Immigration and trade:
the case study of Veneto region in Italy

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Abstract. This paper investigates the relation between immigration and trade by focusing on Veneto region in Italy. The reference period is 2008-2015, interfering with the economic crisis, thus the results obtained can be time specific. The presence of immigrants in Veneto was constantly on the rise, also during the crisis, although at a slower pace compared to pre-crisis years. The question is which role could this play in ascertaining the stability, if not expansion, of trade relations between the region and the countries of immigrants' origin. The estimates of gravity model suggest a non-linear relationship between the number of immigrants and total exports from (imports to) the host-province to (from) the country of origin. The type of this relation moreover differs by sector of origin of trade. This could mean that further inflow of immigrants can potentially induce shifts in the structure of local economy of Veneto region which is highly dependent on international trade.

Keywords: immigration, exports, imports, gravity model, dose-response function.

JEL Classification codes: F10, F14, F22, R10

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1. INTRODUCTION

Migration is known to stimulate bilateral trade between countries (see e.g. Egger et al., 2012; Genc et al., 2012). Different channels are at work, but networking and home product preference bias effects largely explain complementarity rather than substitution between international trade and international labour mobility (see e.g. Felbermayr and Toubal 2012). On the one hand, migrants may have biased preferences in favour of their country of origin products which positively affects import in the host country. On the other hand, migrants very often act as transaction cost reducer in international trade because they help lowering linguistic barriers and convey social, institutional and market information about their home country which native traders of the host country may find difficult and costly to obtain. Transaction cost reduce non-linearly with the number of immigrants giving rise to a network effect which positively affects both import and export at a decreasing rate (Parson and Wingters, 2014). Bratti et al. (2014) who used the Italian province data, suggest that the overall effect of migration on trade is mainly pro-import. At the same time Aleksynska and Perri (2014) point out that the outcome depends on the composition of immigrants' stocks. Immigrants in business network occupations are the one who intensify exports.

This paper aims at enhancing our understanding of the impact of immigration by looking at one of the Italian regions, Veneto. It is among the most dynamic regions in Italy experiencing a huge inflow of immigrants over the recent decades (ORI 2015). Our main enquiry here is whether the latter translates in higher international trade volumes. We start by looking at the aggregate trade volumes between the single provinces and the countries of origin of immigrants and then propose a disaggregate analysis by looking at different sectors. This way we are able to check whether there is a differential impact of immigration on trade in different sectors of economy. The composition of trade volumes may in fact be changing over time with the number of immigrants alongside the characteristics of both sending and accepting countries. The related question is whether immigration can change the structure of the host economy or does it reinforce already existing specialization.

We perform several steps in order to verify the existence of causal relation between immigration and trade flows and identify the shape of this relation. First, we estimate a so-called gravity model, where the number of immigrants enters alongside to other characteristics of both provinces and countries of origin of migrants which can potentially have an impact on bilateral trade (exports/imports). Then we exploit the Generalised Propensity Score methodology proposed by Imbens (2000) which consists in estimating the dose-response function which allows to determine the association between the number of immigrants (our treatment variable), at each level of immigration flows, and exports/imports (our outcome variables). The information obtained with this methodology can be instrumental to policies setting up migration quota.

The reference period for this paper is 2008-2015 which overlaps with the economic crisis, thus the conclusions obtained might be time specific. The study can be thought as an extension to a comprehensive analysis for Italy implemented by Bratti et al. (2014). Their trade flows data spans from 2003 to 2009, whereas immigration stocks data covers the period 2002-2008. The aim of our paper is to highlight the most recent developments, as well as to check which way the crisis might have influenced the much-debated relationship between immigration and trade.

In what follows we first provide a brief survey of the literature on the impact of migration on trade. In section two, we explain why the focus was put on Veneto and present the most recent trends regarding migration and international trade in the region. The data and methodology used in the empirical part of the paper are discussed in section three. Section four presents the main findings. We end up with some concluding remarks.

2. LITERATURE REVIEW AND THE HYPOTHESIS TO BE TESTED

There is an increasing number of studies looking at complementarity between migration and trade. The first attempts to test the causal relation were made for the US (Gould 1994). Since then, several case studies have appeared, including Head and Ries (1998) for Canada, Girma and Yu (2002) for the UK, Bruder (2004) for Germany, Briant et al. (2014) for France, Artar-Tur et al. (2012) for Italy, Spain, and Portugal, Bratti et al. (2014) for Italy. In this literature, general consensus is that there is a positive impact of migration on trade. These findings have been also confirmed by cross-country analysis, including Egger et al. (2012), based on the OECD data, and Genc et al. (2011), a meta-analysis relying on 48 previous studies.

Despite there seems to be no doubt that migration stimulates bilateral trade, the consensus has not been reached as to the magnitude and stability of this effect, which is partly explained by methodological differences. Some of the recent studies point out that the relationship is not of the log-linear type (see e.g. Egger et al. 2011, Serrano-Domingo and Requena-Silvente 2013). In particular, the effect seems to be the largest at small levels of migration, whereas there is a point of saturation beyond which the pro-trade effect becomes almost negligible.

Besides using more sophisticated methodologies, additional insights have been gained from more detailed data on both trade volumes and immigrants. Herander and Saaverda (2005) distinguished between in-state and out-state immigrants in the US, suggesting that network effects are enhanced by proximity. This is in line with the more traditional gravity models used in the literature where the distance between countries has always been one of the key ingredients (De Benedictis and Taglioni 2012). Artal-Tur et al. (2003) also point out the importance of using small geographical units, having proved that export enhancing effect is localized within the hosting province, i.e. it would not manifest itself if immigrants live outside the given province. In testing the importance of network effects Rauch (1999) moreover distinguished between homogeneous (those possessing a reference price) and differentiated products.

In their recent study Aleksynska and Peri (2014) outline the importance of the composition of immigrants' stocks. After incorporating into the analysis the occupational data for immigrants, they find that each business immigrant network generates over ten times the value of trade than a non-business immigrant network does.

Trade volumes data has also been subject to scrutiny. Egger and Wolfmayr (2014) point out that the estimates of gravity models often differ substantially once trade volumes data is taken from different supranational sources. Here we opt for the use of regional statistics data on exports (imports) from (to) Veneto (made up of seven rather homogeneous provinces). A disadvantage of our choice is that our results can be region specific on the other side, the use of disaggregated data on trade volumes originating from different economic sectors (and subsectors) is expected to provide new insights. Few studies have taken this perspective by looking at specific disaggregated sectors, rather than at overall bilateral trade flows. Among them, Ottaviano et al. (2015) who referred to the UK service sector while De Arcangelis et al. (2015a) looked at the manufacturing sector in Italy by associating the share of migrant workers with broader indicators of firm performance such as Sales/Workers and Production/Workers. A significant effect was found for the relatively low-tech sectors.

We hypothesize that the product composition of bilateral trade could be changing over time with the number of immigrants. The main question is whether immigration can change the structure of the local economy or does it reinforce already existing specialization. The outcome might depend on the composition of immigrant inflows, on how well they get assimilated, and on how far they can go is establishing their own

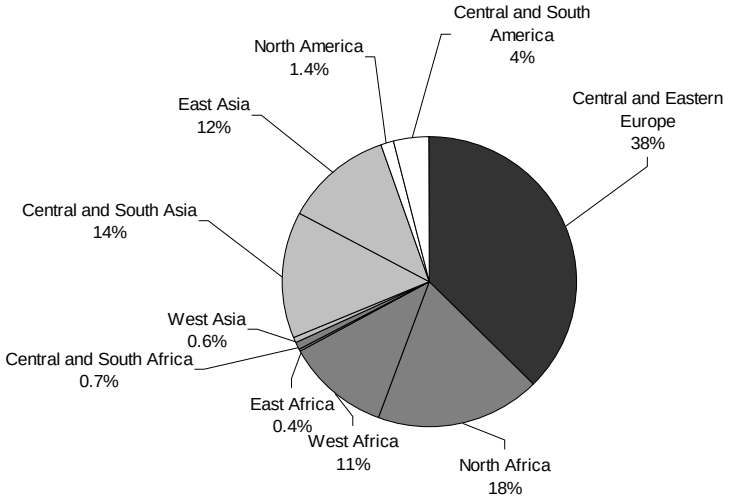
business[i]. It would also depend on the characteristics of both sending and accepting countries like the ones entering the traditional gravity equation[ii].

3. THE CASE STUDY OF VENETO REGION

3.1. Migration profile

Veneto is among the regions attracting the highest shares of immigrants coming to Italy. At the beginning of 2015, the total number of immigrants was around 5 mln. people, with more than half of them concentrated in Lombardy (23%), Lazio (12.7%), Emilia-Romagna (10.7%) and Veneto (10.2%) (ORM 2015). One out of ten people residing in Veneto nowadays has foreign origins.

Figure 1: Geographical areas of origin for foreigners living in Veneto



Source: own elaboration using ISTAT (foreign residence) data referring to 01.01.2015.

More than one third of immigrants come from Central and Eastern Europe, the second largest share (30%) corresponds to Africa, followed by Asia (27%), and only a bit more than 5 percent are from America (Fig. 1). The main countries of origin of Extra-Communitarian (Non-EU) immigrants are Morocco, China, Albania, and Moldova (see Tab. A1 in the Appendix)[iii].

Figure 2 maps the distribution of residence permits issued to non-EU citizens over the earliest and the latest years covered in this study. Veneto was and remains among the dark areas on the map, suggesting that

[i] Bratti et al. (2016) highlight the role of diasporas and ethnic firms for the development of trade relations between countries.

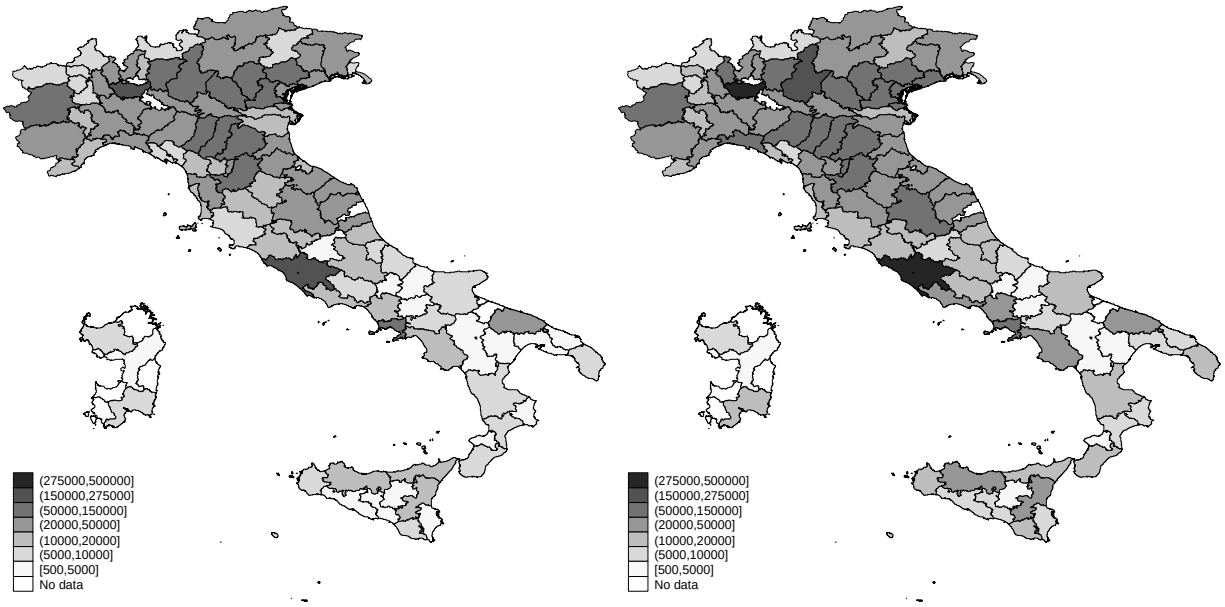
[ii] $F = G\frac{m_1 * m_2}{r^2}$, according to which the two objects attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them (G is the gravitational constant). By analogy, higher "economic mass" (proxied by VA/GDP per capita of accepting province and the sending country) is expected to stimulate bilateral trade, whereas longer distance between countries can be an impediment to trade.

[iii] Romania ranks first in terms of number of immigrants in Italy but this country is not included in our list because residence permits are no longer necessary after accession of Romania to the EU in 2007.

the region continues attracting immigrants in large numbers[iv]. The highest levels have been observed in the case of Rome, Naples and Milan metropolitan areas[v].

Figure 2: Number of permits issued, by province, years 2008 and 2015

A. Year 2008 B. Year 2015



Source: own elaboration based on ISTAT data.

3.2. The structure of local economy and international trade

In terms of economic dimension, Veneto is the third region in Italy with a 9.0% share of Italian GDP in 2015 after Lombardy (21.05%) and Lazio (11.12%). However, the economic structure of Veneto is different with a greater role of manufacturing which accounted for 23.12% of the regional VA in 2014. For comparison, in the same year the VA weight of manufacturing in Lombardy and Lazio were equal to 19.80% and 5.66% (ISTAT, National Accounting Database)[vi]. It is also worthwhile noting that manufacturing in Veneto absorbs a share of total regional employment (32%) which is greater than its share of VA[vii]. The core role of the industrial sector in the regional economy also explains while despite the service sector growth in the last decades, a large part of it also serves the needs of manufacturing. In so far as specialization is concerned, in the last decade there was a shift towards more technology-intensive productions and a simultaneous reduction in the share of traditional goods (from 9.4% in 2005 down to 6.4% in 2011) with recent interesting steps in the direction of the development of a low emission sustainable economy[viii].

[iv] This may seem in contrast to findings emerging from ORI (2015) reporting the recent reduction in foreign resident population in Vicenza and Treviso. The discrepancies are due to the fact that we use information on residence permits which applies to non-EU citizens only. It appears to be less affected by acquisitions of Italian citizenship (which peaked in 2013-2014) compared to the data on foreign resident population (for more details see Data section).

[v] Rome in Milan have seen the largest increase in the number of new entries per year (plus almost 150,000 and 200,000 respectively), reaching the highest mark of 470,601 in the case of Milan (01.01.2015).

[vi] http://dati.istat.it/Index.aspx?DataSetCode=DCCN_PILPRODT.

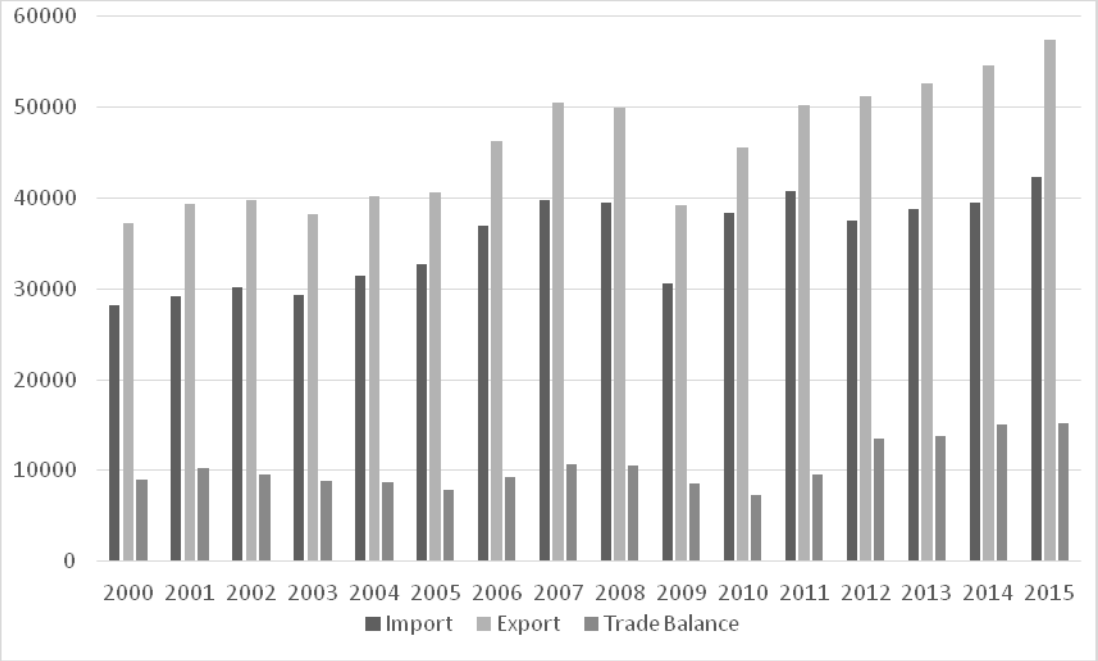
[vii] Unioncamere Veneto (2016a) p. 33, Table 2.1.

[viii] Unioncamere Veneto (2016a) pp. 166-76.

The analyses of the spatial distribution of economic activity reveals a clustering of firms in the central part of the region with two provinces[ix], Vicenza and Treviso, which produce almost half of the regional VA in manufacturing (27.71% and 20.92%). Noteworthy is the case of Vicenza which is one of the most industrialized areas in Italy with a share of manufacturing being 35.49%, a figure more than twice greater than the Italian average (15.51%).

Veneto is very open to international trade. The region is running a persistent trade surplus and is the second Italian exporting region generating 14% of total Italy's export (Unioncamere Veneto, 2016b). In 2015, export accounted for 10% of the region's GDP. Figure 2 shows the negative impact of the Great Recession on foreign trade, which in the case of Veneto nonetheless returned on the previous upward trend already in 2010. At the NUTS 3 (province) level, Vicenza alone generates 28.53% of the regional export, followed by Treviso (20.88%) and Verona (17.86%).

Figure 3: International trade of Veneto in the period 2001-2015 (MEUR)



Source: ISTAT COEWEB database.

In 2015, EU absorbed 58.17% of regional export remaining the most important destination market for Veneto products. Among individual countries, Germany, France, USA, UK, Spain and Switzerland have been the main destinations for goods produced in Veneto. In so far as emerging countries are concerned, China is the most important trade partner, being the second exporter to Veneto and the tenth importer (Unioncamere Veneto 2016a: Tab. 2.3). The position of China as the second supplier of imported goods reflects the internationalization of the regional value chain, particularly in the textile and fashion sectors. In the wake of the economic crisis which hit the main trade partners too, emphasis has been made on expanding trade relations with emerging markets. Among the latter, in the last five years Mexico, Arab Emirates, Saudi Arabia and Hong Kong have been the most dynamic countries of destination of products from Veneto (Unioncamere Veneto, 2016b).

[ix] Provinces in Veneto region are Belluno, Padova, Treviso, Venezia, Verona and Vicenza.

The composition of exports is dominated by mechanical and fashion industries (Unioncamere Veneto 2016a: Table. 2.2). BBF[x] products are an important part of the output from Veneto and represent about one third of exports from the region. They have been especially welcomed in emerging countries like Russia, Brazil, China, and India.

Table A2 in the Appendix provides information on export and import volumes towards top ten countries of origin of immigrants, as identified in Tab. A1. It provides some evidence on the relation between immigration and trade. In particular, most of these countries have seen considerable increase in trade with Italy. The biggest increase in exports was observed towards Albania, Bangladesh, Serbia, India, China, and Nigeria, whereas imports increased most from Bangladesh, Albania, Serbia, Moldavia, China and India. In terms of levels China and India lead both of the lists.

In what follows we are going to study empirically the existing relation between immigration and trade. The section to come will present the data and methodology we are going to use for this purpose.

4. DATA AND METHODOLOGY

4.1. Data

Our unit of analysis is a couple 'Italian province-Country of origin of immigration', the latter being also a destination/origin for exports from/imports to a given province. The data on trade, immigrants and other country/province characteristics derives from different sources.

Our key variables are export/import volumes (dependent) and the number of residence permits (explanatory) as an indicator of immigrants' presence. Residence permits are issued to non-EU citizens, thus we do not take into account immigrants coming from EU Member States (including recent accession countries like Romania and Bulgaria). An alternative to the residence permits could be the number of foreign residents in the region[xi]. However, since no homogeneous time series is available for periods before and after the last census in 2011, we preferred to use the homogeneous residence permits data set. Furthermore, the concept of permits of stay is more appropriate than residence because our focus is on internationalization and diversification of trade partners, which implies going beyond the boundaries of the EU.

Initially, we use total exports/imports over the period 2008-2015. Then we take into account disaggregated trade flows originating from different sectors as of ATECO (Classification of Economic Activity) 2007[xii] at 1-digit level (see Table A3 in the Appendix). Finally, we complete the analysis looking at different subsectors using data on import and export by pseudo-subsectors of manufacturing (ATECO 2007, 2 digits). The data on trade volumes comes from regional statistics for Veneto[xiii] and the ISTAT COEWEB

[x] 'Bello e Ben Fatto' (BBF, eng. Beautiful and Well-Made,) indicates Made-in-Italy medium-high level goods from old traditions which are innovative in terms of design and state-of-the-art technology. BBF are produced according to high quality and professional standards.

[xi] This would include immigrants coming from other EU Member States [ISTAT: "Foreign resident population is represented by individuals who do not have Italian citizenship having usual residence in Italy. It is calculated for each municipality on December 31st of each year that follows the population Census, adding to the foreign population enumerated by the census the foreign population inflows and outflows recorded during each calendar year"].

[xii] A National version of the European nomenclature NACE Rev.2.

[xiii] http://statistica.regione.veneto.it/banche_dati_economia_commercio_estero.jsp

database, while the source of information on permits of stay is ISTAT (the Italian National Statistical Institute)[xiv].

In addition, we use the great circle distance between the main city in the Italian province and the capital city in the country of origin of immigrants to assess its weight on bilateral trade (for more details see Tab. A3 in the Appendix). Other variables include the total value added[xv] for accepting province and the GDP per capita[xvi] for the country of origin of immigrants.

4.2. Methodology

Our basic model derives from the literature on gravity models in international trade (see e.g. De Benedictis and Taglioni 2011). We first estimated the following log-linear type of equations for total exports/total imports by province versus the country of origin of immigration:

$$\ln(Exp_{ijt}) = Immigr_{ijt-1}+Immigr^2_{ijt-1}+\ln(Distance_{ij})+\ln(VA_{it-2})+\ln(GDPpc\_pp_{jt})+\lambda_t+\varepsilon_{ijt} \quad (1)$$

$$\ln(Imp_{ijt}) = Immigr_{ijt-1}+Immigr^2_{ijt-1}+\ln(Distance_{ij})+\ln(VA_{it-2})+\ln(GDPpc\_pp_{jt})+\lambda_t+\varepsilon_{ijt} \quad (2)$$

where Exp_{ijt} / Imp_{ijt} stands for Exports /Imports from 'province i to country j'/ 'country j to province i' in time t.[xvii] $Immigr_{ijt-1}$ is a measure of immigrant stocks from country j in province i at time t-1 (measured by the number of permits issued and still valid on January 1st in year t), VA_{it-2} is the value added reported for a given province in year t-2[xviii], $GDPpc\_pp_{jt}$ is the GDP per capita for country j in year t, λ_t is time fixed effects and ε_{ijt} is an error term[xix]. We also estimated equations 1 and 2 for specific sectors (Exp_{ijt_s}/ Imp_{ijt_s}) and subsectors of manufacturing (Exp_{ijt_ss}/ Imp_{ijt_ss}) as reported in Tab. A3 of the Appendix.

Note that the log-linear transformation suggests the following interpretation of the estimated coefficients for the number of immigrants. A one unit increase in *Immigr* yields an increase in export volumes by a multiple of e^{β}. Since *Immigr is* defined as the number of permits issued by country divided by 1000, the final interpretation would be that 1000 increase in the number of immigrants would increase exports by a multiple of e^{β}.

The estimates obtained from standard gravity models as above may be criticized for not taking into account the issue of endogeneity of our key explanatory variable (Immigration), which may derive from the reverse causality or omitted variables. In order to affront this problem, we estimate a model of three equations, for Exports, Imports and Immigration, allowing for feedback loops and correlated errors:

$$\begin{cases} \ln(Exp_{ijt}) = Immigr_{ijt-1} + Immigr^2_{ijt-1} + \ln(Imp_{ijt-1}) + \ln(Distance_{ij}) + \ln(VA_{it-2}) + \ln(GDPpc\_pp_{jt}) + \lambda_t + \varepsilon_{ijt} \\ \ln(Imp_{ijt}) = Immigr_{ijt-1} + Immigr^2_{ijt-1} + \ln(Exp_{ijt-1}) + \ln(Distance_{ij}) + \ln(VA_{it-2}) + \ln(GDPpc\_pp_{jt}) + \lambda_t + \varepsilon_{ijt} \\ Immigr_{ijt} = \ln(Exp_{ijt-1}) + \ln(Imp_{ijt-1}) + Border_{ij} + \ln(Distance_{ij}) + \ln(VA_{it-2}) + \ln(GDPpc\_pp_{jt}) + \lambda_t + \varepsilon_{ijt} \end{cases} \quad (3)$$

[xiv] We are grateful to colleagues from ISTAT, in particular Dott.ssa Cinzia Conti, for providing us with this data. The list of 41 countries includes: AL, BA, HR, MK, MD, RU, TR, UA, CH, DZ, EG, MA, TN, BF, CI, GH, NG, SN, ER, ET, MU, SO, CM, CG, IR, LB, SY, BD, IN, PK, LK, CN, PH, US, AR, BR, CO, CU, DO, EC, PE.

[xv] http://statistica.regione.veneto.it/servlet/scaricoXls?downfile=ContoEc5.xls

[xvi] http://data.worldbank.org/indicator/NY.GDP.PCAP.CD/countries

[xvii] Before taking log of Exp/Imp one unit was added in order to keep in the picture observations with 0 values of the respective variables and be able to use the log-linear specification. For the same reason, the missing values for the number of permits have been substituted with 1.

[xviii] The two-year lag depends on availability of data.

[xix] Following Bryan and Jenkins (2013) we restrict the use of fixed effects down to only time fixed effects.

The idea behind is that establishing relations between trade partners may create favourable conditions for both increasing exports and imports. Originating from the same or even different sectors the two often concatenate each other. This is also likely to be accompanied by some people moving towards the country of trade flows destination fuelling migration.[xx] We thus impose a certain structure on the on-going processes and try to model them jointly.[xxi]

The estimation of structural equation model using panel data is bound to difficulties and numerous approaches has recently been proposed to solve them (for a discussion see e.g. Allison et al. 2017). We here use one-year lagged values of associated explanatory variables and allow for the error terms to be correlated in the equations for Exports and Imports. This is the way to bring into the picture unobserved characteristics which may affect simultaneously Imports and Exports.

After estimating the gravity type equations (1) and (2), as well as the system of three equations (3), we proceeded by tackling the number of immigrants as a form of treatment variable (having in mind immigration quotas as a possible policy instrument). What we are interested in is the "response" of bilateral trade flows to different levels ("dose") of immigrant stocks (the "treatment" variable). The estimation of average treatment effect requires adjustment for differences in pre-treatment variables, and to this end we use the generalized propensity score (GPS)[xxii]. Immigrants from different countries very likely took their decision to emigrate under different economic, social and institutional conditions which should be taken in account in order to draw an unbiased causal inference. This is solved by first estimating GPS and then using it to obtain the dose-response function which associates an average potential outcome (exports/imports) to a certain level of treatment T (number of immigrants). Egger et al. (2012) and Serrano-Domingo and Requena-Silvente (2013) are good examples of this approach used in a similar setting.

The regression model for exports behind our dose-response analysis is the following[xxiii], and it is just analogous for imports:

$$\ln(Exp_{ijt}+1) = Immigr_{ijt-1} + Immigr_{ijt-1}^2 + GPS + GPS^2 + Immigr_{ijt-1}*GPS \quad (4)$$

In the paper, we also report the estimates of the treatment effect function which is the first derivative of the dose-response function. It shows the effect of the marginal increase in the number of immigrants on bilateral trade flows.

5. MAIN FINDINGS

The estimates of gravity model reported in Table A5 of the Appendix confirm our expectations in that there is a positive relation between the number of immigrants present in the territory and exports towards the country of their origin. At the same time, a negative relation is observed between the number of immigrants squared and exports, suggesting a non-linear relationship between the key variables of interest.

Estimates by sector suggest that immigration tends to stimulate exports from A-agriculture, B-mining, C-manufacturing, E-water supply and waste management, as well as V-sector producing other goods; the

[xx] It would also be interesting to account for emigration flows, but it is out of the scope of this paper.
[xxi] For a recent survey of structural equation modelling see Tarka (2017).
[xxii] GPS has the meaning of conditional probability of receiving certain level of treatment given pre-treatment variables. Once we have the estimate of GPS, instead of having to adjust for all pre-treatment variables, it is sufficient to adjust for GPS (Imbens 2000).
[xxiii] The estimates of this model do not have direct interpretation. They are used to construct the dose-response function as in Figure A1 of the Appendix.

remaining sectors including J-information and communication, M-professional, scientific and technical activities, R-arts, sports and entertainment, do not respond to an increase in the number of immigrants.

Since manufacturing has always been and remains the key sector for the Veneto region we deepened the analysis by looking at different subsectors of manufacturing. The estimates reported in Tab. A6 of the Appendix suggest that the inflow of immigrants is associated with higher export volumes in the case of food and drinks (CA), textile, leather goods and accessories (CB), chemical products (CE), metal products and equipment (CH), computer and electronic equipment (CI), machines and equipment (CK) and transport means (CL); the effect is minor for products of wood (CC), rubber and plastic goods (CG), electrical devices (CJ); and is practically irrelevant for exports of oil and petroleum products, as well as pharmaceutical and medical products. In the case of imports, the picture is quite similar in terms of significance by subsectors except for the case of computer, electronic and optical devices for which imports are not sensitive to the presence of immigrants (differently from exports).

The use of logarithmic transformation in our specification does not allow direct interpretation of the estimated coefficients. But after some manipulations (explained in the methodology section) we obtain that one hundred increase in the number of immigrants from a certain country is expected to increase exports towards that country by 2.8%. The elasticity of total imports with respect to the number of immigrants is higher than that of exports. One hundred increase in the number of immigrants from a certain country is expected to increase imports from that country by 8%. The estimates appear to be slightly higher compared to the findings from a meta-study by Genc et al. (2011) reporting 1-2% increase in exports associated to an increase in the number of immigrants by 10%.

Higher distance between countries is an obstacle, as the coefficient for geographical distance is negative and significant for total exports as well as for 6 out of 8 sectors considered; it matters also on (total) imports, although this effect is less significant, down to inexistent in more than half of the sectors. Provinces generating higher value added tend to both export and import more. This does not hold true only for M-professional, scientific and technical activities in the case of imports. The export /import flows are larger towards/from countries characterized by higher GDP per capita, again with few exceptions observed at sector level such as water supply and waste management (E) for exports.

The results obtained by using standard gravity equations are largely confirmed by those derived from the estimation of simultaneous equations model[xxiv], with few exceptions though (Tab. A7). In particular, both imports and exports appear to be affected by increasing number of immigrants, but the effects are more evenly distributed among sectors, especially for imports. Immigration appears to increase imports from agriculture (presumably substituting for internal production), but not exports. This means that higher inflow of immigrants should not be seen as supporting the development of agricultural sector (despite high share of them perform jobs in agriculture). In addition, the coefficient now turns positive and highly significant for imports from J-sector (information and communication), which is on a high-tech side. Imports appear to be positive and significant for R-sector (Arts, sports and entertainment), probably supporting the idea of cultural diversity, whereas the coefficient turns to be negative and significant for exports in that same sector.

Worth noting that the cross-lagged values of imports and exports entering the list of explanatory variables turn to be positive and highly significant, except for the case of M-sector (professional, scientific and technical activities). The fact that distance is more of an obstacle for exports rather than imports is also catching the eye.

[xxiv] These estimates have only been performed by aggregate sectors at 1-digit ATECO classification.

In the attempt to test more precisely the type of relationship between immigration and trade we estimate the dose-response function for both exports and imports. The graphical presentation of the dose-response function in Figure A1 confirms the existence of a non-linear relationship which again varies by sector. As can be seen from Figure A2.1, the maximum effect on exports is achieved in Manufacturing, at a relatively low levels of immigration flow, around 4 thousand people. The same holds true for imports, as it can be grasped from Figure A2.2. It is worth noting that the pro-trade effect in manufacturing gets weaker for imports at higher levels of immigration, whereas it survives for exports. As to the other sectors, higher inflow of immigrants is expected to translate in higher increase of exports from Agriculture, Mining, Information and Communication, Arts Sports and Entertainment. In the case of imports the same holds true for Agriculture, Mining, Professional, Scientific and technical activities.

By comparing panel A2.1 and A2.2 one can notice that the pro-trade effect is higher for imports to rather than exports from Agriculture, and the other way around for Information and Communication. It seems that the home product preference bias effect dominates trade in the Agriculture sector, while in the case of Information and Communication the immigrant network effect is the relevant pro-trade channel. The latter result could also mean that immigration stimulates the development of technologically more advanced sectors. This finding needs further investigation though, as it is not fully consistent with the estimates reported in Tab. A5, more so with those reported in Tab. A.7. It also goes at odds with the results reported in Bettin et al. (2014) who looked at the Italian manufacturing sector only, as well as Borelli et al. (2017) who analyse the production structure in Europe. Both papers use earlier data, pre-crisis, so our findings referring to the period 2008-2015, if true, could possibly be taken as a signal of on-going change.

We went further in the analysis by looking at subsectors of manufacturing. Most of them are able to take advantage from greater inflow of immigrants by exporting more. In the case of textile and closing, but also wood and paper products, pharmaceutical products and transport means, going beyond 15 thousand new entrants from a single country would allow surpassing the previously identified local maximum of pro-trade effect. The existence of several maxima may not be very intuitive but is a result which is not rare in the literature on the link between migration and trade since the seminal paper by Gould (1994)[xxv].

Our tentative explanation is that immigrants who come first are probably the most open-minded and ready to take risks, which can be helpful in establishing trade relations between countries. They also facilitate trade conveying information about the formal and non-formal aspects of the economy of their countries of origin which helps reducing transaction costs in the trade relationship with the immigrants' destination countries (Parsons and Winters, 2014: pp. 19-21). The second wave of immigrants is in part represented by their family members who are not expected to contribute in developing trade relations to the same extent. Higher order maxima may be the result of network effects which gain importance in business relations as long as there is space for the joint use and accumulation of capital, as well as the result of learning by doing (Rauch, 1999). Positive experience of creating trade-partnerships may stimulate further increase in trade between countries.

[xxv] See also Herander and Saavedra (2005), Parsons and Winters (2014), Wagner et al. (2002).

6. CONCLUDING REMARKS

This paper aims at enhancing our understanding of how the increase in the number of immigrants might affect trade relations between sending and hosting countries. The focus here was on one of the most developed Italian regions, Veneto, which has been and remains among the main attractors for foreigners coming to Italy. The share of foreign-born population living in Veneto nowadays has surpassed 10%. This has raised concerns regarding the impact of immigration on the structure of local economy.

We address this issue first by estimating a standard type gravity model, for both total exports/total imports from/to the single provinces of Veneto region to/from the countries of origin of immigrants. Then we estimate the gravity model separately by sectors of economy in order to understand whether they react differently to the inflow of immigrants. The sample period runs from 2008 to 2015.

Our empirical estimates confirm that immigration has the potential to increase bilateral trade by affecting both exports and imports. The elasticity of aggregate imports with respect to the number of immigrants is nevertheless higher for imports. A closer look suggests that the effect on imports is mainly concentrated in manufacturing sector, whereas that on exports is more evenly distributed among several sectors. In particular, agriculture, mining, manufacturing, water supply and wastes management, as well as sectors producing other goods are the ones which export more in response to the inflow of immigrants. The magnitude of the effect on import is much higher compared to exports in manufacturing. This drives the picture at the aggregate and could mean that a further increase in the number of immigrants might induce shifts in the structure of local economy of Veneto region which is highly dependent on international trade.

The robustness of our finding has been checked by applying alternative approaches. These include an estimation of structural equations model for Exports, Imports and Immigration. This was done also to remedy the problem of endogeneity of Immigration variable. The results are by and large confirmed, albeit more heterogeneous impact on imports from different sectors emerge.

Future developments can be affected by policy actions such as setting up migration quotas. The estimates of the dose-response function complementing the analysis can be instrumental in this respect. They suggest the levels of immigration allowing to achieve the maximum effect on trade. For example, based on the actual numbers of immigrants from specific countries residing in the province Vicenza one may conclude that the maximum trade potential has already been achieve for such countries as Serbia, Montenegro, Morocco, Bangladesh, India, Albania and Ghana. It is close to the maximum for Moldova and the USA. As for the remaining countries, attracting more immigrants to the province of Vicenza may serve the purpose of boosting bilateral trade. These specific conclusions need to be tackled with caution. One reason is data limitation. We relied on a subsample of 41 countries of origin of immigrants, whereas policy implications need to be drawn based on a full picture.

The data was nevertheless enough to show that the effects of immigration differ considerably by sector. The results are inconclusive as to whether the induced structural shifts would go in the direction of high versus low-technology sectors. This would urge further investigation using more detailed data breakdown. Despite data was an issued even at the level of single Italian region, a similar type of analysis would be more than timely for the whole of Italy.

Appendix A. Tables and Figures

Table A1. Immigrants to Veneto region, by country of origin (top 20 sending countries)

Country	Permits valid on 01.01.2015	Rank_2015	Rank_2008
Morocco	65,991	1	1
China	43,210	2	4
Albania	42,685	3	2
Moldova	39,760	4	5
Serbia/ Kosovo/ Montenegro	35,686	5	3
Bangladesh	23,798	6	6
India	18,687	7	10
Ukraine	17,648	8	9
Macedonia	16,477	9	7
Nigeria	16,025	10	11
Sri Lanka	13,428	11	13
Ghana	13,090	12	8
Senegal	10,439	13	14
Bosnia and Herzegovina	9,270	14	12
Philippines	7,621	15	18
Tunisia	7,508	16	16
United States	5,877	17	19
Brazil	4,908	18	17
Pakistan	4,759	19	24
Burkina Faso	3,859	20	21

Note: Croatia ranked no. 15 in 2008 dropped in 2015 due to the EU accession in 2013.
Source: own elaboration on ISTAT (residence permits) data.

Table A2. Trade with the main countries of origin of immigrants, years 2005-2015 (MEUR)

A. Exports to

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2015/2005
China	674	762	877	862	930	1390	1829	1351	1450	1363	1441	**2.14**
India	197	235	310	317	293	372	462	429	390	424	480	**2.44**
Ukraine	229	297	375	470	231	268	329	341	352	259	190	**0.83**
Serbia	82	171	197	216	156	154	175	187	191	189	225	**2.73**
Morocco	134	139	178	181	157	172	166	166	175	160	195	**1.46**
Albania	44	54	70	83	77	89	121	104	108	120	128	**2.92**
Nigeria	37	55	104	69	55	75	82	60	90	103	76	**2.05**
Bangladesh	30	32	24	36	31	44	55	48	54	66	82	**2.78**
Macedonia	24	26	29	39	39	39	40	43	50	48	45	**1.87**
Moldavia	25	33	37	42	27	35	42	44	43	38	46	**1.82**

B. Imports from

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2015/2005
China	2070	2726	3326	3442	2907	3915	4024	3521	3251	3526	3998	**1.93**
India	351	488	544	531	409	704	666	527	571	598	618	**1.76**
Ukraine	290	358	382	465	222	332	528	566	533	518	424	**1.46**
Serbia	60	169	170	139	121	143	175	125	134	172	217	**3.62**
Morocco	84	84	91	84	79	88	85	84	94	87	81	**0.96**
Albania	18	34	36	38	29	49	67	75	62	82	87	**4.83**
Nigeria	6.7	4.6	3.2	3.6	5.2	7	10	8.0	8.9	6.4	5.9	**0.88**
Bangladesh	65	82	84	112	131	177	197	282	324	362	449	**6.91**
Macedonia	21	22	26	36	25	25	23	22	39	39	31	**1.48**
Moldavia	16	29	40	39	27	31	35	18	19	23	36	**2.25**

Note: the values are not adjusted for inflation.
Source: own elaboration using regional statistics for Veneto.

Table A3. Variables definition

Variable	Description
Exp_{ijt} / Imp_{ijt}	Total exports /imports from province *i* to country *j* in year *t*
Exp_{ijt_s} / Imp_{ijt_s}	Exports /Imports originating from sector *s* in province *i towards* country *j* in year *t.* Sectors are defined on the basis of 1-digit ATECO (Classification of Economic Activity) 2007 and include in particular: **A**-agriculture, forestry and fishing; **B**-mining; **C**-manufacturing, **D**-electricity and gas supply; **E**-water supply and wastes management; **J**-information and communication; **M**-professional, scientific and technical activities; **R**-arts, sports and entertainment; **S**-other services; **V**-other goods.
Exp_{ijt_ss} / Imp_{ijt_ss}	Exports /Imports originating from a specific subsector of manufacturing *ss* in province *i towards* country *j* in year *t.* So-called pseudo-subsectors are defined on the basis of 2-digit ATECO Classification 2007 and include in particular: **CA** -food products, drinks and tobacco; **CB** - textiles, clothing, leather goods and accessories; **CC** - wood and products of wood; paper and products of print; **CD** - oil and petroleum products; **CE** - chemical products and substances; **CF** - pharmaceutical, chemical, medical and botanical products; **CG** - products of rubber/plastic/minerals; **CH** - metals/metal products, excluding machines and equipment; **CI** - computer, electronic and optical devices; **CJ** - electrical devices; **CK** - machines and equipment; **CL** - transport means; **CM** - products of other manufacturing activities.
$Immigr_{ijt-1}$	The number of immigrants (in thousands), measured by the number of permits (*ital. permesso di soggiorno*) issued in province *i* and still valid on the 1st of January in year *t*, by country of origin *j* (citizenship).
$Distance_{ij}$	The *great circle distance* between the main city in the Italian province and the capital in the country of origin of migration. It is calculated in the following way. We first transform the latitudes and the longitudes of the two cities, respectively *(a1, b1)* and *(a2, b2)* as of *www.latlong.net*, into radians, multiplying by *(π/180)*. The following formula is then used to calculate the distance between the two cities: Distance [1,2] =arccos [sin*a1**sin*a2*+cos*a1**cos*a2**cos*(b1-b2)*]*z, where z=6371km (radius of Earth).
VA_{it-2}	The value added created by province in year t-2 (2-year lagged value).
$GDPpc_{jt}$	GDP per capita for country *j* in year *t* (PPP, current international US$).
$Border_j$	Dummy equal to 1 if the country of immigrants' origin borders with Italy, 0 otherwise.

Table A4. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ps	2296	1274.007	2477.747	1	18404
exp_total	2296	4.68E+07	1.23E+08	0	1.45E+09
exp_a	2296	358890.5	1828044	0	3.84E+07
exp_b	2296	88275.64	541198.5	0	1.12E+07
exp_c	2296	4.59E+07	1.21E+08	0	1.43E+09
exp_d	2296	71.62108	2790.241	0	128905
exp_e	2296	200245.9	1520239	0	3.47E+07
exp_j	2296	142026.5	761628	0	1.03E+07
exp_m	2296	238.027	3162.794	0	104933
exp_r	2296	78360.67	790496.9	0	1.58E+07
exp_s	2296	15.46733	347.0077	0	13312
exp_v	2296	6556.008	64414.33	0	2798000
ca_exp	2296	2385750	1.12E+07	0	1.65E+08
cb_exp	2296	8118683	2.77E+07	0	3.79E+08
cc_exp	2296	984678.1	2455987	0	3.29E+07
cd_exp	2296	42918.65	526376.2	0	2.07E+07
ce_exp	2296	1700742	6305007	0	1.04E+08
cf_exp	2296	505774.2	3777489	0	9.78E+07
cg_exp	2296	2649437	8000955	0	1.43E+08
ch_exp	2296	5292698	2.64E+07	0	6.69E+08
ci_exp	2296	862120.9	3332318	0	5.27E+07
cg_exp	2296	2649437	8000955	0	1.43E+08
ck_exp	2296	1.15E+07	2.91E+07	0	5.67E+08
cl_exp	2296	1354798	1.08E+07	0	3.83E+08
cm_exp	2296	7626920	3.84E+07	0	7.93E+08
imp_total	2296	3.47E+07	1.06E+08	0	1.22E+09
imp_a	2296	1124583	5279402	0	1.36E+08
imp_b	2296	1178169	1.09E+07	0	3.15E+08
imp_c	2296	3.21E+07	1.04E+08	0	1.21E+09
imp_d	2296	0	0	0	0
imp_e	2296	201995.8	1119476	0	1.84E+07
imp_j	2296	19595.2	111258.4	0	2501193
imp_m	2296	21.79965	494.3337	0	15793
imp_r	2296	83904.43	2559460	0	1.21E+08
imp_s	2296	116.2787	2054.672	0	50896
imp_v	2296	21241.94	137841	0	2766633
ca_imp	2296	1077290	5617985	0	1.92E+08
cb_imp	2296	1.31E+07	4.66E+07	0	6.09E+08
cc_imp	2296	1171294	4320811	0	7.03E+07
cd_imp	2296	748370.5	7674237	0	1.60E+08
ce_imp	2296	974096.5	4213998	0	7.20E+07
cf_imp	2296	85923.38	692394.5	0	1.38E+07
cg_imp	2296	1248681	5370278	0	6.67E+07
ch_imp	2296	5057830	3.19E+07	0	5.92E+08
ci_imp	2296	1314221	9842639	0	2.26E+08
cg_imp	2296	1248681	5370278	0	6.67E+07
ck_imp	2296	1844192	9767083	0	1.09E+08
cl_imp	2296	1096617	8842332	0	2.68E+08
cm_imp	2296	2462348	1.86E+07	0	3.61E+08
distance	2296	4846.802	3235.449	287.5045	11413.46
border	2296	0.243902	0.429528	0	1
va_tot	2296	18469.34	7999.244	5267	25184
gdppc_ppp	2296	11424.9	11207.09	525	60535.16
year	2296	2011.5	2.291787	2008	2015

Source: own elaboration.

Table A5. Basic model: gravity equation estimated on the panel of seven provinces belonging to Veneto region, years 2008-2015

A. Exports

	Sector†								
Variable	**A**	**B**	**C**	**E**	**J**	**M**	**R**	**V**	**Total**
$Immigrants_{ij}$	0.459*	0.539**	0.258***	0.912***	0.315	0.027	-0.221	0.346**	0.251***
$Immigrants_{ij}^2$	-0.023	-0.033*	-0.016**	-0.058***	-0.015	-0.002	0.019	-0.018	-0.015**
$Distance_{ij}$	-1.880***	-1.266***	-0.332**	-0.183	-0.631**	-0.098**	-0.319	0.709***	-0.338**
VA_i	2.302***	2.589***	1.404***	1.121***	1.457***	0.152**	0.904***	1.356***	1.399***
$GDP\_per\ capita_j$	2.249***	1.466***	1.752***	0.282	2.443***	0.126***	1.472***	0.843***	1.741***
Constant	-23.173***	-24.722***	-11.256***	-10.033*	-26.365***	-1.632*	-17.735***	-24.887***	-11.033***
N	2296	2296	2296	2296	2296	2296	2296	2296	2296
sigma_u	3.253	3.196	1.651	3.217	3.122	0.345	2.551	1.607	1.651
sigma_e	3.078	2.667	0.96	2.925	3.021	1.181	2.006	2.975	0.933
rho	0.528	0.589	0.747	0.547	0.516	0.079	0.618	0.226	0.758

B. Imports

	Sector†								
Variable	**A**	**B**	**C**	**E**	**J**	**M**	**R**	**V**	**Total**
$Immigrants_{ij}$	0.278	0.355	0.679***	0.078	0.227	-0.002	0.116	0.323*	0.607***
$Immigrants_{ij}^2$	-0.024	-0.022	-0.037**	0.003	-0.013	0	-0.015	-0.013	-0.034**
$Distance_{ij}$	-0.795*	-1.101***	-0.744**	-2.316***	-0.189	0.003	0.111	-0.007	-0.745**
VA_i	2.707***	1.567***	2.702***	1.200***	0.607*	0.033	0.512*	1.020***	2.471***
$GDP\_per\ capita_j$	0.770**	1.137***	1.948***	1.436***	1.162***	0.048**	0.884***	1.603***	1.911***
Constant	-19.876**	-12.982*	-25.823***	-3.019	-13.322***	-0.735*	-12.723***	-22.570***	-22.655***
N	2296	2296	2296	2296	2296	2296	2296	2296	2296
sigma_u	5.1	4.345	3.919	2.908	2.745	0.18	2.399	2.15	3.767
sigma_e	2.834	2.618	2.423	2.758	1.904	0.472	1.721	2.918	2.299
rho	0.764	0.734	0.723	0.527	0.675	0.127	0.66	0.352	0.729

Note: * p<0.05; ** p<0.01; *** p<0.001

† **A**-agriculture, forestry and fishing; **B**-mining; **C**-manufacturing; **E**-water supply and wastes management; **J**-information and communication; **M**-professional, scientific and technical activities; **R**-arts, sports and entertainment; **V**-other goods.

Source: own calculation

Table A6. Gravity equation estimated by subsectors of manufacturing, Veneto region, years 2008-2015

A. Exports

	Subsector‡												
Variable	**CA**	**CB**	**CC**	**CD**	**CE**	**CF**	**CG**	**CH**	**CI**	**CJ**	**CK**	**CL**	**CM**
$Immigrants_{ij}$	0.655***	0.896***	0.485**	0.035	0.664***	-0.079	0.405**	0.483***	0.643***	0.395**	0.349***	0.563***	0.547***
$Immigrants_{ij}^2$	-0.041**	-0.050***	-0.023	0.001	-0.037**	0.023	-0.022*	-0.032**	-0.038**	-0.022*	-0.020*	-0.032*	-0.031**
$Distance_{ij}$	-1.204***	-1.122***	-1.103***	-1.161***	-0.885***	-0.259	-0.713***	-0.925***	-0.394	-0.591***	-0.027	-1.649***	-0.492*
VA_i	3.134***	3.213***	4.020***	1.266***	2.297***	2.224***	3.354***	2.701***	2.203***	3.572***	1.949***	3.755***	0.455
$GDP\_per\ capita_j$	2.376***	2.585***	2.641***	0.701***	2.616***	1.570***	2.285***	2.455***	2.379***	2.322***	1.991***	1.121***	2.712***
Constant	-32.606***	-35.108***	-44.887***	-7.428**	-28.779***	-29.689***	-36.051***	-29.280***	-30.707***	-39.361***	-22.838***	-24.159***	-13.419***
N	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296
sigma_u	2.91	2.884	2.896	1.999	3.159	3.632	2.294	2.459	2.935	2.43	1.993	2.93	2.858
sigma_e	2.788	2.318	2.642	2.737	2.4	3.38	2.036	2.351	2.677	2.161	1.574	2.76	2.075
rho	0.521	0.607	0.546	0.348	0.634	0.536	0.559	0.522	0.546	0.558	0.616	0.53	0.655

B.Imports

	Subsector‡												
Variable	**CA**	**CB**	**CC**	**CD**	**CE**	**CF**	**CG**	**CH**	**CI**	**CJ**	**CK**	**CL**	**CM**
$Immigrants_{ij}$	0.848***	0.916***	0.727***	-0.06	0.586**	0.221	0.868***	0.841***	0.234	0.633**	0.815***	0.553**	0.808***
$Immigrants_{ij}^2$	-0.047**	-0.047**	-0.052***	-0.003	-0.044**	-0.012	-0.049***	-0.068***	-0.015	-0.036*	-0.056***	-0.047***	-0.045**
$Distance_{ij}$	0.237	-0.948**	-1.637***	-0.573***	-0.943**	0.02	-1.413***	-2.149***	-0.417	-1.252***	-1.167***	-0.647*	-0.487
VA_i	2.509***	2.957***	2.053***	0.682**	1.438**	0.407	1.917***	1.935***	1.301**	1.611***	2.001***	1.131**	0.803
$GDP\_per\ capita_j$	2.629***	1.617***	0.563*	0.789***	2.282***	0.991***	1.862***	2.016***	1.851***	1.935***	2.415***	1.661***	1.947***
Constant	-43.964***	-27.587***	-6.116	-7.983**	-22.614***	-11.834***	-18.651***	-13.728*	-22.314***	-18.821***	-26.181***	-17.701***	-16.340**
N	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296	2296
sigma_u	4.74	5.056	4.784	2.248	4.519	3.117	4.262	4.428	4.199	4.327	3.772	4.317	4.487
sigma_e	2.901	2.811	2.583	2.291	3.029	1.53	2.549	2.802	2.452	2.485	2.939	2.324	2.738
rho	0.727	0.764	0.774	0.49	0.69	0.806	0.737	0.714	0.746	0.752	0.622	0.775	0.729

Note: * p<0.05; ** p<0.01; *** p<0.001

‡ **CA** -food products, drinks and tobacco; **CB** - textiles, clothing, leather goods and accessories; **CC** - wood and products of wood; paper and products of print; **CD** - oil and petroleum products; **CE** - chemical products and substances; **CF** - pharmaceutical, chemical, medical and botanical products; **CG** - products of rubber/plastic/minerals; **CH** - metals/metal products, excluding machines and equipment; **CI** - computer, electronic and optical devices; **CJ** - electrical devices; **CK** - machines and equipment; **CL** - transport means; **CM** - products of other manufacturing activities.

Source: own calculation

Table A7. Estimates of the simultaneous equation model, Veneto region, years 2008-2015.

	A			B			C			E		
VARIABLES	**Export**	**Import**	**Immigration**	**Export**	**Import**	**Immigration**	**Export**	**Import**	**Immigration**	**Export**	**Import**	**Immigration**
$Immigrants_{ijt-1}$	-0.074	0.676***		0.329***	0.166		0.086**	0.569***		0.915***	0.095	
$Immigrants_{ijt-1}^2$	0.008	-0.041***		-0.020***	-0.006		-0.006	-0.030***		-0.058***	-0.006	
$Importa_{t-1}$	0.407***		0.071***	0.476***		0.041***	0.272***		0.113***	0.392***		0.039***
$Export_{ijt-1}$		0.562***	0.051***		0.651***	0.094***		1.595***	0.182***		0.263***	0.125***
$Distance_{ij}$	-1.748***	0.690***	0.139	-0.773***	-0.026	0.072	-0.146***	0.034	0.108	0.746***	-2.334***	0.130
$VAadded_{it-2}$	1.328***	1.606***		1.702***	0.389**		0.697***	0.642***		0.768***	0.811***	
$GDPpc\_pp_j$	1.563***	0.485***	-0.550***	0.713***	0.799***	-0.518***	1.096***	-0.147	-0.969***	-0.174	1.376***	-0.416***
$Border_j$			1.458***			1.167***			1.350***			1.484***
var(e.ln_exp_s)	20.343***			15.145***			3.334***			18.400***		
var(e.ln_imp_s)		32.657***			21.126***			20.076***			15.327***	
var(e.immigr)			5.831***			5.835***			5.364***			5.767***
cov(e.ln_imp_s, e.ln_exp_s)	-9.978***			-5.794***			-4.391***			-4.134***		
Constant	-10.557***	-22.016***	4.175***	-14.752***	-10.082***	4.749***	-3.078***	-18.758***	4.758***	-11.293***	1.004	3.296***
Observations	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009

	J			M			R			V			Total		
VARIABLES	**Export**	**Import**	**Immigration**	**Export**	**Import**	**Immigration**	**Export**	**Import**	**Immigration**	**Export**	**Import**	**Immigration**	**Export**	**Import**	**Immigration**
$Immigrants_{ijt-1}$	0.053	0.368***		0.014	-0.001		-0.245***	0.297***		0.259***	0.269***		0.092**	0.489***	
$Immigrants_{ijt-1}^2$	0.009	-0.027***		-0.001	0.000		0.014**	-0.018***		-0.021***	-0.010		-0.006*	-0.026***	
$Importa_{t-1}$	0.545***		0.075***	-0.065		0.030	0.592***		0.119***	0.078***		0.102***	0.288***		0.109***
$Export_{ijt-1}$		0.301***	0.091***		0.007	0.107**		0.449***	-0.031		0.099***	0.062***		1.582***	0.187***
$Distance_{ij}$	-0.609***	0.104	0.092	-0.068**	0.007	-0.066	-0.459***	0.367***	-0.088	0.655***	0.001	-0.048	-0.128***	0.027	0.109
$VAadded_{it-2}$	1.261***	0.292**		0.119***	0.029		0.539***	0.166*		1.380***	0.902***		0.686***	0.469***	
$GDPpc\_pp_j$	1.776***	0.704***	-0.665***	0.121***	0.042***	-0.316***	0.784***	0.574***	-0.404***	0.378***	1.519***	-0.467***	1.079***	-0.235*	-0.954***
$Border_j$			1.538***			1.244***			1.316***			1.339***			1.350***
var(e.ln_exp_s)	16.483***			1.173***			8.278***			11.941***			3.052***		
var(e.ln_imp_s)		9.587***			0.222***			6.647***			13.135***			17.350***	
var(e.immigr)			5.847***			6.136***			6.053***			5.953***			5.416***
cov(e.ln_imp_s, e.ln_exp_s)	-1.501***			0.024**			-0.903***			0.282			-3.681***		
Constant	-19.269***	-10.080***	5.733***	-1.594***	-0.711***	4.464***	-7.339***	-9.732***	5.398***	-19.644***	-20.784***	5.243***	-3.316***	-15.450***	4.496***
Observations	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009

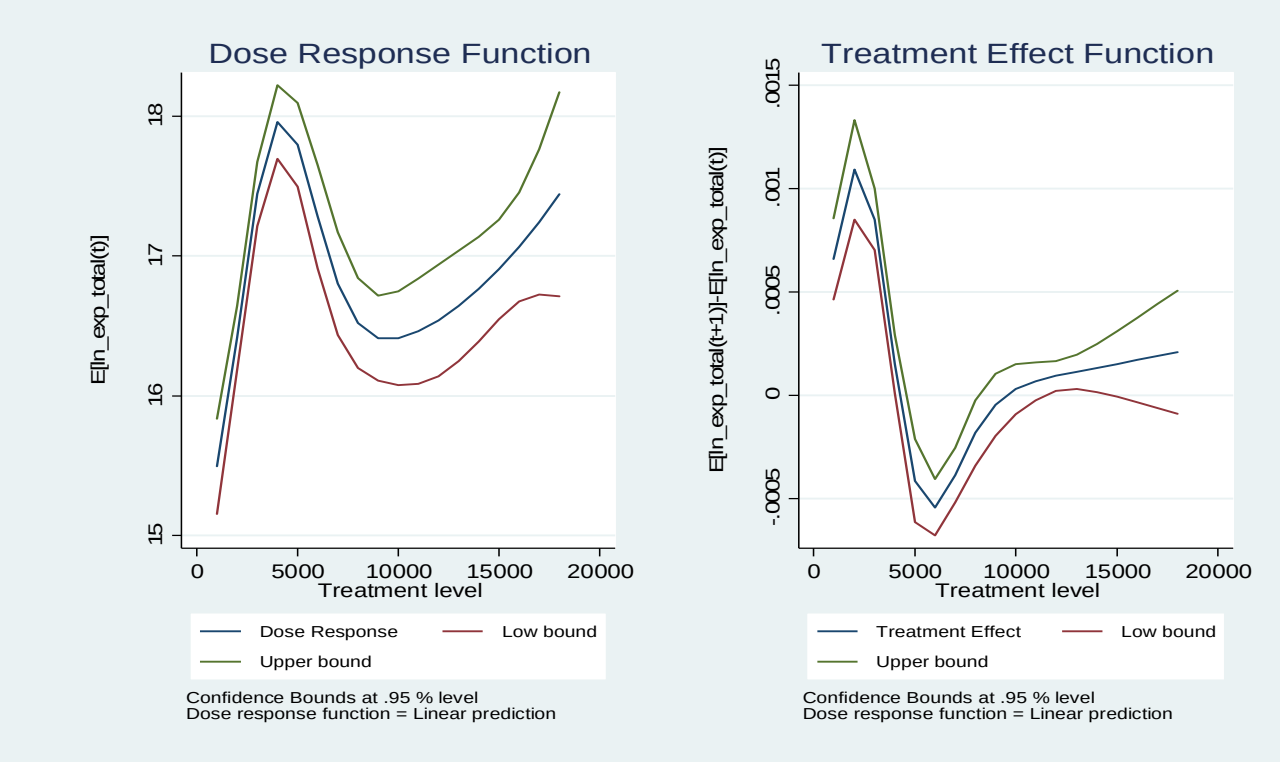
Note: * p<0.05; ** p<0.01; *** p<0.001

† **A**-agriculture, forestry and fishing; **B**-mining; **C**-manufacturing; **E**-water supply and wastes management; **J**-information and communication; **M**-professional, scientific and technical activities; **R**-arts, sports and entertainment; **V**-other goods.

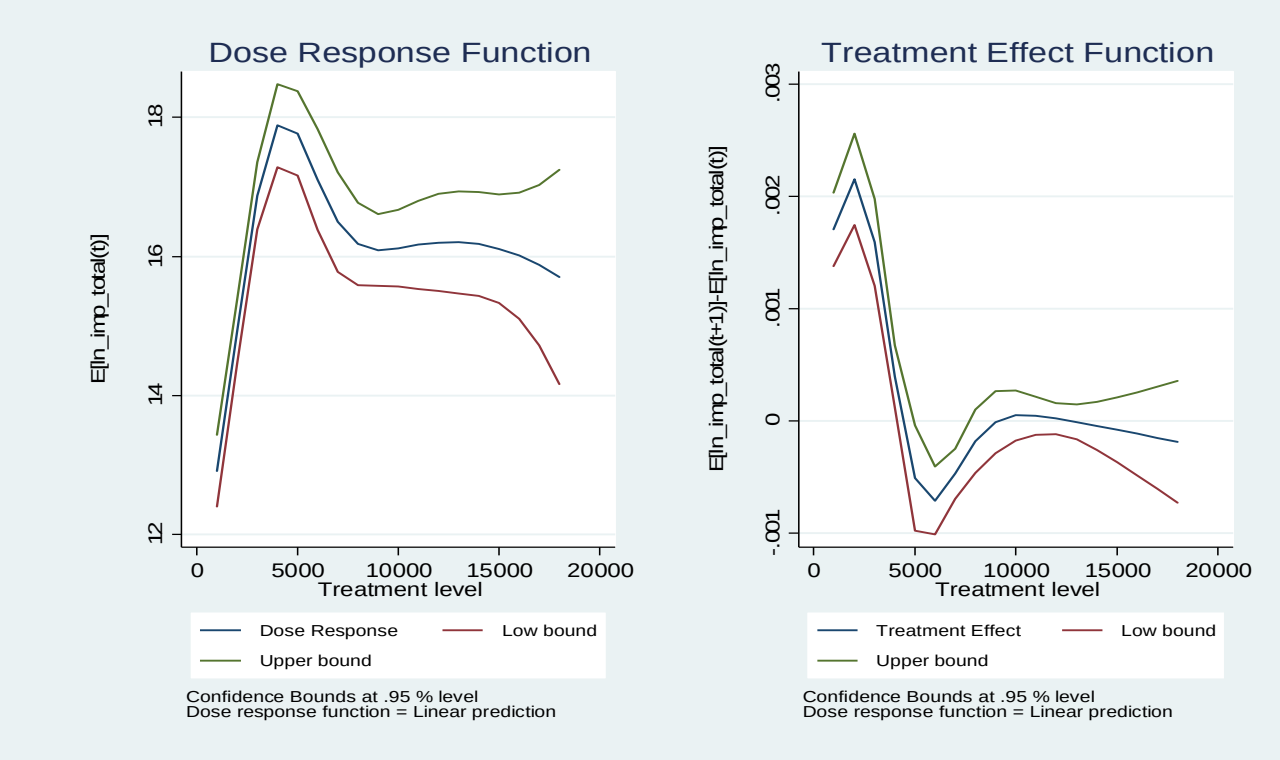
Source: own calculation

Figure A1: The estimates of the dose-response function for total exports and total imports

A1.1. Total exports



A1.2. Total imports

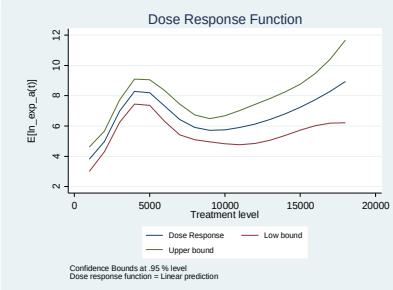


Source: own calculation

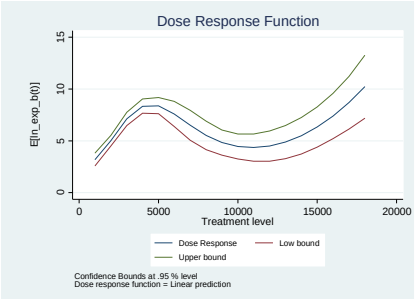
Figure A2: The estimates of the dose-response function for exports and imports by sector

A2.1. Exports

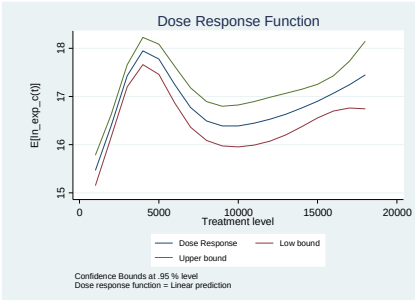
A: agriculture, forestry and fishing



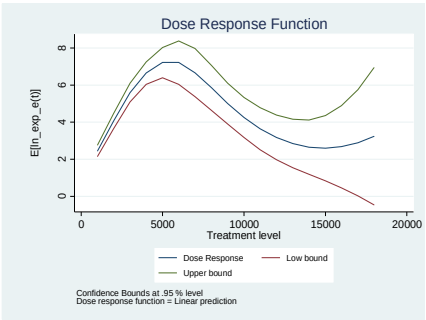
B: mining



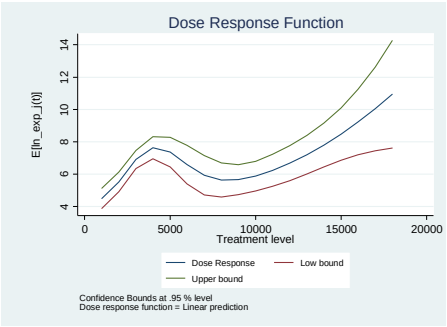
C: manufacturing



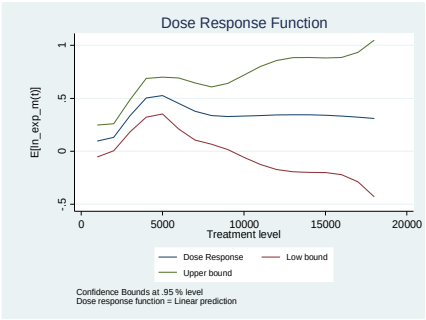
E: water supply and wastes management



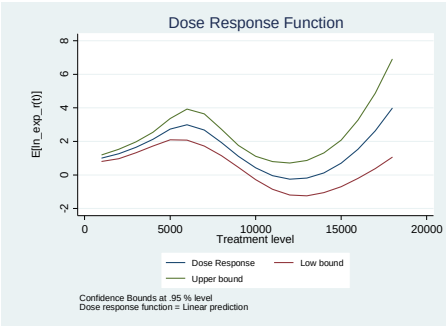
J: information and communication



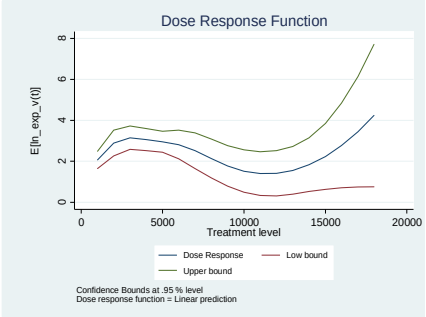
M: professional, scientific and technical activities



R: arts, sports and entertainment

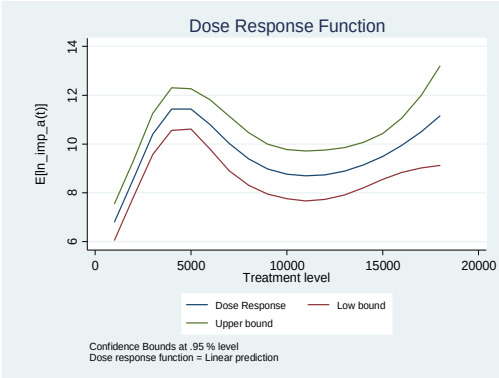


V: other goods

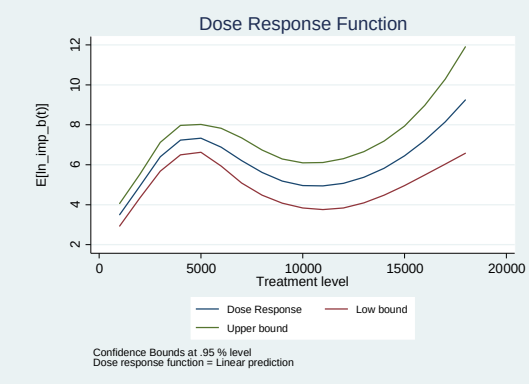


A2.2. Imports

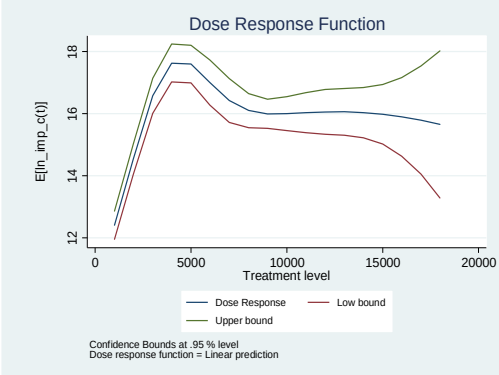
A: agriculture, forestry and fishing



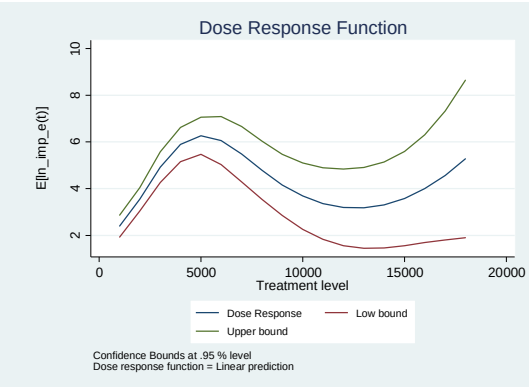
B: mining



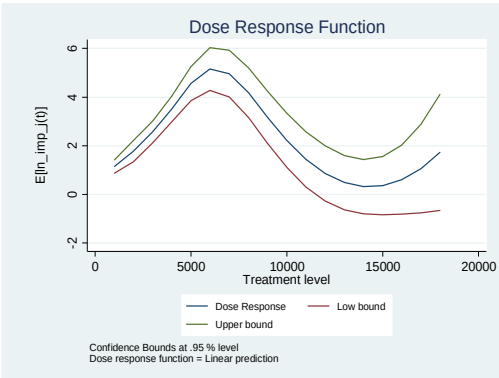
C: manufacturing



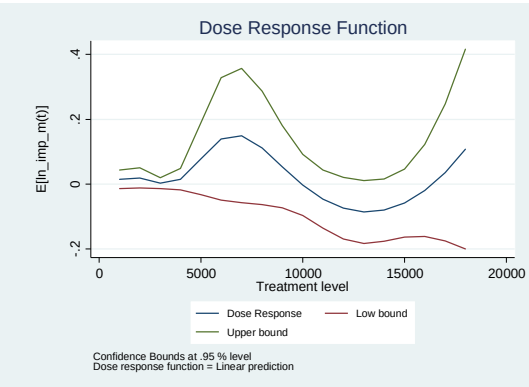
E: water supply and wastes management



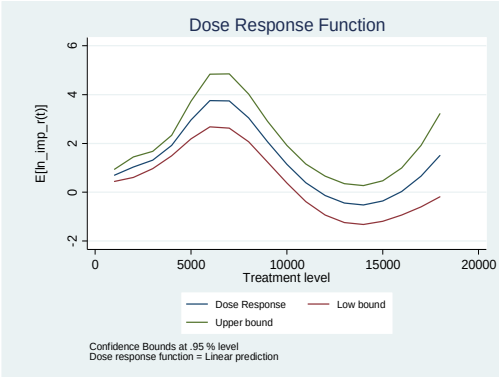
J: information and communication



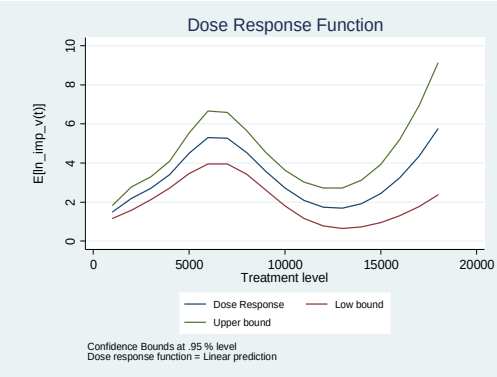
M: professional, scientific and technical activities



R: arts, sports and entertainment



V: other goods

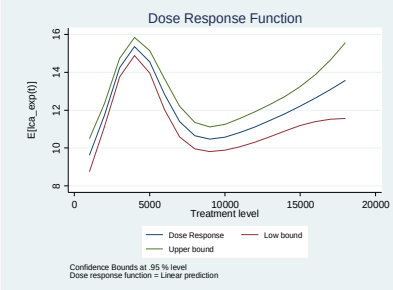


Source: own calculation

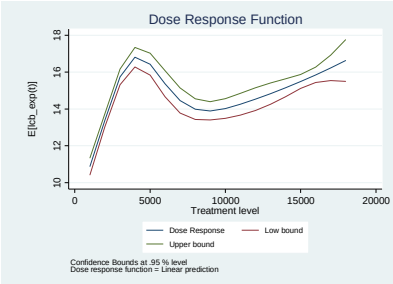
Figure A3: The estimates of the dose-response function for exports and imports by subsectors of manufacturing

A3.1. Exports

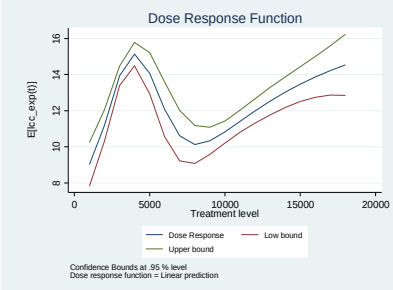
CA: food, drinks, tobacco



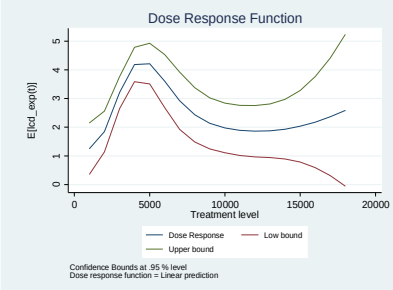
CB: textiles, clothing



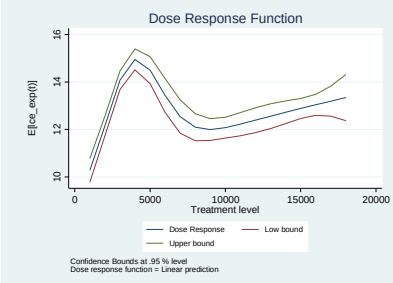
CC: Wood, paper products



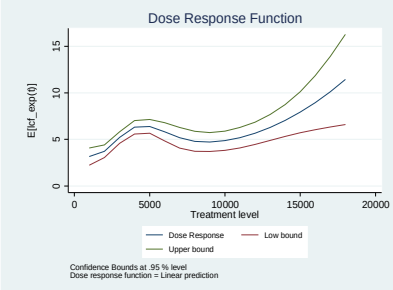
CD: oil and petroleum products



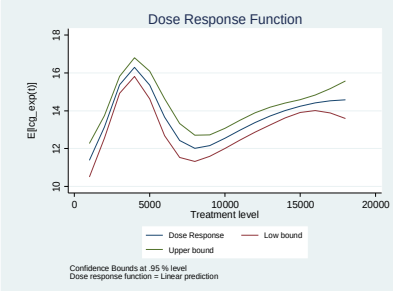
CE: chemical products and substances



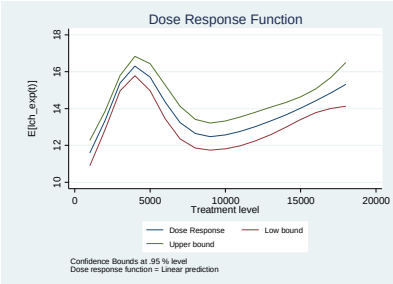
CF: pharmaceutical/chemical products



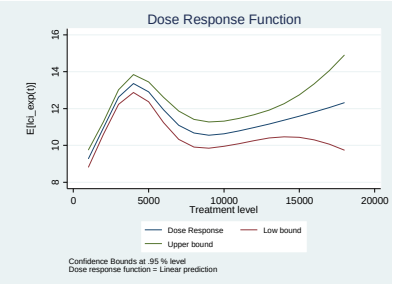
CG: products of rubber/plastic



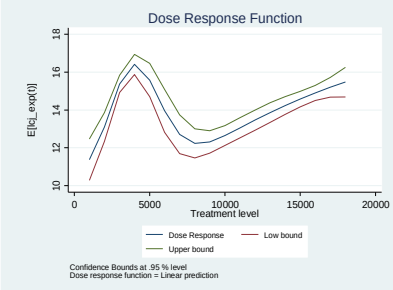
CH: metals/metal products



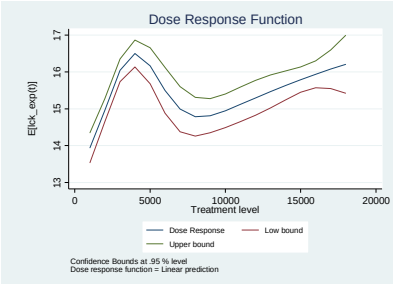
CI: computer, electronic/optical devices



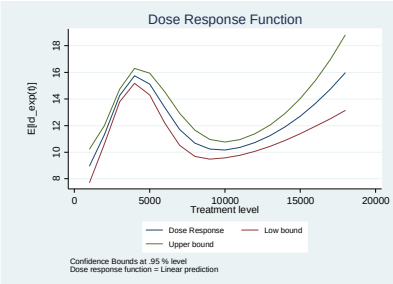
CJ: electrical devices



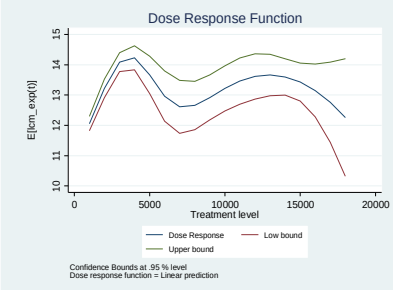
CK: machines and equipment



CL: transport means

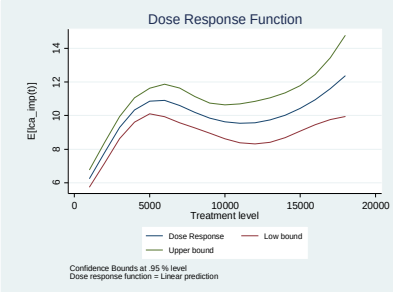


CM: products of other manufacturing activities

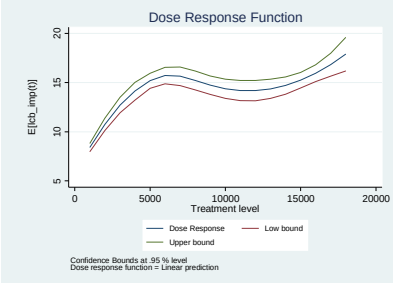


A3.2. Imports

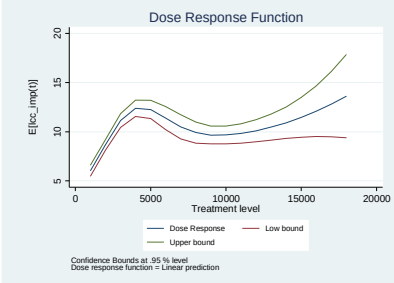
CA: food, drinks, tobacco



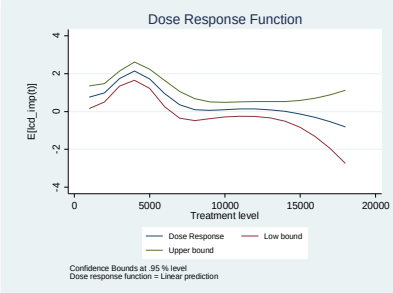
CB: textiles, clothing



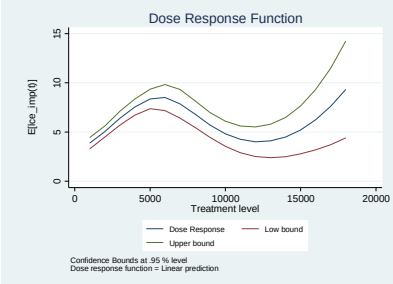
CC: wood, paper products



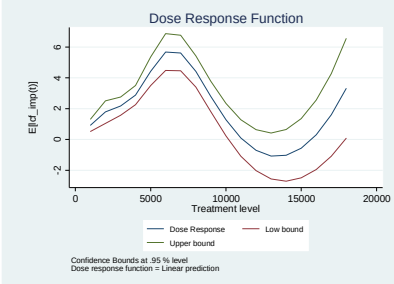
CD: oil and petroleum products



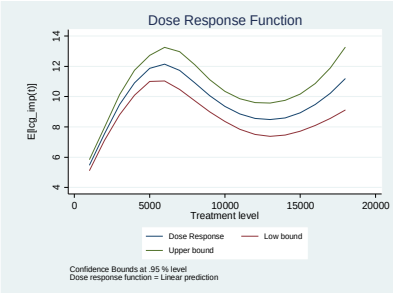
CE: chemical products and substances



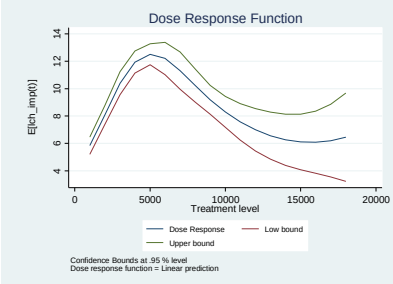
CF: pharmaceutical/chemical products



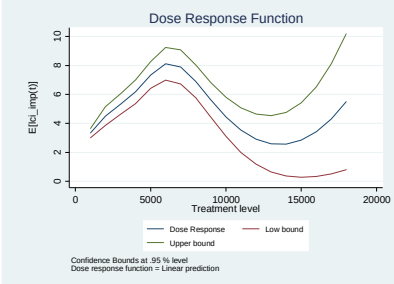
CG: products of rubber/plastic



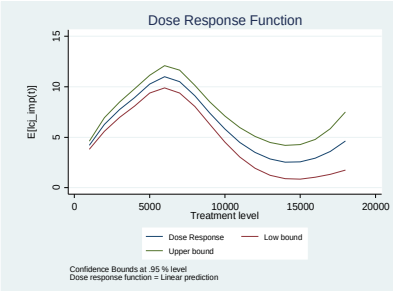
CH: metals/metal products



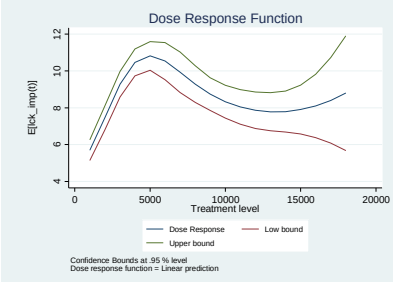
CI: computer, electronic/optical devices



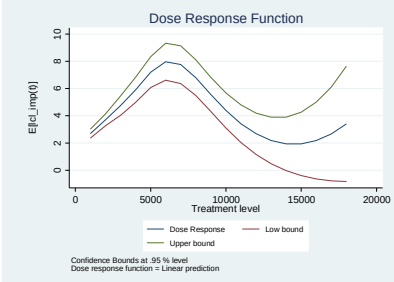
CJ: electrical devices



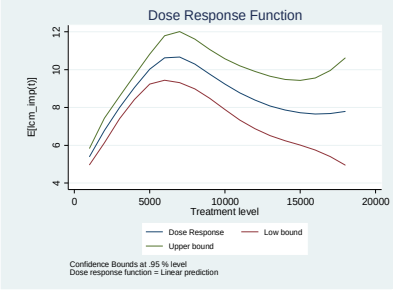
CK: machines and equipment



CL: transport means



CM: products of other manufacturing activities



Source: own calculation

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