540	92.3	0.3	1.3	1.3	0.5	0.4	0.5	0.2	1.1	2.8	1.8	7.7	8.1	1.9	72.2	4.0	94.6
TT	**All sectors**	**467639**	**78.4**	**3.0**	**2.8**	**14.0**	**6.3**	**8.4**	**13.0**	**3.3**	**1.6**	**13.1**	**6.9**	**9.5**	**13.2**	**3.0**	**2.1**	**47.7**	**47.7**
MM	Manufacturing	379888	75.9	1.9	3.2	17.2	7.9	10.5	16.3	4.1	1.3	11.4	5.2	7.3	9.7	2.4	1.7	59.1	37.7
SS	Services	78019	89.5	0.6	1.2	2.0	0.5	0.6	0.8	0.3	1.8	20.8	14.5	19.0	28.6	5.4	3.9	5.4	92.3

Source: authors’ calculations on WIOD data.

Notes: gray shadows highlight the main diagonal. See the Appendix for how the sectors presented here are defined starting from the 35 sectors listed in WIOD tables.

6.3. The full sectoral disaggregation

We now disregard the sectoral origin of GDPX and exploit the full sectoral disaggregation of the WIOD tables for a brief detour that complements our previous geographical analysis; data are presented in Table 7.

As anticipated in Section 5.1, **the countercyclical pattern of GDPX-intensities holds for the vast majority of the sectors**, with the notable exception of the refined petroleum industry (sector 8 in the table), which was affected by the upward trend in the price of unprocessed oil. **Fluctuations in GDPX-intensities tend to be smaller for services relative to manufacturing. When comparing 2009 with 1999, construction is the only sector where the GDPX-intensity did not fall.**

Although GDPX-intensities do not depend on whether exports are for final uses or for intermediate ones, the initial columns in Table 7 reveal that **exports of services and construction are predominantly for intermediate uses, whereas the split is almost fifty-fifty for manufacturing sectors**. Food and beverages, together with traditional sectors (textiles, apparel, leather products) export mostly for final uses, whereas the share of final exports varied in the 1999-2009 period between 58 and 67 percent for machinery and was around a half for transport equipment.

Since the mid-nineties**, textiles, apparel and leather industries** have been re-organising their production processes, their product lines and their customer base. This is reflected in a **constant increase in their orientation towards final consumers**.

The last columns of Table 7 reveal that only a few sectors experienced a significant variation of their weight in overall GDPX. Specifically, the importance of other manufactures (mainly furniture) decreased by one fourth, whereas the biggest gains were recorded by metal products, renting of machinery and equipment, food and beverages and financial intermediation.

The last row of Table 7 reports the column-wise standard deviations over the first 34 sectors.[36] **The sectoral dispersion of GDPX-intensities steadily increased over time**. On the contrary, the sectoral dispersion in the share of final uses in gross exports remained quite flat.

[36] The 35th sector, "Private Households" does not export anything.

Table 7
(continued on the next page)

Share of final uses in gross exports, GDPX-intensity and contribution to overall GDPX: sectoral disaggregation

(units as indicated)

Sectors	Share of final uses in sectoral gross exports			GDPX-intensity of the sector			Percentage sectoral contribution to overall GDPX		
	1999	2007	2009	1999	2007	2009	1999	2007	2009
1. Agriculture, Hunting, Forestry and Fishing	0.691	0.673	0.640	0.928	0.886	0.881	1.7	1.5	1.6
2. Mining and Quarrying	0.061	0.071	0.114	0.923	0.874	0.896	0.2	0.4	0.4
3. Food, Beverages and Tobacco	0.907	0.915	0.912	0.856	0.812	0.829	4.7	4.9	6.2
4. Textiles and Textile Products	0.564	0.710	0.737	0.837	0.799	0.827	8.9	6.8	6.6
5. Leather, Leather and Footwear	0.707	0.786	0.807	0.842	0.801	0.841	4.1	3.6	3.5
6. Wood and Products of Wood and Cork	0.205	0.220	0.214	0.827	0.778	0.815	0.7	0.6	0.5
7. Pulp, Paper, Paper , Printing and Publishing	0.255	0.227	0.238	0.835	0.795	0.821	1.8	1.6	1.6
8. Coke, Refined Petroleum and Nuclear Fuel	0.361	0.407	0.374	0.490	0.303	0.161	0.8	1.3	0.6
9. Chemicals and Chemical Products	0.336	0.380	0.420	0.744	0.666	0.705	6.9	7.1	7.9
10. Rubber and Plastics	0.187	0.170	0.176	0.781	0.715	0.748	3.1	3.1	3.0
11. Other Non-Metallic Mineral	0.082	0.057	0.061	0.857	0.803	0.821	3.3	2.5	2.1
12. Basic Metals and Fabricated Metal	0.181	0.121	0.155	0.802	0.688	0.761	7.7	10.9	10.0
13. Machinery, not elsewhere classified	0.674	0.581	0.672	0.814	0.748	0.797	16.7	16.7	16.7
14. Electrical and Optical Equipment	0.472	0.437	0.438	0.792	0.748	0.787	7.7	7.6	7.7
15. Transport Equipment	0.537	0.517	0.514	0.781	0.689	0.743	8.9	8.9	8.3
16. Manufacturing, Nec; Recycling	0.866	0.772	0.775	0.810	0.751	0.808	5.4	3.9	3.8
17. Electricity, Gas and Water Supply	0.377	0.287	0.347	0.833	0.669	0.588	0.1	0.1	0.1
18. Construction	0.269	0.184	0.370	0.875	0.851	0.881	0.3	0.3	0.3
19. Sale, Maintenance and Repair of Motor Vehicles Retail Sale of Fuel	0.390	0.368	0.387	0.878	0.819	0.853	0.3	0.2	0.2
20. Wholesale Trade and Commission Trade, Except of Motor Vehicles	0.381	0.373	0.423	0.899	0.868	0.883	4.1	3.3	3.6
21. Retail Trade, Except of Motor Vehicles ; Repair of Household Goods	0.695	0.667	0.681	0.923	0.879	0.896	1.8	2.0	2.1
22. Hotels and Restaurants	0.459	0.300	0.317	0.918	0.893	0.901	0.0	0.0	0.0
23. Inland Transport	0.130	0.167	0.200	0.896	0.848	0.866	0.8	0.8	0.9
24. Water Transport	0.233	0.244	0.237	0.860	0.813	0.829	1.1	1.0	1.0

25. Air Transport	0.336	0.357	0.274	0.825	0.747	0.766	0.7	0.7	0.7
26. Other Supporting and Auxiliary Transport Activities of Travel Agencies	0.126	0.130	0.132	0.881	0.852	0.872	2.0	1.5	1.5
27. Post and Telecommunications	0.172	0.175	0.173	0.918	0.896	0.913	0.5	0.7	0.7
28. Financial Intermediation	0.218	0.113	0.147	0.959	0.951	0.958	1.0	2.2	2.2
29. Real Estate Activities	0.290	0.287	0.287	0.988	0.983	0.988	0.7	0.3	0.3
30. Renting of Machinery and Equipment and Other Business Activities	0.145	0.094	0.100	0.927	0.898	0.915	3.6	4.9	5.1
31. Public Admin and Defence; Compulsory Social Security	0.158	0.141	0.144	0.951	0.938	0.939	0.0	0.0	0.0
32. Education	0.663	0.584	0.677	0.987	0.986	0.986	0.1	0.1	0.1
33. Health and Social Work	0.495	0.352	0.374	0.932	0.910	0.919	0.0	0.0	0.0
34. Other Community, Social and Personal Services	0.384	0.393	0.394	0.928	0.894	0.910	0.4	0.5	0.5
35. Private Households	0	0	0	0	0	0	0	0	0
All sectors	**0.483**	**0.441**	**0.475**	**0.821**	**0.746**	**0.784**	**100.0**	**100.0**	**100.0**
Memo item: manufacturing	0.516	0.475	0.516	0.802	0.718	0.759	80.7	79.5	78.5
Memo item: services	0.293	0.255	0.274	0.907	0.879	0.895	16.9	18.2	19.0
Column-wise standard deviation, sectors 1 to 34 only	0.229	0.232	0.233	0.090	0.125	0.144	3.678	3.744	3.724

Source: authors' calculations on WIOD data.

7. Sectoral analysis of foreign demand

So far we have traced the impact on the Italian economy of a shock to the entire vector of final internal demand in a given country (or in all of them simultaneously), where each element of the vector identifies a specific sector. We now change perspective and shock world demand in a given sector so as to answer questions such as: **what is the percentage increase in Italian GDP if final internal demand in the construction sector (or any other sector) increases by 10 percent, everything else equal, in all countries?**

The chain of causal links is worth being stressed: let *i* and *k* be indices running from 1 to 35 (the total number of sectors). In principle, final internal demand in sector *i* in a given country activates exports by all Italian sectors, and the domestic value added contained in exports of any sector *k* originates in all domestic sectors. Here dimensionality is driven by number of sectors to the third power, so that tractability requires some simplification. We choose to shock world final demand only in a few sectors, trace their effect on the exports of all domestic sectors, and finally compute the associated domestic value added content without keeping track of the sector where it originated.

Results for 2009 are presented in Table 8, which considers a 10 percent shock to world internal demand, in turn, in each of **the three sectors with the biggest impact on Italian exports and GDP: machinery, transport equipment and construction.** The ranking was the same in 1999 and 2007.[37] **World demand of goods and services by these three sectors altogether activates more than one third of Italian exports and GDP**,[38] with machinery accounting for roughly 40 percent of this fraction.

Interestingly, **the ordering of domestic sectors based on their weight in gross exports does not have transport equipment and construction in the top positions**. The ranking based on gross exports still has machinery in the first place, followed by metal products; chemicals and transport equipment essentially share the third place; exports of construction are negligible. The reason behind the ranking mismatch is of course that world demand by, say, sector *i* spurs exports by Italian sector *i* and all other domestic sectors, with the relative composition depending on three main factors:

1. how sectors *i* around the world rely on final and intermediate goods (or services) provided by sector *i* in Italy;
2. how sectors *i* around the world rely on production inputs (either domestically-produced or imported) provided by sectors other than *i*;
3. how all Italian sectors are interconnected with sectors *i* around the world and with their suppliers.

These factors affect differently the three sectors in Table 8. An increase of world final demand in the machinery sector activates Italian exports mainly in the machinery sector itself. An increase of world final demand in the transport equipment sector has only a moderate impact on Italian exports of transport equipment. The rest of the impact is diluted across the other manufacturing sectors, primarily metal products and machinery, electrical and optical equipment. Finally, an increase of world final demand in the construction sector has no impact on Italian exports of the construction sector itself; all the impact is indirect, via exports of manufactures (primarily metal products) and services. **Construction is a typical example of world demand of goods and services by a nontradable sector activating Italian exports of tradables**.

[37] Results for 1999 and 2007 are found in the Appendix.

[38] The share grows to around fifty percent with the addition of the next two most important sectors: textiles and apparel, and processed food and beverages.

Table 8

Impact on the Italian economy of a 10 percent shock to world demand in three sectors: 2009

(in percentage of Italian GDP)

Impacted domestic sectors:	Impact of a 10 percent shock to world demand in each of these sectors in turn:							
	machinery		transport equipment		construction		Memo item: all sectors	
	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports
Raw materials	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.04**
Manufacturing	**0.32**	**0.25**	**0.23**	**0.17**	**0.18**	**0.14**	**1.89**	**1.43**
Of which:								
Traditional sectors	0.00	0.00	0.01	0.01	0.04	0.03	0.54	0.44
Chemicals, rubber and plastics	0.01	0.00	0.01	0.01	0.03	0.02	0.28	0.20
Metal products	0.02	0.02	0.03	0.02	0.06	0.04	0.24	0.18
Machinery and electrical equipment	0.29	0.23	0.03	0.02	0.04	0.03	0.56	0.44
Transport equipment	0.00	0.00	0.15	0.11	0.01	0.00	0.20	0.15
Construction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**
Services	**0.01**	**0.01**	**0.01**	**0.01**	**0.04**	**0.04**	**0.39**	**0.35**
Of which:								
Trade	0.00	0.00	0.00	0.00	0.01	0.01	0.12	0.11
Transport services	0.00	0.00	0.00	0.00	0.01	0.01	0.09	0.07
Financial services and real estate	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
Renting of machinery and equipment	0.00	0.00	0.00	0.00	0.01	0.01	0.10	0.09
All sectors	**0.33**	**0.26**	**0.24**	**0.19**	**0.22**	**0.18**	**2.32**	**1.82**

Source: authors' calculations on WIOD data.

Notes: see the Appendix for how the sectors presented here are defined starting from the 35 sectors listed in WIOD tables.

8. Components of foreign demand

WIOD tables split final internal demand in each country into five components:

1. final consumption expenditure by households;
2. final consumption expenditure by non-profit organisations serving households;
3. final consumption expenditure by government;
4. gross fixed capital formation;
5. changes in inventories and valuables.

The analysis we have conducted so far disregards the disaggregation so that, in principle, we could repeat it for each of the five components. Our approach shall be much more sober. Since the GDPX-intensity of any sector is independent of which component of final demand actually activated exports, we shall only report, for each sector, the share of exports that is activated by each component of final demand (Figures 6 below). As for sectoral disaggregation, we choose the intermediate granularity adopted in Section 6.2.

Since components (2) and (5) above tend to be irrelevant, we only distinguish between:

- private final consumption (sum of components 1 and 2 above);
- final consumption by government;
- gross fixed capital formation and changes in inventories and valuables (sum of components 4 and 5 above).

From Figures 6, **rest-of-the-world private consumption is the main driver of Italian exports, more so for services than for manufacturing on average**, with an overall share between 56 and 59 percent.[39] Gross fixed capital formation and changes in inventories come in second place, determining between 35 and 37 percent of overall exports (the share is only slightly higher for manufactures). Public consumption is the least relevant component, with some evidence that its slightly increasing share partly compensated the declining weight of private consumption over time.

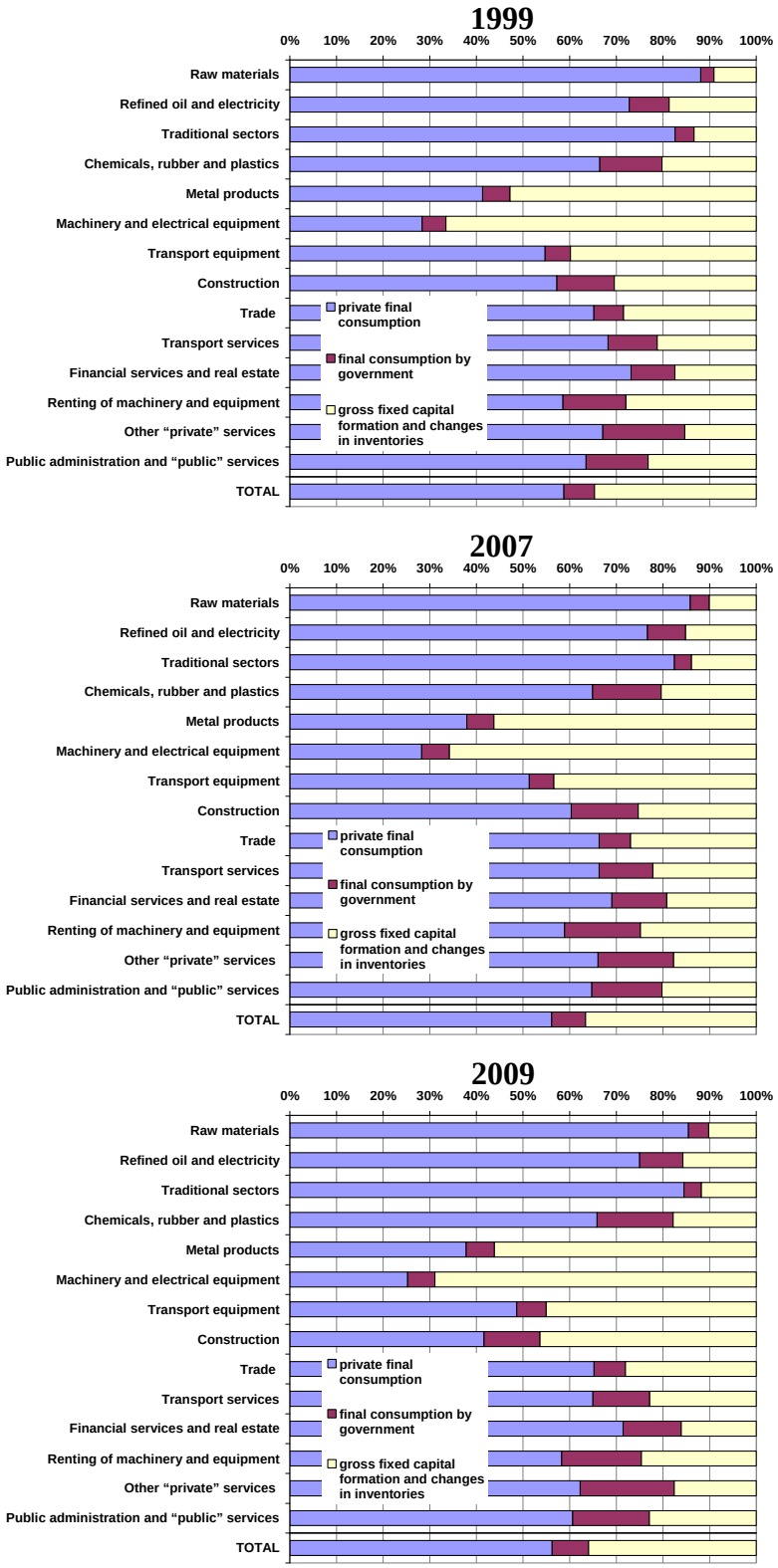
Public consumption around the world mainly activates Italian exports of services and of chemical products, presumably in the component of pharmaceutical supplies. Around two thirds of Italian exports of machinery are activated by gross fixed capital formation, with shares around 55 percent for metal products and electrical equipment. As for transport equipment, the role of private consumption in activating Italian exports is predominant but declining over time, to the advantage of the increasing role of gross fixed capital formation.[40]

[39] For some sectors within manufacturing, private consumption plays a dominant role; in particular, it activates more than 80 percent of Italian exports of traditional goods.

[40] One may suspect a declining share of automotive in overall exports of transport equipment to be the explanation for such evolution. It is only partly convincing, though, since the share in 1999 was definitely higher than in 2009 (70.6 percent *vs* 61.8), but slightly lower than in 2007 (71.3 percent).

Figures 6a, 6b and 6c

Share of exports activated by the various component of final demand, by sector



Source: authors' calculations on WIOD data.

Notes: see the Appendix for how the sectors presented here are defined starting from the 35 sectors listed in WIOD tables.

9. Conclusions

As production becomes more and more internationally fragmented, indicators based on gross exports alone are less and less informative. On the one side, as economies engage in triangular processing trade, the domestic-value-added content of country's exports (GDPX, as we have labelled it in this paper) falls, mainly matched by an increase in the foreign-value-added content. While the contribution of aggregate net exports to GDP growth is unaffected by these developments, a focus that separates external from internal demand is warranted only if the gross-export dimension is complemented with the new tools of analysis we have presented in the paper. On the other side, as intermediates travel to their final destination by an indirect, possibly multi-country route, it becomes more complex to associate a country's exports and its domestic-value-added content with the final demand that activated it.

In this paper we have measured the impact on Italian GDP of a shock to foreign demand and disentangled individual contributions both along a geographical dimension and a sectoral one. New indicators have enabled us to map out the economic relations that underlie Italian trade with the rest of the world. This has required to go beyond the information set provided by standard trade statistics, the global input-output tables evaluated at current prices (in dollars) published in the WIOD database being fit for our purposes. WIOD tables are an extraordinary source of information for a vast array of research questions.

We have benefited from the approach set out by Koopman et al. (2012), who first developed a fully coherent accounting identity that breaks up a country's gross exports into value-added components by source. The Koopman decomposition isolates the double-counting component of gross exports, which is connected with goods that cross borders several times and that are recorded multiple times by a country's trade statistics, despite they contribute only once to its GDP. Having measured this component helps realizing that (a) the widespread fall in the domestic-value-added content of exports is not fully matched by an increase in the foreign-value-added content; (b) double-counting inflates exports of different countries to different extents. Lastly, the Koopman decomposition identifies the contribution of a country's final internal demand in activating its own exports (via imports of foreign goods and services that embody intermediates produced in the home economy).

We focus on the 1999-2009 period; our main conclusions can be summarized as follows.

Firstly, the growing participation of the Italian economy in global value chains is indeed a structural feature, but the intensity of such involvement (i.e. international fragmentation of production) varies with the business cycle. Between 1999 and 2009, on average, domestic value added counted for 78.2 percent of Italian gross exports, foreign value added for 16.7 percent. Double counting inflated Italian exports by the remaining 5.1 percent. In dynamic terms, between 1999 and 2008 the foreign-value-added content of Italian exports increased progressively. This tendency mostly characterized the production of manufactures and was only mitigated by the great trade collapse in 2009. The double-counting component explained about one-third of the fall in the domestic-value-added content of Italian exports between 1999 and the great trade collapse, downplaying the role of the increasing use of imported intermediate inputs in the production of Italian exports.

Secondly, our comparative-statics exercise has shown that, neglecting second round effects, a 1 percent permanent increase in world final demand in 1999 had a 0.19 percent impact on Italian GDP. The impact elasticity increased to 0.21 percent in 2007, with a

sudden step back in 2009 (0.18 percent). The contribution of foreign demand to Italian value added evolved in a pro-cyclical fashion, with the increase between 1999 and 2007 mainly driven by the extra-EU component, and the subsequent reduction mainly due to foreign demand originated in the EU. Overall, our measures have confirmed that Italy became more and more dependent on final demand outside the EU, with emerging economies such as China, Russia and Turkey gaining importance at the expenses of large advanced economies such as the US and Japan. The relative size of the counterparts drove this result, since the Italian GDP content of one dollar of exports(the GDPX-intensity) activated by final demand in each country did not differ substantially across counterparts.

Thirdly, contrary to the geographical analysis, a sectoral disaggregation has revealed that there was some variability in the GDPX-intensity across sectors, more so within manufacturing than within services. Italian sectors of specialization, that is "traditional sectors" and "machinery and electrical equipment" displayed the highest GDPX-intensity among manufactures. The GDPX-intensity of Italian exports for final uses was slightly higher and fell proportionately less, between 1999 and 2009, than the GDPX-intensity of Italian exports for intermediate uses, that represents the larger share of exports.[41] This configures a mildly adverse "specialization pattern": Italian exports were specialized in intermediate uses, which were the least GDPX-intensive.

Fourthly, we have taken into account the fact that final internal demand around the world activates exports in different sectors of the Italian economy and that, in turn, exports of any given sector contain domestic value added that has been created, directly or indirectly, in all domestic sectors. We have found that the domestic inter-sectoral linkages were indeed relevant in shaping the performance and the profitability of Italian exporting firms: around 90 percent of the domestic value added contained in service exports originated in services; vice-versa, around one third of the domestic value added contained in manufacturing exports originated in services. Thus, exports of services were more effective in activating Italian GDP than it appears from trade statistics; because of the growing activation of services by manufacturing exports, the contribution of domestic services in generating GDPX grew over time, surpassing in 2009 that of manufacturing.

Fifthly, we have considered the effect of a sectoral shock on the demand side, by considering an increase of world demand originated, in turn, in each of the three sectors with the biggest impact on Italian exports and GDP: "machinery", "transport equipment" and "construction", that altogether activated more than one third of Italian exports and of their domestic-value-added content. Construction is (predominantly) a nontradable sector whose demand of goods and services activates Italian exports of tradables.

Finally, as for the components of world demand, rest-of-the-world private consumption was the main driver of Italian exports, more so for services than for manufacturing on average, contributing to an overall share of total export slightly short of 60 percent.

[41] The standard accounting of the contribution of gross exports to GDP growth implicitly assumes that the (overall) GDPX-intensity is constant through time.

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Appendix

The algebra of the Koopman decomposition

In this section we briefly describe the decomposition of gross exports developed by Koopman et al. (2012). In order to keep the algebra more simple, we focus on a source country *s* which produces and exports N products to G countries. All gross exports of country *s* are used as an intermediate and final good abroad, according the following definition:

$$E_{s*} = \sum_{r \neq s}^{G} E_{sr} = \sum_{t \neq s}^{G} \left(A_{sr} X_r + Y_{sr} \right) \tag{A.1}$$

where:

- E_{s*} is the GN-by-1 vector of N products exported by country *s* to G countries*;*
- E_{sr} is the N-by-1 vector of gross exports from country *s* to *r, r=1,…,G;*
- A_{sr} is the N-by-N input-output coefficient matrix, with elements a_{sr}^{11} the coefficient for imported inputs from sector *1* in country *s* to sector *1* in country *r, r=1,…,G;*
- X_s is the N-by-1 vector of gross output of country *s;*
- Y_{sr} is the N X 1 vector of final demand in country *r* for final goods produced in *s, r=1,…,G.*

These exports can be fully decomposed into various value-added and double counted components as follows:

$$\begin{aligned} uE_{s*} = & \left[V_s \sum_{r \neq s}^{G} B_{ss} Y_{sr} \right] + \left[V_s \sum_{r \neq s}^{G} B_{sr} Y_{rr} \right] + \left[V_s \sum_{r \neq s}^{G} \sum_{t \neq s,r}^{G} B_{sr} Y_{rt} \right] \\ & + \left[V_s \left(\sum_{r \neq s}^{G} B_{sr} Y_{rs} \right) \right] + \left[V_s \sum_{r \neq s}^{G} B_{sr} A_{rs} \left(I - A_{ss} \right)^{-1} Y_{ss} \right] + \left[V_s \sum_{r \neq s}^{G} B_{sr} A_{rs} \left(I - A_{ss} \right)^{-1} E_{s*} \right] \\ & + \left[\sum_{t \neq s}^{G} \sum_{r \neq s}^{G} V_t B_{ts} Y_{sr} \right] + \left[\sum_{t \neq s}^{G} \sum_{r \neq s}^{G} V_t B_{ts} A_{sr} \left(I - A_{rr} \right)^{-1} Y_{rr} \right] + \left[\sum_{t \neq s}^{G} V_t B_{ts} A_{sr} \sum_{t \neq s}^{G} \left(I - A_{rr} \right)^{-1} E_{r*} \right] \end{aligned} \tag{A.2}$$

where:

- V_s is the N-by-1 row vector of direct value added coefficient*;*
- B_{ss} is the N-by-N block Leontief inverse matrix, which is the total requirement matrix that gives the amount of gross output in producing country s required for a one-unit increase in final demand in destination country *s*, with elements b_{sr}^{11}

- B_{sr} is the N-by-N block Leontief inverse matrix, which is the total requirement matrix that gives the amount of gross output in producing country s required for a one-unit increase in final demand in destination country *r,* with elements b_{sr}^{11} the coefficient of imported inputs from sector 1 in country *s* to sector 1 in country *r;*
- X_{sr} is the N-by-1 vector of gross output produced in *s* and absorbed in *r.*

While the algebra to obtain equation (A.2) may be a bit tedious, expressing a country's gross exports as the sum of these nine terms is very useful. We try to explain briefly their economic interpretations.

The first two terms in the brackets are the direct value added exports, i.e., the source country value added absorbed by direct importer, country *r*. The 3rd term is, instead, its value added exported to country *r* and, after some processing in *r*, finally absorbed in a third country *t*. The sum of the first three terms corresponds to the definition of "value added exports" in Johnson and Noguera (2012).

The 4th and the 5th terms include source country's value added which is first exported but return in both final and intermediate imports to be consumed or re-exported by country *s*. From a National Account point of view, both components are parts of source country GDP but represent a double part in official gross export statistics.

The 7th and 8th terms represent foreign value added in the source country's exports, including foreign value added embodied in both final and intermediate products.

The 6th and 9th terms are the two "pure double counted terms" that sum up the double counted share of two way intermediate trade from all bilateral routes.

Definition of geographical entities

We re-organize the 41 geographical entities considered in WIOD matrices as follows:

1. European Union (EU, 27 countries), broken down in: Euro area (17 members) and countries belonging to the EU27 but outside the Eurozone.
   - The former aggregate is further split as: France, Germany, Italy, Spain, the remaining 13 countries belonging to the Euro area;
   - the latter aggregate is further split between "Eastern" countries[42] and "other" countries (Denmark, Great Britain, Sweden).
2. All countries outside the EU27, further broken down in:
   - Australasia net of China: Australia plus the Asian countries considered in WIOD matrices.[43] The detail on Japan appears in some figures;
   - China;
   - American countries considered in WIOD matrices,[44] with a detail on the US;
   - Russia and Turkey;

[42] Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Poland and Romania.
[43] India, Indonesia, Japan, South Korea, Taiwan.
[44] Brazil and the NAFTA countries (Canada, Mexico, USA).

- All other countries.

3. A memo item for BRIC.

Derivation of equation [2] in the main text

Let ΔGX_j indicate the increase in Italian exports to country *j* and all other destinations activated by a 10 percent increase in final internal demand in country *j*, and let $\Delta GDPX_j$ be the Italian value added embodied in ΔGX_j. The associated GDPX-intensity is defined as

$$gdpx_j := \Delta GDPX_j / \Delta GX_j .$$

Splitting exports (activated by final internal demand in country *j*) between final uses and intermediate uses:

$$\Delta GX_j = \Delta GX_j^{Fin} + \Delta GX_j^{Int} .$$

Italian value added embodied, respectively, in ΔGX_j^{Fin} and ΔGX_j^{Int} is $\Delta GDPX_j^{Fin}$ and $\Delta GDPX_j^{Int}$, with

$$\Delta GDPX_j = \Delta GDPX_j^{Fin} + \Delta GDPX_j^{Int} .$$

The corresponding GDPX-intensities are defined as:

$$gdpx_j^{Fin} := \Delta GDPX_j^{Fin} / \Delta GX_j^{Fin} ,$$

$$gdpx_j^{Int} := \Delta GDPX_j^{Int} / \Delta GX_j^{Int} .$$

Equation [2] in the main text is derived as follows:

$$\begin{aligned}
&\Delta GDPX_j = \Delta GX_j \cdot (\Delta GDPX_j / \Delta GX_j) = \\
&= \Delta GX \cdot (\Delta GX_j / \Delta GX) \cdot (\Delta GDPX_j / \Delta GX_j) = \\
&= \Delta GX \cdot (\Delta GX_j / \Delta GX) \cdot [(\Delta GDPX_j^{Fin} / \Delta GX_j) + (\Delta GDPX_j^{Int} / \Delta GX_j)] = \\
&= \Delta GX \cdot \frac{\Delta GX_j}{\Delta GX} \cdot \left[\frac{\Delta GX_j^{Fin}}{\Delta GX_j} \frac{\Delta GDPX_j^{Fin}}{\Delta GX_j^{Fin}} + \frac{\Delta GX_j^{Int}}{\Delta GX_j} \frac{\Delta GDPX_j^{Int}}{\Delta GX_j^{Int}} \right] = \\
&= \Delta GX \cdot s_j \cdot [s_j^{Fin} \cdot gdpx_j^{Fin} + s_j^{Int} \cdot gdpx_j^{Int}],
\end{aligned}$$

where

$$s_j := \frac{\Delta GX_j}{\Delta GX}, \quad s_j^{Fin} := \frac{\Delta GX_j^{Fin}}{\Delta GX_j}, \quad s_j^{Int} := \frac{\Delta GX_j^{Int}}{\Delta GX_j} .$$

Definition of sectors in Table 6, Table 8 and in Figures 6

Sectors presented in Table 6, Table 8 and Figures 6 (in bold in the list below) are defined as follows, starting from the 35 sectors considered in WIOD tables:

Raw materials: Agriculture, Hunting, Forestry and Fishing; Mining and Quarrying.

Refined oil and electricity: Coke, Refined Petroleum and Nuclear Fuel; Electricity, Gas and Water Supply.

Traditional sectors: Food, Beverages and Tobacco; Textiles and Textile Products; Leather, Leather and Footwear; Wood and Products of Wood and Cork; Pulp, Paper, Printing and Publishing; Other Non-Metallic Mineral; Manufacturing not elsewhere classified; Recycling.
Chemicals, rubber and plastics: Chemicals and Chemical Products; Rubber and Plastics.
Metal products: Basic Metals and Fabricated Metal.
Machinery and electrical equipment: Machinery not elsewhere classified; Electrical and Optical Equipment.
Transport equipment: Transport Equipment.

Construction: Construction.

Trade: Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel; Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles; Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods.
Transport services: Inland Transport; Water Transport; Air Transport; Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies.
Financial services and real estate: Financial Intermediation; Real Estate Activities.
Renting of machinery and equipment: Renting of Machinery and Equipment and Other Business Activities.
Other "private" services: Hotels and Restaurants; Post and Telecommunications.
Public administration and "public" services: Public Administration and Defence; Compulsory Social Security; Education; Health and Social Work; Other Community, Social and Personal Services; Private Households with Employed Persons.

Table A1

Decomposition of Italian gross exports of goods and services

(in percentage of total gross exports, except otherwise indicated)

Year	Gross exports (millions of US dollars)	GDP in gross exports						Foreign value added in gross exports			Double counting in gross exports		
		Value-added exports			Re-imported domestic value added								
		in direct final exports	in interme-diates exports absorbed by direct importers	in intermediates re-exported to third countries	in intermediates that return home via final imports	in intermediates that are absorbed at home via intermediates imports		in final exports	in intermediates exports		in intermediates exports produced at home	in intermediates exports produced abroad	
		(1)	(2)	(3)	(4)	(5)		(7)	(8)		(6)	(9)	
1999	267,446	39.7	33.2	8.2	0.6	0.4	**82.1**	8.6	5.7	**14.3**	0.2	3.4	**3.6**
2000	271,817	37.4	32.0	8.5	0.6	0.4	**78.9**	9.8	6.7	**16.4**	0.2	4.4	**4.6**
2001	278,623	38.1	31.6	8.8	0.6	0.4	**79.5**	9.7	6.3	**16.0**	0.2	4.3	**4.6**
2002	289,677	38.9	31.6	8.8	0.6	0.4	**80.3**	9.4	6.0	**15.3**	0.2	4.1	**4.3**
2003	341,425	38.8	31.5	8.9	0.6	0.4	**80.2**	9.4	6.0	**15.4**	0.2	4.2	**4.4**
2004	405,297	36.2	32.6	9.2	0.6	0.4	**79.1**	9.4	6.5	**15.9**	0.3	4.8	**5.0**
2005	428,302	35.1	32.3	9.1	0.6	0.4	**77.6**	9.9	7.1	**16.9**	0.3	5.2	**5.5**
2006	481,657	33.4	31.7	9.0	0.6	0.4	**75.2**	10.6	7.9	**18.5**	0.3	6.0	**6.3**
2007	574,778	33.2	31.4	9.0	0.5	0.4	**74.6**	10.9	7.9	**18.8**	0.3	6.2	**6.6**
2008	620,446	34.0	30.6	8.7	0.5	0.4	**74.1**	11.4	8.0	**19.4**	0.3	6.2	**6.5**
2009	467,639	37.6	31.8	8.2	0.5	0.4	**78.4**	10.0	6.9	**16.8**	0.2	4.5	**4.7**

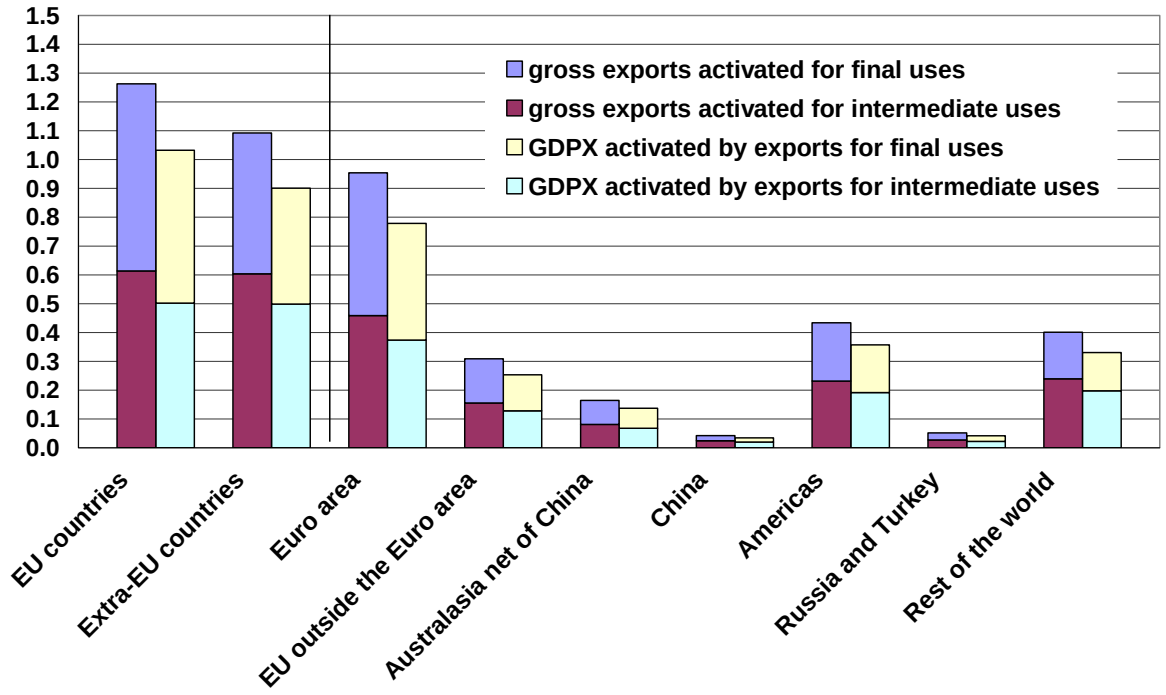
Source: authors' calculations on WIOD data.
Notes: numbering (1) to (9) follows the ordering in Koopman et al. (2012).

Figures A1a and A1b

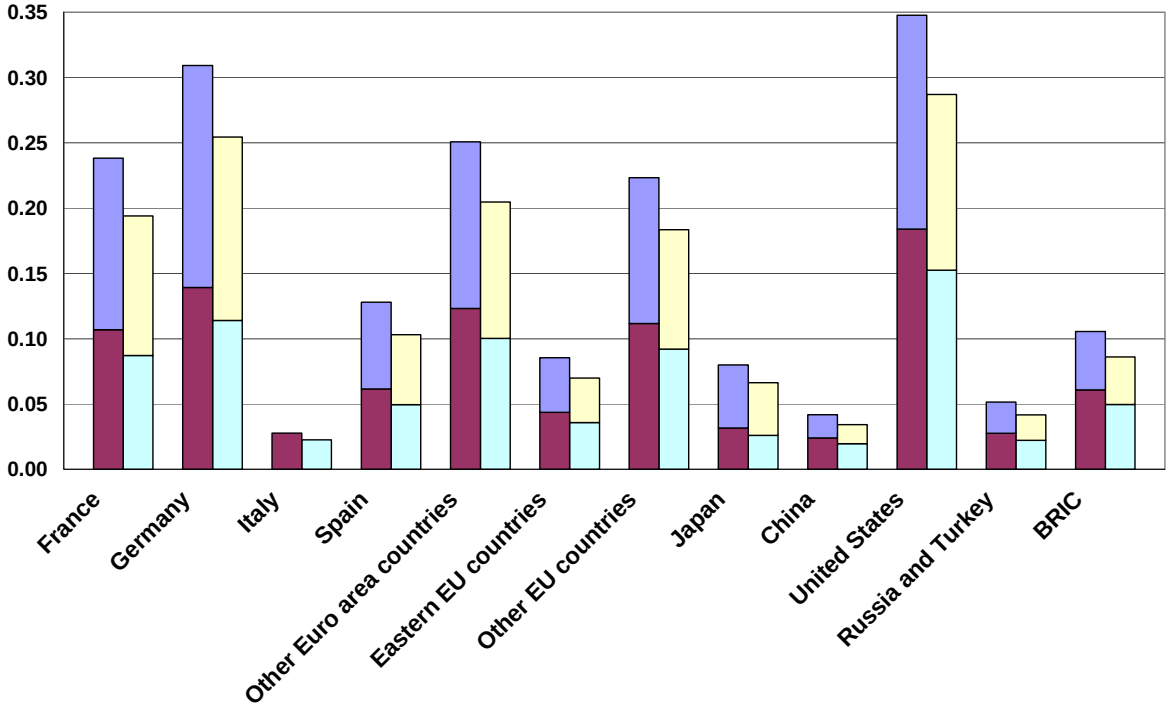
Impact on Italian exports and GDPX of a 10 percent increase in selected areas' final internal demand in 1999

(in percentage of GDP)

A1a



A1b



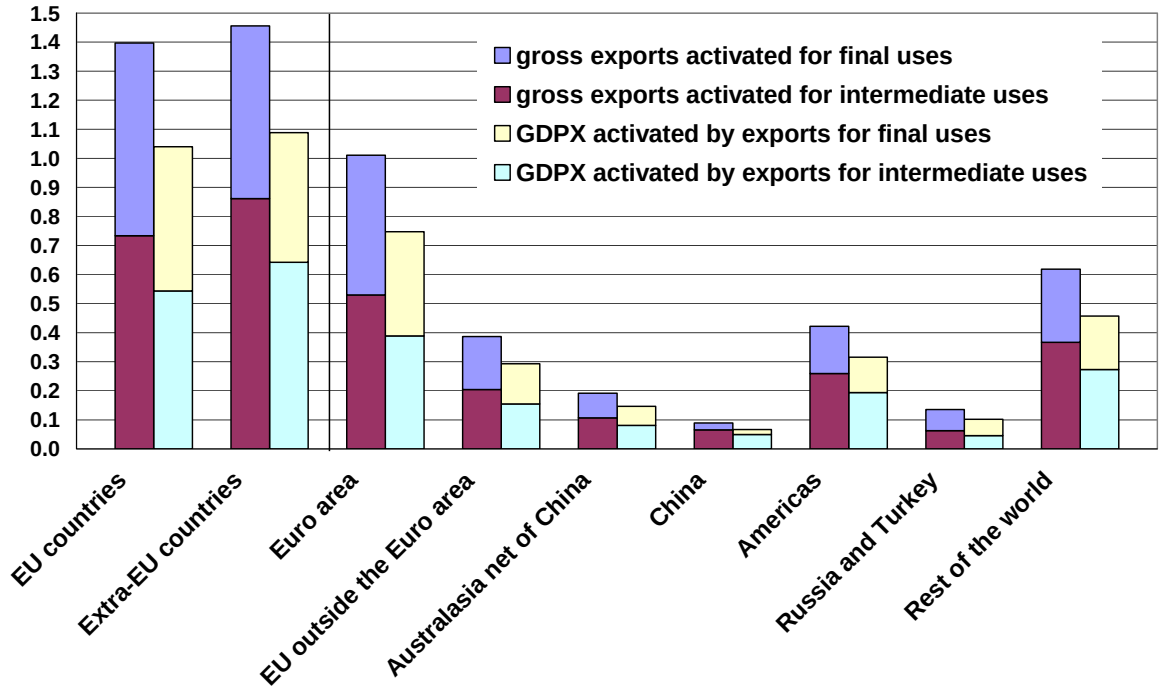
Source: authors' calculations on WIOD data.
Notes: see the Appendix for the definition of the geographical entities listed in the figures.

Figures A2a and A2b

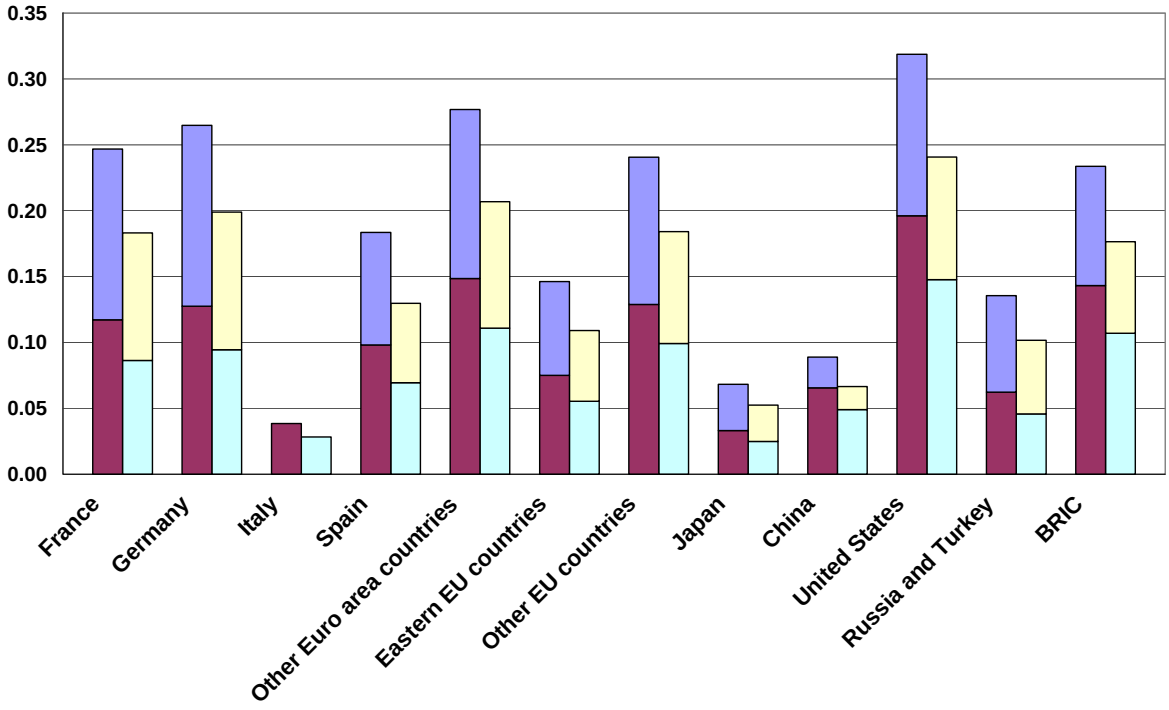
Impact on Italian exports and GDPX of a 10 percent increase in selected areas' final internal demand in 2007

(in percentage of GDP)

A2a



A2b



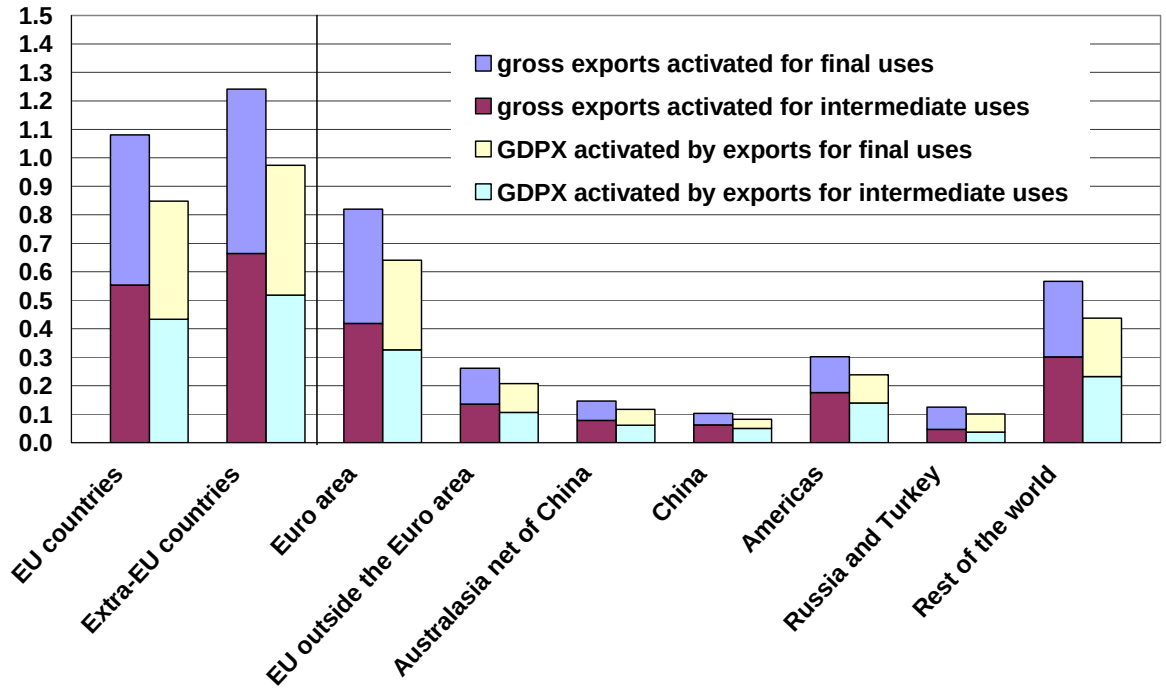
Source: authors' calculations on WIOD data.
Notes: see the Appendix for the definition of the geographical entities listed in the figures.

Figures A3a and A3b

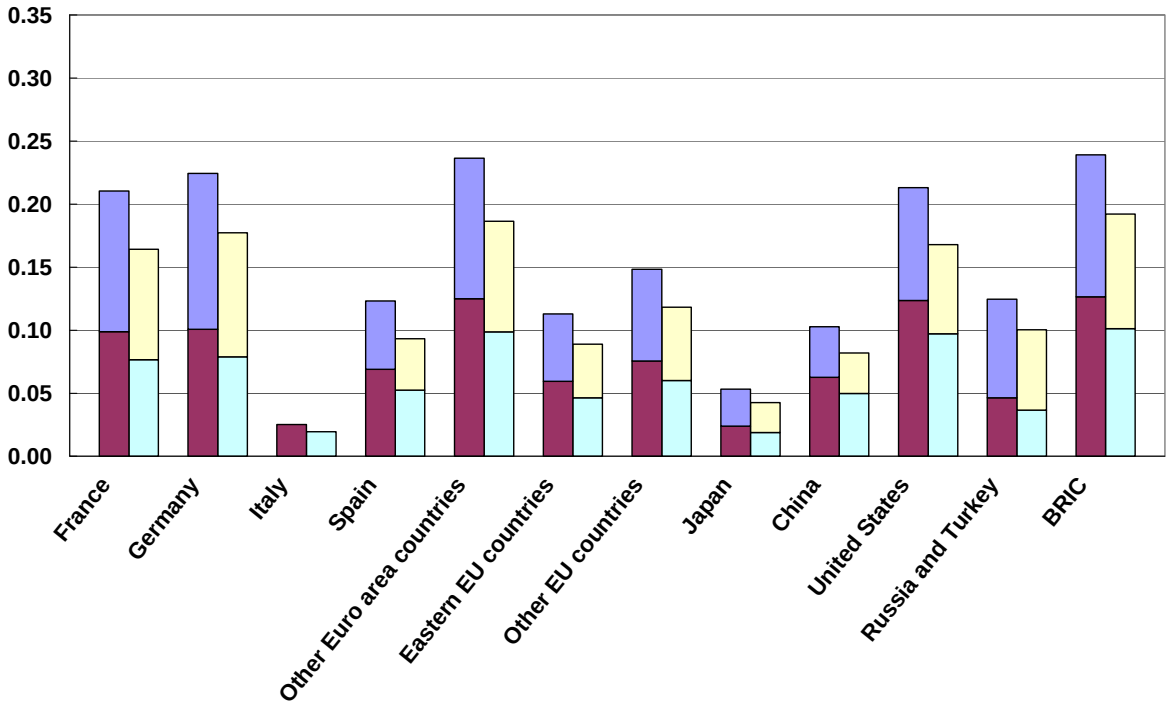
Impact on Italian exports and GDPX of a 10 percent increase in selected areas' final internal demand in 2009

(in percentage of GDP)

A3a



A3b



Source: authors' calculations on WIOD data.
Notes: see the Appendix for the definition of the geographical entities listed in the figures.

Table A2

GDPX-intensities:
exports activated by final internal demand in selected areas (column A)
vs
exports to selected areas (column B)
(unitless fractions)

Counterpart countries and areas:	1999		2007		2009	
	A	B	A	B	A	B
EU countries	**0.817**	**0.817**	**0.744**	**0.746**	**0.785**	**0.785**
Euro area (EA)	0.816	0.816	0.739	0.741	0.782	0.783
of which: *France*	0.815	0.813	0.742	0.739	0.780	0.778
Germany	*0.823*	*0.822*	*0.751*	*0.744*	*0.790*	*0.788*
Italy	*0.813*	*0.000*	*0.733*	*0.000*	*0.777*	*0.000*
Spain	*0.804*	*0.803*	*0.707*	*0.697*	*0.757*	*0.749*
EU countries not in the EA	0.820	0.821	0.758	0.761	0.793	0.793
Eastern EU countries	0.817	0.818	0.746	0.745	0.787	0.786
Other EU countries	0.822	0.823	0.765	0.773	0.798	0.800
Extra-EU countries	**0.824**	**0.825**	**0.747**	**0.746**	**0.784**	**0.783**
Australasia net of China	0.833	0.836	0.765	0.776	0.794	0.799
of which: *Japan*	0.831	0.832	0.768	0.779	0.801	0.809
China	0.818	0.820	0.750	0.759	0.797	0.809
Americas	0.824	0.825	0.749	0.752	0.791	0.795
of which: *USA*	*0.826*	*0.828*	*0.755*	*0.761*	*0.788*	*0.790*
Russia and Turkey	0.808	0.807	0.750	0.753	0.804	0.807
Rest of the world	0.824	0.825	0.740	0.733	0.771	0.766
Total	**0.821**	**0.821**	**0.746**	**0.746**	**0.784**	**0.784**
Memo item: BRIC	0.816	0.816	0.755	0.764	0.804	0.813

Source: authors' calculations on WIOD data.
Notes: see the Appendix for the definition of the geographical entities listed in the table.

Table 6 in the main text for year1999

Domestic value added in Italian exports by sector of origin: 1999

(units as indicated)

Sector identifier:	Exporting sector:	Gross exports (millions of US dollars)	GDPX as a percentage of gross exports	Percentage distribution of GDPX across internal origin sectors (percentage points) Sector identifier (as defined in the first column of the table): 1	2	3	4	5	6	7	8	9	10	11	12	13	14	MM	SS
1	Raw materials	4528	92.8	78.2	1.7	2.8	0.7	0.5	0.4	0.1	0.5	5.8	2.0	3.0	2.5	0.9	0.8	6.3	15.0
2	Refined oil and electricity	3774	52.6	13.0	58.0	1.9	1.5	0.9	1.2	0.1	1.0	5.4	2.6	5.1	5.0	2.1	2.1	63.7	22.3
3	Traditional sectors	75917	83.7	5.1	2.5	50.6	2.1	2.1	1.1	0.2	1.0	12.9	4.7	6.3	7.2	2.2	2.0	58.6	35.3
4	Chemicals, rubber and plastics	29043	75.5	1.4	3.4	4.4	51.2	2.2	1.5	0.3	1.0	11.9	4.7	5.6	7.9	2.2	2.2	63.0	34.6
5	Metal products	21066	80.2	0.9	2.4	4.1	1.6	56.6	1.9	0.3	1.0	9.3	3.6	6.9	7.8	2.1	1.6	66.9	31.2
6	Machinery and electrical equipment	66432	80.7	0.8	2.0	2.9	2.3	9.3	48.1	0.4	1.0	9.8	3.9	6.5	8.5	2.7	1.7	65.1	33.0
7	Transport equipment	25021	78.1	0.8	2.2	3.9	3.2	9.7	4.5	38.5	1.0	11.6	4.9	6.1	9.4	2.3	1.9	61.9	36.3
8	Construction	689	87.5	1.5	1.4	7.2	1.4	4.4	1.9	0.2	51.5	7.2	3.9	6.5	8.3	2.7	2.0	16.6	30.4
9	Trade	14805	90.5	1.5	1.2	3.1	0.9	1.0	1.0	0.3	1.2	60.7	4.5	9.1	10.6	2.9	2.0	7.5	89.7
10	Transport services	11329	87.0	1.4	1.5	3.0	1.0	1.2	1.3	1.3	2.1	7.8	54.8	7.8	10.6	4.3	1.7	9.3	87.1
11	Financial services and real estate	3691	97.1	0.2	0.5	0.6	0.2	0.2	0.2	0.0	0.7	1.2	0.7	89.0	4.3	1.6	0.6	1.6	97.4
12	Renting of machinery and equipment	8556	92.7	0.4	0.9	1.6	0.6	0.5	0.8	0.2	1.3	3.5	2.7	6.9	75.4	3.2	2.1	4.6	93.7
13	Other “private” services	1286	91.8	0.6	1.3	2.3	0.7	0.8	1.7	0.2	3.4	4.3	3.0	6.8	9.1	63.7	2.0	7.1	88.9
14	Public administration and “public” services	1309	93.7	0.4	1.0	1.4	0.7	0.5	0.6	0.2	0.9	3.2	1.8	7.2	6.6	2.1	73.2	4.5	94.2
TT	**All sectors**	**267446**	**82.1**	**3.7**	**2.7**	**17.0**	**6.8**	**8.5**	**13.0**	**3.7**	**1.2**	**13.5**	**6.5**	**7.8**	**10.5**	**2.8**	**2.2**	**51.7**	**43.3**
MM	Manufacturing	221252	80.2	2.6	3.0	20.4	8.3	10.3	15.8	4.5	1.0	11.3	4.4	6.3	8.0	2.3	1.9	62.3	34.1
SS	Services	40976	90.7	1.1	1.2	2.4	0.8	0.8	1.0	0.5	1.5	25.1	16.9	15.8	23.6	5.1	4.1	6.7	90.8

Source: authors’ calculations on WIOD data.

Notes: gray shadows highlight the main diagonal. See the Appendix for how the sectors presented here are defined starting from the 35 sectors listed in WIOD tables.

Table 6 in the main text for year 2007

Domestic value added in Italian exports by sector of origin: 2007

(units as indicated)

Sector identifier:	Exporting sector:	Gross exports (millions of US dollars)	GDPX as a percentage of gross exports	Percentage distribution of GDPX across internal origin sectors (percentage points) Sector identifier (as defined in the first column of the table): 1	2	3	4	5	6	7	8	9	10	11	12	13	14	MM	SS
1	Raw materials	9036	88.3	73.1	2.3	3.2	0.7	0.6	0.5	0.2	0.7	6.3	2.9	4.1	3.6	1.1	0.8	7.4	18.7
2	Refined oil and electricity	19257	31.6	6.2	60.8	1.9	1.8	0.8	1.3	0.1	0.9	6.6	3.5	5.9	5.8	2.3	1.9	66.8	26.1
3	Traditional sectors	129005	79.3	3.9	2.9	49.7	1.5	1.8	1.1	0.2	1.3	12.6	5.5	7.2	8.2	2.3	1.7	57.2	37.5
4	Chemicals, rubber and plastics	64360	68.0	1.1	4.0	4.2	48.0	1.6	1.6	0.3	1.3	12.4	5.6	6.7	8.9	2.4	1.9	59.7	37.9
5	Metal products	67645	68.8	0.6	2.6	3.7	1.1	56.1	1.9	0.3	1.1	9.3	4.1	7.1	8.3	2.1	1.5	65.8	32.5
6	Machinery and electrical equipment	139570	74.8	0.5	2.2	2.7	1.5	8.2	49.9	0.4	1.2	9.3	4.3	7.0	8.9	2.6	1.4	64.9	33.4
7	Transport equipment	55401	68.9	0.6	2.4	3.8	2.2	8.5	5.2	36.1	1.3	12.1	5.9	7.0	10.7	2.5	1.7	58.2	40.0
8	Construction	1555	85.1	1.0	1.5	6.4	0.8	3.5	1.5	0.2	57.8	6.1	3.6	6.2	7.6	2.4	1.4	13.9	27.3
9	Trade	26870	87.0	1.0	1.7	3.0	0.7	0.8	1.0	0.2	1.5	58.6	4.9	10.4	11.5	3.0	1.8	7.4	90.1
10	Transport services	21024	82.1	0.9	2.1	2.9	0.7	1.1	1.2	1.1	2.2	7.8	56.1	7.7	10.6	4.1	1.6	9.1	87.9
11	Financial services and real estate	11369	95.4	0.1	0.5	0.6	0.1	0.2	0.3	0.0	0.8	1.4	0.9	86.0	6.2	2.1	0.7	1.8	97.3
12	Renting of machinery and equipment	23481	89.8	0.3	1.1	1.6	0.5	0.5	0.8	0.2	1.7	3.4	2.6	7.3	75.0	3.3	1.6	4.9	93.2
13	Other “private” services	3465	89.6	0.3	1.4	2.0	0.5	0.7	1.6	0.2	4.1	3.7	2.9	6.4	10.1	64.0	2.0	6.4	89.2
14	Public administration and “public” services	2740	90.7	0.3	1.3	1.5	0.5	0.5	0.6	0.2	1.1	3.2	2.0	7.6	7.8	2.1	71.4	4.6	94.0
TT	**All sectors**	**574778**	**74.6**	**2.8**	**3.3**	**14.2**	**6.1**	**9.6**	**13.4**	**3.5**	**1.5**	**12.6**	**6.7**	**9.2**	**12.1**	**3.0**	**2.0**	**50.1**	**45.5**
MM	Manufacturing	475238	71.8	1.7	3.8	17.2	7.5	11.9	16.7	4.3	1.2	10.9	4.9	7.0	8.8	2.4	1.6	61.3	35.7
SS	Services	88948	87.9	0.6	1.4	2.2	0.5	0.7	0.9	0.4	1.7	20.6	14.9	19.2	27.5	5.6	3.7	6.2	91.5

Source: authors’ calculations on WIOD data.

Notes: gray shadows highlight the main diagonal. See the Appendix for how the sectors presented here are defined starting from the 35 sectors listed in WIOD tables.

Table 8 in the main text for year 1999

Impact on the Italian economy of a 10 percent shock to world demand in three sectors: 1999

(in percentage of Italian GDP)

Impacted domestic sectors:	Impact of a 10 percent shock to world demand in each of these sectors in turn:							
	machinery		transport equipment		construction		Memo item: all sectors	
	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports
Raw materials	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.04**
Manufacturing	**0.32**	**0.26**	**0.26**	**0.20**	**0.16**	**0.13**	**1.95**	**1.56**
Of which:								
Traditional sectors	0.00	0.00	0.01	0.01	0.05	0.05	0.67	0.56
Chemicals; rubber and plastics	0.01	0.00	0.02	0.01	0.02	0.02	0.26	0.19
Metal products	0.02	0.01	0.03	0.02	0.03	0.03	0.19	0.15
Machinery; electrical equipment	0.29	0.24	0.03	0.02	0.04	0.03	0.59	0.47
Transport equipment	0.00	0.00	0.17	0.13	0.00	0.00	0.22	0.17
Construction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**
Services	**0.01**	**0.01**	**0.01**	**0.01**	**0.03**	**0.03**	**0.36**	**0.33**
Of which:								
Trade	0.00	0.00	0.01	0.01	0.01	0.01	0.13	0.12
Transport services	0.00	0.00	0.00	0.00	0.01	0.01	0.10	0.09
Financial services and real estate	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03
Renting of machinery and equipment	0.00	0.00	0.00	0.00	0.01	0.01	0.08	0.07
All sectors	**0.33**	**0.27**	**0.28**	**0.22**	**0.20**	**0.16**	**2.36**	**1.93**

Source: authors' calculations on WIOD data.

Notes: see the Appendix for how the sectors presented here are defined starting from the 35 sectors listed in WIOD tables.

Table 8 in the main text for year 2007

Impact on the Italian economy of a 10 percent shock to world demand in three sectors: 2007

(in percentage of Italian GDP)

Impacted domestic sectors:	Impact of a 10 percent shock to world demand in each of these sectors in turn:							
	machinery		transport equipment		construction		Memo item: all sectors	
	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports	Impact on Italian gross exports	Impact on domestic value added contained in Italian gross exports
Raw materials	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.04**
Manufacturing	**0.37**	**0.28**	**0.33**	**0.23**	**0.24**	**0.17**	**2.36**	**1.69**
Of which:								
Traditional sectors	0.00	0.00	0.01	0.01	0.05	0.04	0.64	0.51
Chemicals; rubber and plastics	0.01	0.01	0.02	0.01	0.03	0.02	0.32	0.22
Metal products	0.03	0.02	0.05	0.03	0.08	0.05	0.34	0.23
Machinery; electrical equipment	0.32	0.24	0.04	0.03	0.06	0.04	0.69	0.52
Transport equipment	0.00	0.00	0.21	0.14	0.01	0.01	0.27	0.19
Construction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**
Services	**0.01**	**0.01**	**0.02**	**0.01**	**0.05**	**0.04**	**0.44**	**0.39**
Of which:								
Trade	0.00	0.00	0.00	0.00	0.01	0.01	0.13	0.12
Transport services	0.00	0.00	0.00	0.00	0.01	0.01	0.10	0.09
Financial services and real estate	0.00	0.00	0.00	0.00	0.01	0.01	0.06	0.05
Renting of machinery and equipment	0.00	0.00	0.00	0.00	0.01	0.01	0.12	0.10
All sectors	**0.38**	**0.28**	**0.35**	**0.24**	**0.29**	**0.21**	**2.85**	**2.13**

Source: authors' calculations on WIOD data.
Notes: see the Appendix for how the sectors presented here are defined starting from the 35 sectors listed in WIOD tables.