The Italian coffee import: a gravity model analysis

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Abstract

After the US and Germany, Italy is the third world's largest importer of green coffee, above all from Brazil, Vietnam and India, being also the second roasted coffee producer, exporter and consumer in EU, after Germany. Given the importance of coffee import in Italy, this paper applies the gravity model to investigate the influence of the main variables affecting the Italian coffee import. In particular, the aim of this paper is to identify the most influent factors determining the level of import flows between Italy and its 11 main coffee export partners. Our results show that the exporters' GDP, their coffee production, the distance between the Italian capital town and those of the other partners, and finally the continental territorial boundary affect the Italian coffee import, as well as the tradition to drink coffee and the consumers' demand for quality.

Key words
Italian Coffee Import, Gravity Model, Panel Data.

Introduction

Coffee is one of the most important commodities and widely consumed beverages all around the world. It is one of the most valuable primary products in world trade, in many years second in value only to oil as a source of foreign exchange for producing countries(Lewinet al., 2004; Catturaniet al., 2008).Coffee has the largest sales volume and the longest history among fair trade products (Cerjaket al., 2015).Coffee is also crucial to the economies and policies, accounting for more than 50% of world's least developed countries exports (ICO, 2015). In 2014, the global production has been about 9 billion tons. The two most important species of coffee are Arabica coffee, which accounts for about 55% of world production, and Robusta coffee (USDA, 2014).
After the USand Germany, Italy is the third world's largest importer of green coffee, above all from Brazil, Vietnam and India, being alsothe second roasted coffee producer, exporter and consumer in EU, after Germany (Coffitalia, 2014;ECF, 2014b; Eurostat, 2015).

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Given the importance of the import in the Italian coffee market, this paper applies the gravity model to investigate the influence of the main variablesaffecting the Italian coffee import. In particular,the aim of this paper isto identify the most influent factors determining the level of import flowsbetween Italy and its 11 main coffee exporters.

An overview of the Italian coffee market

Nowadays, more than 50 countries around the world produce coffee, especially in South America, Africa and Southeast Asia. In 2014, coffee global production has been about 9 billion tons, covering up to 10.5 million hectares all over the world (Panhuysen and Pierrot, 2014). Four countries produced up to 66% of the global coffee: Brazil (35%), Vietnam (15%), Indonesia (9%) and Colombia (7%) (USDA, 2014).
In 2013, EU has been by far the largest importer of green coffee with 3 billion tons, part of which has been re-exported either as green or roasted coffee. Among the EU Member States, in Italy coffee sector is one of the most dynamic in the food and beverage industry, representing 70% of total consumed hot drinks (USDA, 2014).In the same year, Italy imported about 505 million tons of green coffee[1](Coffitalia, 2014) mainly from Brazil (30%), Vietnam (21%) and India (13%), being the second in EU after Germany (ECF, 2014b). Italy represents also the second European country in terms of exports. According to Coffitalia (2014), more than over 70% of the coffee imported by Italy is then re-exported, especially to France, Germany and Austria, in the form of roasted coffee[2] (about 179 million tons).
In addition, Italians have been one of the largest coffee consumers all around EU after Germany in 2013 (ECF, 2014a). The Italian coffee consumption has gone up from 279 thousand tons in 1995 to about 339 thousand tons in 2013 (+22%) (ICO, 2015).

Methodology

The gravity model derives from Newton's gravity law, which says that two bodies are attracted 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. In the international trade analysis, the theory around the gravity model follows the same logic, in which the attraction force is represented by trade flows, import or export, and the masses are represented by gross domestic production (GDP), population or territorial extension (Linnemann, 1966). However, to analyze the international trade by means of gravity model it is necessary to insert more variables beyond the original ones like territorial boundaries, common languages, exchange rates, common participation in trade agreements, and others (Cochrane, 1975; Anderson, 1979; Frankel, 1997).

[1]Decaffeinated and not decaffeinated coffee.
[2]Processing green coffee, roasted coffee gets a weight loss of 20% (Roasted coffee = 80% green coffee).

In order to analyze the Italian coffee import, we used a gravity model in panel data designed to cover imports between Italy and his major 11 trading coffee exporters (Brazil, Cameroon, Colombia, Ethiopia, Guatemala, Honduras, India, Indonesia, Tanzania, Uganda and Vietnam)[3] during a period of 19 years, from 1995 to 2013.
Gravity model has been intensively used in literature to investigate both bilateral and multilateral trade (Martinez-Zarzoso and Nowak-Lehmann, 2003;Thai, 2006; Fincoet al., 2009; Almeida et al., 2012; Ademe and Yismaw, 2013;Shinyekwa and Othieno, 2013).
In order to choose the more efficient method for interpreting the results, among pooled estimation, random or fixed effect, gravity model has been estimated by all three statistical tests: Chow test (1975), L.M. Breusch-Pagan test (1979) and Hausman test (1983).Moreover, the Wooldridge test has been appliedin order to check the first order autocorrelation. All the estimates have been performedusing STATA12.
The estimated gravity model has the following form:

$$IMP_i = \alpha_0 GDPit\_pc_i^{\alpha_1} GDPc\_pc_j^{\alpha_2} PROD_j^{\alpha_3} CONS\_pc_i^{\alpha_4} DIST2_{ij}^{\alpha_5} e^{\alpha_6 ADJ_{ij} + \alpha_7 HARB_j + u_{ij}} \quad (1)$$

The above equation can be reformulated after having logarithmic application as:

$$IMP_i = \alpha_0 + \alpha_1 GDPit\_pc_i + \alpha_2 GDPc\_pc_j + \alpha_3 PROD_j + \alpha_4 CONS\_pc_i + \alpha_5 DIST_{ij} + \alpha_6 ADJ_{ij} + \alpha_7 HARB_j + u_{ij} \quad (2)$$

where:
i = Italy;
j = Brazil, Cameroon, Colombia, Ethiopia, Guatemala, Honduras, India, Indonesia, Tanzania, Uganda and Vietnam;
α_0= intercept;
α_k= slope;
IMP_i= Italian coffee import (not roasted not decaffeinated coffee, not roasted decaffeinated coffee and roasted coffee);
$GDPit\_pc_i$=Gross Domestic Production (GDP) per capita for Italy;
$GDPc\_pc_j$= Gross Domestic Production (GDP) per capita for all cited countries;
$PROD_j$= coffee production in the cited exporter countries;
$CONS\_pc_i$= coffee consumption in Italy per capita;
$DIST_{ij}$= distance-squared between the Italian capital town and those of the partners;
ADJ_{ij} = dummy representing continental territorial boundary and indicates whether the exporting country is adjacent with the European continent (adjacency);
$HARB_j$= dummy representing the presence of the harbor in the cited exporter countries;
u_{ij}= error term.

[3] In this paper we analyzed only the major countries that export to Italy because the countries where Italy exports and the countries from where Italy imports are not the same and. So in this case, the gravity model (in panel data) doesn't analyze both together.

Data related to Gross Domestic Production (GDP) for all cited countries derived from United Nations Statistics Division (UNSD, 2015) whileItalian coffee imports have been obtained from Eurostat (2015). The exporter countries' coffee production has been collected from Faostat (2015); Italian coffee consumption has been taken from International Coffee Organization (ICO, 2015). Finally, the distance-squared between the Italian capital town and those of the exporterpartners come from the Centre d'ÉtudesProspectivesetd'InformationsInternationales (CEPII, 2015).

Results

Performing all three tests as above mentioned (α = 0.05), we found that the best equation estimation method is random effect[4].Table 1 shows the estimation results of multilateral trade between Italy and its main coffee import partners using equation (2).
The χ^2 value shows that the model is significant or the variation in the dependent variable can beexplained by the variables considered as an explanatory, being the coefficients in the model different from 0.The determinant variables considered for the Italian coffee import explain 76% of the variation in the model, being the variation among the years explained up to 48% and the considered countries up to 83%.The model results show that four of the total variables (seven) are significant at 5% level of significance(GDPc_pc, PROD, DIST, ADJ) and one at 10% (CONS_pc).

Table 1. Gravity model results

DEPENDENT VARIABLE = IMP	COEFFICIENT	STAND. ERR.	Z	P>|Z|
GDPIT_PC	0.3882	1.0341	0.38	0.707
GDPC_PC	0.8427	0.1984	4.25	0.000*
PROD	0.5247	0.0992	5.29	0.000*
CONS_PC	1.5530	0.9082	1.71	0.087**
DIST	-0.8333	0.2732	-3.05	0.002*
ADJ	0.6127	0.1717	3.57	0.000*
HARB	-0.1922	0.2236	-0.86	0.390
CONS	10.8300	7.7129	1.40	0.160
R^2 (OVERALL) = 0.7582	R^2 (within) = 0.4812			R^2 (between) = 0.8294
X^2 (8) = 144.47, PROB>X^2 = 0.0000	n = 209		id = 11	temp = 19

* = 5% ** = 10%

Source: own elaboration, 2015

The Italian GDP per capitarepresents population's purchasing power, i.e. the Italian richness magnitude, but this variable is not significant for the coffee imports. One of the possible reasons is that in Italy drinking coffee is a tradition, although the economic possibilities of people.In addition, coffee is not one of the main imported products in Italy, being the 0.08% of Italian GDP in 2013 (Eurostat, 2015; UNSD, 2015). On the other hand, import partners' GDP per capita, representing the productive capacity of each country(economic magnitude),

[4]Chow test: F (4,194) = 48.05, Prob> F = 0.0000; L.M. Breusch-Pagan test: chibar^2 (01) = 526.23, Prob> chibar^2 = 0.0000; Hausman test: χ^2 (4) = 0.78, Prob> chi^2 = 0.9405. Autocorrelation Wooldridge test: F (1,10) = 33.707, Prob> F = 0.0002.

boast a positive relation with the Italian coffee import. It is expected that the higher the GDP of the exporter countries, the greater their capacity to supply the importing countries' consumption needs and to diversify the exported products. Moreover, there is a positive relationship between exporter countries' coffee production and the Italian coffee import. Being Italy one of the largest green coffee importers in the world, the exporter countries tend to produce more when the Italian demand increases.
The Italian coffee consumption per capita is significant at 10% but, according to our level of significance (0.05), this variable is not significant. It can be explained by the fact that Italy imports more green coffee than the other kinds, than processes it and finally exports roasted coffee to other countries, especially those belonging to European Union. The distance, the presence of the adjacency and the presence of harbor are all linkedto the transport used for coffee imports. However, the distance and the adjacency are significant but the first of them has a negative relationship with the Italian import. The presence of the harbor is not significant. The abovementioned negative relationship represents asort of resistance to trade because high transport costs limit the import; nevertheless, this relationship does not reflect at all the Italian trend, where the tradition to drink coffee and the consumers' demand for quality coffee are so strong to overwhelm this kind of limit. Finally, the adjacency, as continental territorial boundary, has a positive relationship with the Italian import flows. The significance reflect the relevance of physical borders for the coffee trade. In addition, the quality of infrastructure (road, port, airport and telecommunications) and the cost and quality of related services are another important determinant of trade performance. The infrastructure efficiency could have an impact on trade among all partners. A poor quality of infrastructure is likely to be associated to a higher risk of damaging the cargo and therefore higher losses and insurance costs (Nordås and Piermartini, 2004). Therefore, the quality of infrastructure can also create or reinforce comparative advantage in the international coffee trade.

Conclusion

EU acceded to the International Coffee Agreement in 2007, recognizing the importance of the coffee sector to the economies of many countries and considering the importance of improving relations between coffee exporting and importing countries (ICO, 2007).The agreement aims to enhance and to promote the sustainable development of the worldwide coffee sector. As the other Member States, Italy fulfils to this agreement, being also one of the largest green coffee importers in the world.
Italian coffee import is continually increasing, so that in 2013 the Italian imports increased by 64% respect to 1995. Nowadays Brazil is the most important player in the Italian coffee import (30%), followed by Vietnam (21%) and India (13%). Coffee import can be affected by many variables, such as GDP, production, consumption, distance among countries, territorial boundary and the presence of harbor and many others. This paper applied the gravity model in panel data with random effect to investigate the influence of the main variables affecting the Italian coffee import, covering the period of 19 years from 1995 to

2013. In particular, the aim of this work is to identify the most influent factors determining the level of import flows between Italy and its 11 main coffee exporters.
The investigated variables explain up to 76% of the variation in the model. The model results show that the exporters' GDP (GDPc_pc), their coffee production (PROD), the distance between the Italian capital town and those of the other partners (DIST), and finally the continental territorial boundary (ADJ) mostly affect the Italian coffee import.
However, the macroeconomic variables considered in this paper mostly explain the determinants of Italian coffee import. However, some other factors can influence it, such as the coffee tradition and the consumers' demand for quality coffee. Coffee is a part of Italian culture, indeed, and this engenders a interesting field for consumers' behaviour investigation (Giampietri et al., 2015).
In addition, given than over 70% of the coffee imported by Italy is then processed and re-exported, it would be interesting in future studies to include this variable. We believe this further analysis will certainly contribute to a better understanding of international coffee trade.
To conclude, we would like to emphasize our results, suggesting some evidence on the international trade between Italy and each exporter country. In this context, Italy should improve the existing bilateral and multilateral agreements mainly improving the quality standard required from the consumers, implementing more efficient certification and labeling systems that seek to enhance environmental and social sustainability (Raynoldset al., 2007; Marie-Vivienet al., 2014) and to ensurethe exact origin of the product, and limiting trade tariff-related and regulatory barriers.

References

Ademe, A.S., Yismaw, M.A. (2013). Ethiopian Coffee Trade Pattern: an Augmented Gravity Modeling. *Journal of Economics and Sustainable Development*,4 (17), 110-121.
Almeida, F.M., Gomes, M.F.M., Silva, O.M. (2012). Non-tariff measures in international coffee trade. *Selected Poster prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference. Foz do Iguaçu, Brazil, 18-24 August 2012, n. 126538.* https://ideas.repec.org/p/ags/iaae12/126538.html.
Anderson, J.E. (1979). A theoretical foundation for the gravity equation. *The American Economic Review*, 69, 106-116.
Breusch, T.S., Pagan, A.R. (1979). A simple test for Heteroscedasticity and random coefficient variation. *Econometrica*, 47 (5), 1287-1294.
Catturani, I., Nocella, G., Romano, D., Stefani, G. (2008). Segmenting the Italian coffee market: marketing opportunities for economic agents working along the international coffee chain. *Paper presented at the 12th Congress of the European Association of Agricultural Economists*. Ghent, Belgium, 26-29 August 2008, n. 44146. http://ageconsearch.umn.edu/handle/44146.
Centre d'ÉtudesProspectivesetd'InformationsInternationales - CEPII (2015). *CEPII distances and geographical database*. http//www.cepii.fr/anglaisgraph/bdd/distances.htm.

Cerjak, M., Naglić, T., Mesić, Z., Tomić, M. (2015). Croatian consumers' knowledge and attitudes towards Fair Trade. *Paper prepared for presentation at the EAAE-AAEA Joint Seminar "Consumer Behavior in a Changing World: Food, Culture, Society"*. Naples, Italy, 25-27 March 2015.http://econpapers.repec.org/paper/agseaa143/202756.htm

Chow, G.C. (1975). *Analysis and control of dynamic economic systems*. John Wiley, New York. Cochrane, R.A. (1975). A Possible Economic Basis for the Gravity Model. *Journal of Transport Economics and Policy*, 9 (1), 34-49.

Coffitalia. (2014). *Annuario 2014/2015 Directory.*Beverfood.com Edizioni Srl, Milano. http://www.beverfood.com/downloads/annuario-coffitalia-caffe-italia/.

European Coffee Federation – ECF (2014a). *Coffee Market Overview August 2014* (Issue Nr 11). http://www.rucquoy.com/sites/default/files/Coffee_market_overview_August_2014.pdf.

European Coffee Federation – ECF (2014b). *European Coffee Report 2013/14*: *European chapter and key national data.* http://www.stc-coffee.com/wp-content/uploads/2014/08/European_Coffee_Report_2013-14_European_chapter.pdf.

Eurostat (2015). *Data Explorer - Europa*. http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do.

Faostat (2015). *Coffee production*. http://faostat3.fao.org/download/Q/QC/E.

Finco, A., Padella, M., Di Pronio, G., Pollonara, M. (2009). Dinamiche del commercio internazionale dell'olio di oliva italiano: un'analisi prospettica. *Economia Agro-alimentare*, (2), 169-185.

Frankel, J.A. (1997). *Regional trading blocs in the world economic system*. Institute for International Economics, Washington.

Giampietri, E., Finco, A., Del Giudice, T. (2015), Exploring consumers' attitude towards purchasing in short food supply chains, *Quality - Access to Success*, Vol. 16, No. 1, pp. 135-141.

Hausman, J.A. (1983). Specification and estimation of simultaneous equation models. In: Z. Griliches& M D. Intriligator (Ed.), *Handbook of Econometrics*, Vol. 1 (pp. 391-448). North-Holland Publishing Company, Amsterdam.

International Coffee Organization - ICO (2007). *International Coffee Agreement 2007*. http://dev.ico.org/documents/ica2007e.pdf International Coffee Organization - ICO (2015). *Coffee consumption*. http://www.ico.org/new_historical.asp?section=Statistics

Lewin, B., Giovannucci, D., Varangis, P. (2004). *Coffee Markets. New Paradigms in Global Supply and Demand.* The World Bank, Washington DC.

Linnemann, H. (1966). *An econometric study of international trade flows*. North-Holland Publishing Company, Amsterdam.

Marie-Vivien, D., Garcia, C.A., Kushalappa, C.G., Vaast, P. (2014). Trademarks, Geographical Indications and Environmental Labeling to Promote Biodiversity: The Case of Agroforestry Coffee in India. *Development Policy Review*, 32 (4), 379-398.

Martinez-Zarzoso, I., Nowak-Lehmann, F. (2003). Augmented gravity model: an empirical application to Mercosur-European Union trade flows. *Journal of Applied Economics*, 6 (2), 291-316. http://ageconsearch.umn.edu/bitstream/43996/2/martinez.pdf.

Nordås, H.K., Piermartini, R. (2004). *Infrastructure and Trade. WTO Staff Working Paper N. ERSD-2004-04.*https://www.wto.org/english/res_e/reser_e/ersd200404_e.htm.

Panhuysen, S. Pierrot, J. (2014). *Coffee Barometer 2014*. https://hivos.org/sites/default/files/coffee_barometer_2014_report_1.pdf.

Raynolds, L.T., Murray, D., Heller, A. (2007). Regulating sustainability in the coffee sector: A comparative analysis of third-party environmental and social certification initiatives. *Agriculture and Human Values*, 24 (2), 147-163.

Shinyekwa, I., Othieno, L. (2013). *Comparing the Performance of Uganda's Intra East African Community Trade and Other Trading Blocs: A Gravity Model Analysis*. *Economic Policy Research Centre (EPRC), Research Series n. 100,* Kampala.

Thai, T.D. (2006). *A gravity model for trade between Vietnam and twenty-three European countries*. Department of Economics and Society - Dalarna University, Sweden. http://www.diva-portal.org/smash/get/diva2:518029/FULLTEXT01.pdf.

United Nations Statistics Division - UNSD (2015). *National accounts main aggregates database*. http://unstats.un.org/unsd/snaama/selbasicFast.asp.

United States Department of Agriculture - USDA (2014). *Coffee: World Markets and Trade.* Foreign Agricultural Service/USDA Office of Global Analysis. https://apps.fas.usda.gov/psdonline/circulars/coffee.pdf.