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S1.03 DETERMINANTS OF CHESTNUTS DEMANDED QUANTITIES: AN EMPIRICAL ESTIMATION USING PANEL DATA

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ABSTRACT

In this work, we studied the economic determinants of chestnuts demanded quantities. It concludes by stating that chestnuts are only demanded in countries with the tradition of their presence in people's diets, receiving strong challenges from the globalisation process. We also have found a significant dependence on real income per capita of chestnuts demanded quantities. Price effects were concluded as not influencing CDQ in the panel estimations.

Key Words: Chestnuts; Demand; Determinants; panel data

JEL Codes: Q11; D12; C33

1. INTRODUCTION

The role of own price and consumer income in the chestnuts demanded quantities (CDQ) have been often documented in national accounting frameworks, but there are fewer cross-country comparisons of CDQ determinants emphasizing the role of economic factors and the mix impact from the presence of Other Agropecuary Related Products (OARP). The most cited OARP are pig meat (whose gastronomic confections often include chestnuts), almonds, dry beans and wheat (as complimentary sources of hydrates of carbon), nuts and potatoes (as usual substitute commodities), and apples, oranges, peaches and strawberries (as seasonally consumed fruits, usually used to infer about the influence of the persistence of warm weather, *i.e.*, who use to eat chestnuts during autumn and winter, also use to consume some of these pointed summer fruits during the remaining seasons, indicating a relation of seasons complementarity)³. Therefore, if estimated, the impacts of these OARP on CDQ should be clearly positive for pig meat, clearly negative for nuts and potatoes, and not undoubtedly defined for the remaining commodities (mainly depending on national consumption habits).

The (hypothesizable) non-significance of the influence of consumer income or own-price in CDQ is often linked with the assumptions of the inelasticity of chestnuts demand function induced by historical foodstuffs habits, especially in Mediterranean rural areas (Fidanza, 2002; Smith *et al.*, 2004). Econometric studies of this hypothesis are however scarce.

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³ The rationale behind this choice is detailed in the reports from the "FOOD PROCESSING CENTER INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES UNIVERSITY OF NEBRASKA – LINCOLN, 2002" and from Gold, Cernusca and Godsey (2005).

This article builds on FAO (Food and Agriculture Organization of the United Nations) cross-country data of potential CDQ determinants. It uses an extended panel of 13 countries⁴ (weighting 95,9% of the 2004 chestnuts market) and the use of the generalized method of moments (GMM), which allows certain determinants to have a diffusion effect on CDQ.

It concludes by stating that chestnuts are only demanded in countries with the tradition of their presence in people's diets, receiving strong challenges from the globalisation process, with a significant dependence on real income per capita. Price effects were observed as not influencing CDQ in the panel estimations.

2. DETERMINANTS OF CHESTNUTS DEMANDED QUANTITIES – A DISCUSSION

This study⁵ is seeking to identify the main determinants of the CDQ. The baseline equation that is estimated takes the form:

$$\Delta CDQ_{i,t} = \alpha \cdot \Delta CDQ_{i,t-1} + \beta \cdot Det_{i,t} + u_i + \eta_t + \varepsilon_{i,t}$$

where $i=1\dots N$ (where N is the number of countries, 13 as already stated) and $t=1990,1991,\dots,2004$. β is a row-vector of l coefficients for the l determinants (the suggested OARP plus real income per capita⁶ and the openness level of the economy⁶) and $Det_{i,t}$ is a column-vector taking the observation for each l determinant from the i -country at the t -year. $\Delta CDQ_{i,t-1}$ is the log difference of CDQ . All the variables are in logs. The usual country-specific effect, u_i , is included. η is a time dummy. ε is disturbance.

Fixed effects regression is the model to use when a researcher wants to control for omitted variables that differ between cases but are constant over time. It lets him use the changes in the variables over time to estimate the effects of the independent variables on the dependent variable (and is the main technique used for analysis of panel data).

The fixed-effects results appear in the first column of Table 1. According to these findings, we have to notice the positive influence of the nuts and orange demanded quantities (0,129 and 0,372). The real income per capita also has a positive impact on the CDQ (0,762) and the openness evidences a negative influence on CDQ (-0,786).

⁴ By alphabetical order, Bolivia [3%], China [71%], France [2%], Greece [1%], Hungary [0,3%], Italy [3%], Japan [4,1%], (South) Korea [3,5%], Portugal [2,3%], Russia [1,7%], Serbia and Montenegro [0,1%], Spain [0,3%] and Turkey [3,7%]. Between square brackets, the national proportion of aggregate CDQ, using FAOSTAT (2006), category 'Food quantity – tons'.

⁵ Data used from FAOSTAT (2006), available from <http://faostat.fao.org/site/336/default.aspx>, and *Penn World Table – PWT 6.2*, developed by Heston, Summers and Aten (2006), available from http://pwt.econ.upenn.edu/php_site/pwt62/pwt62_form.php.

⁶ CDQ and OARP units are (the logs of) 'Food quantity/day/capita – grams'. Real income per capita and the openness data were taken from the cited source *Penn World Table – PWT 6.2*.

If the research team has reason to believe that some omitted variables may be constant over time but vary between cases, and others may be fixed between cases but vary over time, then they can include both types by using random effects.

The random-effects findings are shown in the second column of Table 1. Actually, they significantly differ from the fixed-effects ones. Firstly, they signal different and significant influences from dry beans (0,482) and openness (1,450). Secondly, they find significance in the estimated coefficients for peaches (0,396), pig meat (-2,712), and potatoes (0,612). Thirdly, they notice the loss of significance of wheat and real income per capita.

Table 1 – Estimations of CDQ determinants [n = 13; t = 1990,...,2004; N_obs = 83]

	Fixed-effects	Random-effects	GMM
Autoregressive term, $\Delta CDQ_{i,t-1}$			0,505*** (0,059)
Almonds	-0,115 (0,095)	-0,079 (0,129)	-0,056 (0,059)
Dry beans	-0,249 (0,212)	0,482** (0,162)	-0,393*** (0,167)
Nuts	0,129*** (0,048)	0,049 (0,085)	0,084 (0,059)
Oranges	0,372** (0,145)	-0,312 (0,285)	0,265** (0,123)
Peaches	0,259 (0,178)	0,396** (0,189)	0,103 (0,108)
Pig meat	-0,684 (0,547)	-2,712*** (0,289)	-0,051 (0,338)
Potatoes	0,484 (0,325)	0,612** (0,208)	0,075 (0,120)
Strawberries	0,169 (0,113)	0,006 (0,111)	0,001 (0,078)
Wheat	1,543*** (0,504)	0,090 (0,443)	0,813** (0,339)
Real Income per capita	0,762** (0,311)	0,210 (0,222)	1,041** (0,309)
Openness	-0,786*** (0,205)	1,450*** (0,207)	-0,523*** (0,108)
Chestnuts (own-price)	-0,045 (0,142)	0,028 (0,246)	0,028 (0,077)
	Sigma_u: 1,593 Sigma_e: 0,226 Rho: 0,980 F(12,61)=5,53***	Sigma_u: 0,000 Sigma_e: 0,226 Rho: 0,000 Wald(12)=276,3***	P-value (Arellano-Bond test, no autocorrelation, order 1): 0,0526
			P-value (Arellano-Bond test, no autocorrelation, order 2): 0,9289

However, the generally accepted way of choosing between fixed and random effects is running a Hausman test. Statistically, fixed effects are always a reasonable thing to do with panel data (they always give consistent results) but they may not be the most efficient model to run. Random effects will give better p-values (as noticed in this case) because they are a more efficient estimator. The Hausman test tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. In this case, they are not, because we get a significant p-value (chi-square of 250,24, with a null probability, $\text{prob} > \text{chi-square} = 0.00$). Therefore, we have to properly pay attention to fixed-effects results and not value the random-effects values.

Finally, given the small n ($n=13$) and the small t ($t=15$), some characteristics of the fixed-effects estimator must be pointed. According to Arellano and Bond (1991), there are various sources of bias in the fixed effects model, especially due to the correlation of the lagged dependent variable and to the eventual small dimension of n and of t . Therefore, their final suggestion is to estimate using GMM technique because a more efficient estimator results from the use of additional instruments whose validity is based on orthogonality between lagged values of the dependent variable and the errors.

The GMM findings, presented in the third column of Table 1, confirm the marked influence of some OARP on CDQ, namely dry beans (a significant consumption rival), oranges (a summer fruit particularly consumed in the Mediterranean and in the Asia, revealing again the relevance of cultural patterns) and wheat. Remarkably, the real income per capita has a positive impact on the CDQ. The estimated coefficient signifies that a rising of 1% in income per capita may induce an increasing of 1,04% of CDQ⁷.

This result is very noticeable because it indicates that CDQ are now being highly influenced by the standard of life of modern populations: if, in most cases, chestnuts have been incorporated in rural diets, actually, today, we only can expect increasing CDQ if people income rises. Also very interestingly, the coefficient of own-price is not characterized by a significant value, which induces an inelastic demand through the panel. Therefore, the consumption of chestnuts tends to replicate the past patterns, strengthened by the magnitude (and the significance) of the autoregressive term (0,51) and the negative and significant coefficient of the openness of each country – CDQ are highly depending on traditional diet habits, if new imported nuts commodities arrive, they can easily been seen as chestnuts preferable substitutes.

⁷ Looking at the (non-significant) coefficient of chestnuts own-price (0,028), an interesting positive value, and combining with the strong influence of the income factor, we could be wrongly suggested that chestnuts are a *giffen good*. However, this relevant non-significance shows that the chestnuts demand is inelastic, quantities do not vary because of price changes.

3. CONCLUSION

In this work, we have studied the economic determinants of chestnuts demanded quantities. Our estimates suggest a possibility of positive influences from oranges and wheat, oranges (as a seasonally consumed fruits, usually used to infer about the influence of the persistence of warm weather), wheat (as a complimentary source of hydrates of carbon). The main consumption rival is identified with dry beans. The real income per capita has a positive impact, contrasting with the non-significance of price estimates, which promotes the final conclusion that, actually, facing modern urban consumption patterns, chestnuts are only demanded in countries with the tradition of their presence in people's diets, receiving strong challenges from the globalisation process.

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