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# Drivers of the International Pear Market: A Panel data Approach

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***Abstract***

*This paper aims to analyse pear consumption in the main client countries of the major global exporting countries. Among the factors considered to explain the pear consumption we find the price of the pear and of substitute or complementary goods, including apples and stone fruit, the consumption per capita of these goods, the real income of consumers, the general price index of the goods, the technology and the USD real exchange rate against the currencies of each of the countries considered. It has been used the panel data methodology with a sample made up of statistical data on the 17 main players in the global market from 1990 to 2012. Findings show that the results – the coefficients and their signs - are in line with the economic theory.*

***Key words:*** pear, international market, panel data, substitution, complementary preference**.**

## 1. Introduction

International trade of pears is highly focused both as exporting and importing countries. Taking data from COMTRADE in 2014 as a reference (last consolidated data), 92% of world exports was concentrated in ten countries (Argentina, the Netherlands, China Belgium, Italy, United States of America, South Africa, Spain and Portugal).

Furthermore, these countries have very specific markets. The Netherlands, Belgium, Italy and Spain export to the European continent and Russia. In turn, Brazil is the main importing country of pears from Portugal. However, it must be taken into account that the Netherlands and Belgium re-export to other markets (Mellens et al, 2007).

In the case of China, it is observed that its market is shaped by Asian countries, although its exports to Russia have increased in the last few years, taking advantage of the Russian veto in the European Union. Hong Kong is also a re-exporting market in the same way as the countries described previously in the European bloc.

In the American bloc, Argentina holds the first place both in that market and at world level. Its main clients are Brazil, United States and Canada.

***Tab. 1.*** *- Main exporting and customer countries of pears, 2014 (%)*

| Customer Countries | | Main Exporting Countries | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Argentina | Netherlands | China | Belgium | Italy | USA | South Africa | Chile | Spain | Portugal |
| European Bloc | Italia | 8,71 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 20 | 0 |
| | Nether | 4,36 | 0 | 0 | 9,6 | 0 | 0 | 29 | 40 | 0 | 0 |
| | Germany | 2,8 | 22,67 | 0 | 0 | 32 | 0 | 5 | 0 | 15 | 0 |
| | France | 3,4 | 10,26 | 0 | 11,5 | 10 | 0 | 0 | 0 | 12 | 18 |
| | Spain | 1,2 | 2 | 0 | 5,2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | U.K. | 0 | 13,85 | 0 | 6,7 | 0 | 0 | 12 | 0 | 0 | 16 |
| | Belgium | 0 | 9,2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Sweden | 0 | 5,5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Denmar | 0 | 4,7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Russia | 20,58 | 8,24 | 7,49 | 27 | 0 | 15 | 18 | 0 | 8 | 0 |
| American Bloc | Brasil | 35,5 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 12 | 42 |
| | USA | 10,93 | 0 | 4,37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Canada | 2,6 | 0 | 4,05 | 0 | 0 | 26 | 0 | 0 | 0 | 0 |
| | Mexico | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 |
| Asian Bloc | Indonesia | 0 | 0 | 23,2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Vietnam | 0 | 0 | 11,2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Malasia | 0 | 0 | 11,7 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| | Singapore | 0 | 0 | 5,2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Saudi Arabia | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 |

*Source. U.N. Comtrade. 2014.*

Generally, exporting countries have their markets in neighboring territories through trade agreements or historic relationships. Table 1 shows links between the USA with Mexico and Canada, the EU countries such as the Netherlands, Spain, Italy and Portugal, China with Indonesia, Vietnam with Malaysia, Argentina with Brazil, Belgium with Russia, Italy with Germany, Portugal with Brazil and South Africa with the Netherlands (De Pablo Valenciano et al, 2017).

It is worth highlighting the growth rate and economic size of some importing markets in the last decade. Brazil is a very attractive market for EU countries (Portugal and Spain) and for the American continent (Argentina and USA). Russia is a strong market where nearby countries, such as Belgium and the Netherlands, and far away countries, including Argentina and South Africa, compete among them to conquer it (De Pablo & Giacinti Battistuzzi, 2014).

Having identified the major client countries of the main exporters of pears, the objective of this paper is to analyse their consumption of pears by using data panel model according to the following variables: the own pear price, the price and consumptions of other competitive fruits (e.g., apple and stone fruits such as peach and nectarine), the general price index, consumer income, real exchange rate of the USA$ against the different currencies of competing stakeholders and technology, factors that

have important impacts on consumption per capita in the main pear consumer countries.

## 2. Methodology and data

The pear fruit has been studied from a wide variety of angles. Cardamone (2011) analysed the trade agreements in the EU; Goetz & Grethe (2009, 2010) the relation of destination/entry prices for Chinese exports to USA and EU markets; Musunuru (2009), Arnade & Pick (1998) and Tiffin & Aguiar (1995) the export potential of a chosen set of fresh fruits from USA; On his turn Wann & Sexton (1992) and Arnade & Pick (2000) compared the oligopolistic system in the pear markets; Gamble et al. (2006) made a first research on consumer preferences in pear flavour, specifically focusing on the importance of its appearance for buying the good, R.K. Gallardo (2011) determined consumer preferences taking into account pear varieties (Williams and Anjou), Reid & Buisson (2001) focused on appraising the response to new pear and apple varieties in the United Kingdom, Drogue & De María (2012) examined food quality and safety. Gallardo et al. (2011) focused on the quality and price of pears sold at supermarkets in the North East of the Pacific States, Zhang et al. (2010) estimated a model to study the relationship between sensory attributes and the willingness of consumers to pay for Anjou pears and assess the effect of ethylene treatment in determining consumers' preferences and Souza Monteiro & Caswell (2009) analysed the importance of traceability in the pear industry in Portugal.

In some of these papers related to pears and fruits in general, the authors used very different models, including the AIDS-Almost Ideal Demand System (Green et al., 1991; Molina, 1994; Agbola, 2003, 2005; Amaza & Fregene, 2008; Bertail & Caillavet, 2008; Musunuru, 2009, Paudel et al, 2010) and the Rotterdam model (Angulo et al, 2002; Schmitz et al., 2002; Matsuda, 2004, Feleke & Kilmer, 2009; Paudel et al, 2010). The two previous models (AIDS and Rotterdam) have a great inconvenient: they only take into account a sole dimension of the data (either the cross-section or time series).

In order to solve the previous inconvenient, we have considered combining these two dimensions and then adding a new contribution by using panel data models that have become very popular in economy, finances and management.

The methodology used is the panel data analysis –models of random, fixed and pooled effects –estimated with the PLS and PEGLS[1] methods. Diagnostic tests to check if there is a multicollinearity among the explanatory variables, tests to appraise endogeneity among the different markets and others to control the autocorrelation and heteroscedasticity errors' effects are used.

Although we are not aware of any research that uses the panel data methodology applied to the pear market, there are some authors who have used it in their researches in other fields or areas that are, to a certain extent, similar to this one. Also, we can refer to the influence of exchange rate volatility on fruit trade with USA by Sheldon et al. (2013), who used a gravity model to find that US bilateral trade was negatively affected by riskiness in exchange rate; the effect of preferential trade agreements on monthly fruit exports of fresh grapes, pears, apples, oranges and mandarins to the European Union (EU) during the 2001-2004 period using a gravitational model by Cardamone (2011), finding a positive effect of regional trade agreements in exports of all fruits except oranges. This author and Smed (2012) have also studied the effects of the health-related media on organic fruit and vegetable demand through the double hurdle model with panel data, suggesting

[1] POLS-Pooled Ordinary least squares; PEGLS-Panel Estimated General Least Squares.

that information consumers receive directly is the most influential media.

The source of the data is not unique depending on the type of variable. Some of the sources were UN Comtrade databases, FAO of United Nations, U.S. Census Bureau, International Macroeconomic Data Set (USDA), International Monetary Fund and World Bank.

The panel data sample used refers to 17 of the major client countries (France, Germany, United Kingdom, Italy, Spain, Sweden, Denmark, USA, Canada, Mexico, Brazil, Russia, Malaysia, Singapore, Indonesia, Saudi Arabia and Portugal) of the main pear exporting countries (Argentina, Netherlands, China, Belgium, Italy, USA, South Africa, Chile, Spain and Portugal). The time frame was 1990-2012.

The data panel considered is a balanced one, in which each panel has the same number of observations.

The dependent factor is pear consumption per capita, a quantitative and continuous variable, and the independent factors are consumption per capita of apple, general consumer price index, CIF prices of pears and stone fruit (per kilo), consumer real income per capita, the USD exchange rate and technology (proxied by the trend (t=1,2,...). These variables were coded to make it easier to process and/or estimate models and were converted in their natural logarithms a common practice in these studies in order to reduce and stabilize the variance, hence minimizing the heteroscedasticity issue among the errors of the considered models (table 2). Technology has been included as a factor that improves quality of products and decreases perishability of fruits and vegetables (Alandes et al, 2009; Solivia-Fortuny et al, 2001).

***Tab. 2.*** *-Notation of variables.*

| Variable | Meaning |
|---|---|
| Lapppccons | Apple consumption per capita (pc) (ln) |
| Lconsprindex | Consumer price index (ln) |
| Lpearcifkg | CIF price/kg of pear (ln) |
| lrpcincome – | Real income pc (ln) |
| Lstonecifkg | CIF price/kg of stone fruit (ln) |
| Lstonepccons | Fruit stone consumption pc (ln) |
| lusdrexchr | USD real exchange rate (ln) |
| @trend | Proxy for technology (time) |

*Obs: ln and pc indicate natural logarithm and per capita, respectively*.

Before doing the estimation of the models, we used a suitable text to study (Baltagi, 2008) if there were an endogeneity problem among the 17 countries in the

sample and with several tests we analysed the multicollinearity issue among explanatory variables or factors found in the model.

The study considers the three most frequent models that use panel data: the random effects model (RE), the fixed effects model (FE) and the pooled model (PL). The methods used to estimate coefficients or parameters are the PLS (Panel Least Squares) for the PL and RE models and the PEGLS (EGLS, Estimated General Least Squares) Panel for the FE model. Jointly with the RE model we conducted the Hausman test to discover if the factors or variables are correlated with the model's errors or if there is endogeneity. The test uses the t and F statistics and the rejection of this hypothesis refutes endogeneity, which in turn means that the FE model is more suitable for this analysis than the RE one. Likewise, with the fixed effect model we conducted the Likelihood Ratio (LR) test to check whether there are significant statistical differences between countries; rejecting this hypothesis means that there are differences among the countries, or, in other words, there is heterogeneity among consumer countries. We also estimate the dummy coefficients related to each country. In our computations we used the Eviews software (v.9).

## 3. Results and Discussion

Table 3 shows the findings from the three estimates got for the corresponding models. Each one of the models is highly significant taking into account the global F test (Prob=0,0000 in each case). In general, the explanatory factors of world pear demand are significant in statistical terms at the usual significance levels except for stone fruit consumption that is not significant with neither the RE model nor the FE one (it is significant only with the pooled model). The USD real exchange rate against the different currencies of the countries is neither significant in the fixed effect model. The explanatory power of the FE model is 97.5% and the LR test to appreciate the redundant fixed effects lead us to reject the null hypothesis that the fixed effects are the same for all countries this meaning there is heterogeneity among the different markets. Also, the RE model has an explanatory power of 75.4%. In order to check if the endogeneity problem exists in the model, in other words, if there is correlation between the model's explanatory factors and the model's errors, we conducted the Hausman test. As the null hypothesis is not rejected, there is no proof that the model's errors are correlated to the explanatory variables, reason why there is no endogeneity issue. For this reason, the RE model is the most suitable for this study. For the model estimates and the discussion of their statistical significance, we followed Baltagi (2008), among others.

***Tab. 3.*** *-Estimates of the three panel data models*

| **Model** | **PM** | | **RE** | | **FE** | |
|---|---|---|---|---|---|---|
| Method | Panel Least | | Panel | | Panel Least | |
| Sample: | 1990 – 2012 | | 1990 - | | 1990 - 2012 | |
| Periods included: | 23 | | 23 | | 23 | |
| Cross-sections | 17 | | 17 | | 17 | |
| Tot panel balanced obs | 391 | | 391 | | 391 | |
| Dep variable | Lpearpccons | | Lpearpcco | | Lpearpccons | |
| Indep variables | | | | | | |
| - lapppccons | 1.180432 | * | 1.009394 | * | 1.007441 | * |

| | | | | | | |
|---|---|---|---|---|---|---|
| - lconsprindex | 0.081026 | * | 0.030525 | * | 0.030181 | * |
| - lpearcifkg | -0.861183 | * | -0.267220 | * | -0.254417 | * |
| - lrpcincome | -0.202960 | * | -0.226511 | ** | -0.257597 | * |
| - lstonecifkg | 0.847264 | ** | 0.125845 | ** | 0.112078 | * |
| - lstonepccons | -0.043326 | | -0.010764 | ** | -0.009620 | |
| - lusdrexchr | 0.034996 | * | 0.006152 | | -0.010242 | |
| - C | -0.540657 | | 0.558034 | * | 0.932156 | |
| - @trend | 0.015046 | | 0.016414 | | 0.017677 | * |
| **R-squared** | 0.827192 | | 0.753721 | | 0.974505 | |
| Adj R-squared | 0.823573 | | 0.748563 | | 0.972834 | |
| F-statistic | 228.5686 | | 146.1358 | | 582.9139 | |
| Prob(F-statistic) | 0.000000 | | 0.000000 | | 0.000000 | |
| Durbin-Watson stat | 0.341728 | | 1.132244 | | 1.192010 | |
| Cross-section random- | | | 0.8627 | | | |
| Idiosyncratic random- | | | 0.1373 | | | |
| Unweighted Statistics | | | | | | |
| **Correlated RE - Hausman Test** | | | | | | |
| Chi-Sq. Statistic | | | 0.00000 | | | |
| Prob. | | | 1.0000 | | | |
| Chi-Sq. d.f. | | | 8 | | | |
| Decision (Hausm Test) | | | Do not | | | |
| **Redundant FE Test** | | | | | | |
| Cross-section F | | | | | 132.176064 | |
| Cross-section Chi- | | | | | 748.260571 | |
| d.f. F | | | | | (16;366) | |
| d.f. chi-sq | | | | | 16 | |
| Prob - F stat | | | | | 0.0000 | |
| Prob - chi-sq stat | | | | | 0.0000 | |
| Decision (red fix eff | | | | | Reject H0 | |

*Note: own calculations with Eviews v.9. *, ** and *** statistical significance with significance levels of 1%, 5% and 10%, respectively.*

The findings provide empirical evidence of the fact that some of the factors that positively affect pear consumption per capita in the market worldwide are apple consumption per capita, the general consumer price index, the price of stone fruit and technology (proxied by the time trend). Some of those with a negative impact on the market are the price of the pear, real income per capita and the stone fruit consumption per capita. The USD real exchange rate is not significant for the RE and FE models.

The findings generally show that the results – the coefficients and their signs - are in line with the economic theory. Pear consumption responds to the stimulus of apple consumption with a higher unit elastic demand (Wani et al, 2015). But its sign shows that it is a substitute and not a complementary good (Stolarska, 2014). This result can be justified by the inclusion in the same analysis, of countries that consume local and imported pears, countries that only pear importers, and developed and emerging markets.

Stone fruit is a substitute for pears, as the consumption per capita of peaches and nectarines have a negative impact on the pear.

The negative sign of the coefficient for the real income per capita, the demand elasticity of pear and the positive price index lead us to believe that this good is not one of the most sought goods by consumers as it is usually consumed when apples are more expensive, when they have less income or when the price of stone fruits rises.

Another significant aspect of the results is that the consumption of pears, apples and stone fruit tends to decrease or stagnate contrary to the other fruit that are increasing (Iglesias, 2013).

The vectors that explain the consumption of pear, apple and stone fruit – peach and nectarine between others - are mainly linked to health and flavour. Some research highlights the preference for peaches and nectarines because they are sweeter and for pears because they are sweet and have a crunchy flesh, whereas the preference for apples lies in their sweetness. Delgado et al (2013) found that sweetness and grassy aroma were the main drivers of liking for fresh nectarines and peaches in terms of consumer preferences. However, with regard to apples, consumption rises in varieties that are sweeter (soluble solids) more acid and firmer (Iglesias, 2010; 2013).

It is interesting to point out the main forms of innovation in the pear sector, such as the harvesting of new pear varieties in countries that have never been planted in before or the introduction of earlier strains of varieties that exhibit an increasing demand (B.C. Ministry of Agriculture, 2015).

When the price of pears rises, stone fruit consumption grows. In markets, the substitution phenomenon is so remarkable that trade services link the business potential of pears to the availability of peaches and nectarines, highlighting their sweetness.

On the other hand, an increase in the price of pears tends to have a shrinking effect on apple consumption because there is less spendable income. We must highlight that the largest apple production worldwide is currently dominated by the traditional varieties (e.g. red and golden delicious varieties); with a constant increase of new varieties (crunchier flesh, sweet and sour flavour and aromatic, some even juicy) which will come to predominate in the future. The proportion of apple consumption per inhabitant is considerably higher than for pear consumption, but there is greater loyalty to the purchase of pears in many countries compared to apples of standard or traditional varieties.

Some distributors say that when they begin to start selling nectarines and peaches they see how this affects the sale of pears and traditional apples, except for new varieties that are so far minorities in the yearly supply. Only in this scenario, can very acid apples like Granny Smith (described by consumers as fresh) and new sweet and sour varieties keep a passable trade volume in the presence of nectarines and peaches from the new harvest. Nevertheless, we see different behaviours in some market niches.

## 4. Conclusions

This paper analyses the explanatory factors of pear consumption in the main import countries based on the random effect panel data model, whose choice is supported by the Hausman test (cross-section random effects test). The explanatory power of the model is high and very significant in statistical terms (Prob=0,000).

The elasticity value and sign are comparable to other papers and they are in line with the economic theory except for apple consumption per capita that has a positive impact on pear demand, which proves that this good is complementary and not a substitute, as one would expect. The reason for this stems from two elements: the first is

because we simultaneously studied the 17 top pear consuming nations including in the same analysis producing countries, net importers, and developed and emerging countries; the second is the trade position of stagnated consumption with regard to pears, apples and stone fruit, linked to their flavour and prices at certain times of the year.

However, the role of pears as a substitute is more relevant in volume with regard to nectarines and peaches (stone fruit) than their role as a complementary good for apples. Other significant factors in the markets analysed are the general price index, stone fruit consumption, technology in product handling measured by a proxy (trend) and the resiliency to deterioration of some varieties, such as the Portuguese Rocha pear, which is native and very resilient.

This paper provides a new contribution or innovation by using the panel data method that, to the best of our knowledge, has never been applied to the global pear market. Another innovating factor is the measurement of the role of technology through a proxy (trend) linked to other macroeconomic variables, including income per capita, the USD exchange rate and the general price index.

The policies we would suggest for the pear market are as follows:

a) This is a complex market that needs to be sorted by priorities when analysed, as there are differences among the different consumer countries;

b) The peculiarities of the market, developed or emerging, need also to be considered when deciding the scope and magnitude of technological incorporation in the entire value chain.

c) A systematic view is necessary when assessing the trade plan, not only for the pear business but for other fruit too (stone fruit or apple).

d) As for the incorporation of technology and the necessary consideration of technology as a trade strategy, we can refer to the growing of new varieties (e.g. Forelle) as an example which prevails in trade from the southern hemisphere in the Middle East, as opposed to the traditional varieties (such as Packhams Triumph), to developed markets in Asia (de Pablo & Giacinti, 2014).

## References

Agbola, F. W. 2003. Estimation of food demand patterns in South Africa based on a survey of households. Journal of Agricultural and Applied Economics, 35(3): 663-670.

Agbola, F. W. 2005. Estimating demand elasticities with the linear approximate almost ideal demand system (LA/AIDS): Some empirical evidence from India. Empirical Economics Letters, 4(1): 1-12.

Alandes, L.; A. Quiles, I. Pérez-Munuera and I.Hernando 2009. Improving the Quality of Fresh-Cut Apples, Pears, and Melons Using Natural Additives. Journal of Food Science, 74(2): 90-96

Amaza, P. S., and T. Fregene. 2008. Determinants of food demand among rural households in Borno State, Nigeria. Empirical Economics Letters, 7(6): 607-613.

Angulo, A.M.; J.M. Gil, B. Dhehibi, and J. Mur .2002. Town Size and the consumer behavior of Spanish household: a panel data approach. Applied Economics 34: 503-507.

Arnade, C. and D. Pick. 1998. Seasonality and unit roots: The demand for fruits. Agricultural Economics, 18(1): 53-6

Arnade, C., and D. Pick. 2000. Seasonal oligopoly power: The case of the US fresh fruit market. Applied Economics, 32(8): 969-977.

Baltagi, Badi H. 2008. Econonetric Analysis of Panel Data, 4ed, John wiley & sons Ltd

Bertail, P., and F. Caillavet. 2008. Fruit and vegetable consumption patterns: A segmentation approach. American Journal of Agricultural Economics, 90(3): 827-842.

B.C. Ministry of Agriculture 2015. Assessment of B.C. Stone Fruit & Pear Varieties. Available online: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/programs/treefruit-replant-program/bc_stone_fruit_and_pear_variety_assessment.pdf. Visited on 01/05/2017

Cardamone, P. 2011. The effect of preferential trade agreements on monthly fruit exports to the European Union. European Review of Agricultural Economics, Vol 38 (4): 553-586.

De Pablo, J., and M.A. Giacinti. 2014. Complejidad en el comercio mundial de peras. Revista Facultad Ciencias Agrarias, Universidad Nacional de Cuyo, vol.46 (1):125-141.

Delgado, C.; G. M. Crisosto, H. Heymann and C.H. Crisosto (2013) Determining the Primary Drivers of Liking to Predict Consumers' Acceptance of Fresh Nectarines and Peaches. Journal of Food Science, 78(4): 605-614

Drogue, S., and F. De Maria. 2012. Pesticide residues and trade, the apple of discord. Food Policy, 37(6): 641-649.

Feleke, S. T., and R.L. Kilmer. 2009. The Japanese market for imported fruit juices. International Food and Agribusiness Management Review, 12(4): 1-28.

Gallardo, R. K. 2011. Choice experiments' findings: A tool for fruit agribusiness managers' decision making. International Food and Agribusiness Management Review, 14(3): 95-109

Gallardo, R.K., E.M. Kupferman, R.M. Beaudry, S.M. Blankenship, E.J. Mitcham, C.B. Watkins. 2011. Market Quality of Pacific Northwest Pears. Journal of Food Distribution Research, 42(2): 89-99.

Gamble J., S.R. Jaeger and F.R. Harker. 2006. Preferences in pear appearance and response to novelty among Australian and New Zealand consumers. Postharvest Biology and Technology, Vol 41(1): 38-47.

Goetz, L., and H. Grethe. 2009. The EU entry price system for fresh fruits and vegetables-paper tiger or powerful market barrier? Food Policy, 34(1): 81-93.

Goetz, L., and H. 2010. The entry price system for fresh fruit and vegetable exports from china to the EU--breaking a fly on the wheel? China Economic Review, 21(3): 377-393.

Green, R. D., H.F. Carman, and K. McManus. 1991. Some empirical methods of estimating advertising effects in demand systems: An application to dried fruits. Western Journal of Agricultural Economics, 16(1): 63-71.

Iglesias, I. 2010. Nuevas variedades de fruta dulce. Innovación, diversificación y calidad, en beneficio de la salud y del disfrute de los consumidores. Frutas y Hortalizas: 144- 159. On line http://www.frutas–hortalizas.com/pdf_SP10/144_159.pdf

Iglesias, I. 2013. Hacia dónde va el consumo de fruta? Análisis de los vectores que rigen su compra. Revista Fruticultura, n° 28: 6-51. On line http://www.quatrebcn.es/descargas/Revista–Fruticultura–28–Articulo–Ignasi–Iglesias.pdf

INTI. 2012. Informe final proyecto COFECYT. Respuesta a las limitantes tecnológicas que amenazan la competitividad de la pera Williams Argentina: aspectos nutricionales y sensoriales, e Instituto Nacional de Tecnología Industrial (INTI). On line http://inta.gob.ar/documentos/informe-final-de-proyecto-cofecyt

Matsuda, T. 2004. Incorporating generalized marginal budget shares in a mixed demand system. American Journal of Agricultural Economics, 86(4): 1117-1126.

Mellens, Martin C., Noordman, Herman G. A., Verbruggen, Johan P. 2007. Re-Exports International Comparison and Implications for Performance Indicators. CPB Netherlands Bureau for Economic Policy Analysis, No. 149, July. 58 p.

Molina, J.A. 1994. Food Demand in Spain: An applied of the Almost Ideal Demand System. Journal of Agricultural Economics, 45 (2): 252-258.

Musunuru, N. 2009. Economic analysis of export potential for U.S. fruits. International Journal of Economic Research, 6(2): 259-268.

Paudel, L., M. Adhikari, J. Houston, and K.P. Paudel. 2010. Low carbohydrate information, consumer health preferences and market demand of fruits in the United States. Applied Economics Letters, 17(4-6), 411-415.

Reid, M., and D. Buisson. 2001. Factors influencing adopting of new apple and pear varieties in Europe and the U.K. International Journal of retail & Distribution Management, Vol 29- 6: 315-327.

Schmitz, T. G., and J.L. 2002. Import demand for disaggregated fresh fruits in Japan. Journal of Agricultural and Applied Economics, 34(3): 585-602.

Sheldon, S., K. Mishraa, D. Pick, and S. Thompson. 2013. Exchange rate uncertainty and US bilateral fresh fruit and fresh vegetable trade: an application of the gravity model. Applied Economics, 45: 2067-2082.

Smed, S. 2012. Information and consumer perception of the "organic" attribute in fresh fruits and vegetables. Agricultural economics, Vol 43 Supplement 1: 33-48.

Soliva-fortuny, R.; M. Biosca-Biosca, N. Grigelmo-Miguel, and O. Martín-Belloso 2001. 30B-30 Browning and firmness changes in fresh-cut pears. International Food Technology (IFT) Annual Meeting, June 23 - 27, New Orleans, LA

Souza Monteiro, D.,M., and J.A. Caswell. 2009. Traceability adoption at the farm level: An empirical analysis of the Portuguese pear industry. Food Policy, 34(1): 94-101.

Stolarska A., 2014. Demand of polish households for fruit as an opportunity for the development of domestic fruit production. Oeconomia 13 (4): 157-167

Tiffin, R., and M. Aguiar. 1995. Bayesian estimation of an almost ideal demand system for fresh fruit in Portugal. European Review of Agricultural Economics, 22(4): 469-480.

Wani M.H., Huma Sehar, Ranjit Jumar P.; Anil Kuruvila. and Ishfaq Hussain (2015) Supply Response of Horticultural Crops: The Case of Apple and Pear in Jammu & Kashmir. Agricultural Economics Research Review. Vol. 28 (No.1): 83-89.

Wann, J. J., and R.J. Sexton. 1992. Imperfect competition in multiproduct food industries with application to pear processing. American Journal of Agricultural Economics, 74(4): 980-990.

Zhang, H., R.K. Gallardo, J.J. McCluskey, E.M. Kupferman. 2010. Consumers' Willingness to Pay for Treatment- Induced Quality Attributes in Anjou Pears. Journal of Agricultural and Resource Economics 35(1):105–117.