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THE DEMAND BEHAVIOUR OF CONSUMERS IN PERU: A DEMOGRAPHIC ANALYSIS USING THE QUAIDS

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ABSTRACT

This paper models the demand behaviour of consumers in Peru. To that end, we estimate a demographic version of the Quadratic Almost Ideal Demand System (QUAIDS) using one Peruvian cross-section from 1997. Our results indicate first that the rank two AIDS model is rejected in favour of the rank three demographic QUAIDS model. Secondly, the income elasticities reveal that Transport and Leisure are luxury goods, whilst Tobacco, Health and Miscellaneous Goods are found to be necessities. Our policy recommendations indicate that policy makers should not focus exclusively on economic variables. Rather, it is similarly important to define social policies (education, health, …) that harmoniously redistributes income, as well as to improve their efficiency in such a way that the individual becomes more productive.

JEL Classifications: D12, C31
Keywords: Demand Behavior, Consumers, Peru, QUAIDS

INTRODUCTION

Peru is a developing country, as is confirmed by a number of previous papers which have drawn on a variety of different data bases. Thus, Thomas (1980) employed a 1971-1972 household survey undertaken by the Ministry of Agriculture in order to examine Peru's regional differences in poverty. Glewwe and Hall (1994) evaluated the evolution of living standards during the period 1985-1990 in Lima, the capital city of Peru.

Two of their main conclusions confirmed that, during these years, the average household experienced a decline in per capita consumption of over 50% and, secondly, those who were poor in 1985 suffered the greatest declines, thereby rendering the distribution of consumption more unequal in 1990 than in 1985. For his part, Moncada (1996) used the 1994 Peru Living Standards Measurement Survey (LSMS) to conclude that 49.6% of the Peruvian population suffered from economic problems which resulted in a situation of poverty. Some years later, the same LSMS, but now corresponding to 1997, showed that a lower, but still very high, percentage of households, 44.1%, suffered from the same economic problems and, indeed, that 11.9% were faced with a situation of extreme poverty. This poverty was found to be concentrated in rural areas; thus, 20.9%, 26.9% and 25.1% of households located in coastal, mountain or forest rural areas, respectively, were in this situation of extreme poverty.

According to this same data base, that is to say, the 1997 LSMS, it is similarly clear that the type of housing, the existence of utilities or the presence of household appliances are also important in determining whether this precarious situation continues or not. In particular, this survey reveals that no less than 80% of houses are built of brick or adobe, that around 40% of households do not have a supply of running water, that 30% have no electricity supply and 46% are not connected to the public sewerage system. Finally, only 37%, 22% and 6% of households have a refrigerator, telephone or car, respectively.

Additionally, a number of papers have shown that two of the most fundamental means of raising individual levels of welfare in a developing country, such a Peru, are, first, to increase the health status of individuals through, for example, access to health services and public health facilities (Gertler et al., 1987; Cortez, 2000; Savedoff and Schultz, 2000) and, secondly, to improve access to a public education system (Gertler and Glewwe, 1990; Rodríguez, 1994). In this same line, Escobal et al. (1999) uses several household surveys from 1985 to 1994 to analyse the possession of, and access to, a range of different assets on the part of the Peruvian poor. The authors found that the average level of access to some public services (e.g. education,…) has increased, although the inequality levels are still very high. They conclude that whilst the possession of these goods is not sufficient to explain transitions towards and from poverty, they are nevertheless crucial in explaining permanence inside or outside poverty. They also show that changes in the characteristics of Peruvian families, for example, a reduction in family size, together with increases in the number of employed family members or the decision to migrate, are crucial to escape from poverty.

Having said that, it is also clear that one relevant way to gain a better understanding of the developing character of Peru is to analyse the demand behaviour of households by incorporating the demographic structure of the population as an important factor when seeking to determine the consumption profiles. To that end, we can adopt two different approaches for modelling demographic effects in demand systems: translating or additive augmentation proposed by Pollak and Wales (1978) and the scaling or multiplicative augmentation technique developed by Barten (1964). Most empirical studies have used these

both approaches, which allow the parameters of the demand system to depend on demographics (Pollak and Wales, 1980 and 1981; Alessie and Kapteyn, 1991; Blundell *et al*., 1993).

Furthermore, recent empirical literature on micro data (Lewbel, 1991; Blundell *et al*., 1993; Banks *et al*., 1997) has questioned whether popular rank two representations of preferences, namely the Translog Function developed by Christensen *et al*. (1975) or the Almost Ideal Demand System proposed by Deaton and Muellbauer (1980), can fit current data sufficiently well. Thus, in order to provide a better picture of reality, this literature indicates that demand systems should incorporate further terms in income, thereby allowing for more flexibility. In other words, demand systems should be rank three, which implies that they will be able to display a greater variety of shapes of the Engel curves than is the case with rank two models. Following this line, Banks *et al*. (1996 and 1997) have derived a complete class of integrable, rank three, quadratic logarithmic share systems, and proposed the Quadratic Almost Ideal Demand System (QUAIDS), belonging to that class in which the Almost Ideal Demand System (AIDS) is nested.

Against this background, this article incorporates both these aspects in modeling the demand behaviour of Peruvian households with respect to the consumption of goods and services. In particular, we estimate a demographic version of the rank three QUAIDS model, which allows for the inclusion of several demographic characteristics of each household. To that end, we use the earlier-mentioned LSMS from 1997 which provides information on households expenditure and demographic variables. In particular, we use the quantities and prices of six aggregated consumption goods: Food, Tobacco, Health, Transport, Leisure and Miscellaneous Goods. With respect to the demographic characteristics, we include the age and education level of the family head, as well as the presence of children in the household, the region of residence and the poverty level of the family. Estimations of the model allow us to calculate the income elasticities, computed at both the sample means and the mean point of the sub-samples corresponding to each demographic characteristic. Our empirical results will hopefully allow us to obtain a better understanding of the developing character of Peru, which must be the starting point of any effective policy aimed at reducing the percentage of households who suffer from economic problems, as well as those who find themselves in a situation of extreme poverty.

The rest of the paper is organised as follows. In the following section we present the theoretical model. We then consider the data and estimation procedure, before turning to the empirical results of the analysis. Finally, we close the paper with a summary of the most relevant conclusions.

THE THEORETICAL MODEL

Let us assume a rational consumer with an available income y to spend on the purchase of n different consumption goods $Q = (Q_1, \ldots, Q_n)$. The consumer considers both the monetary income y and the prices of goods $p = (p_1, \ldots, p_n)$ to be exogenous;

furthermore, he has the possibility of consuming the desired quantities and does not face transaction costs. Given the prices of the goods and the monetary income, the individual chooses a particular consumption vector, $q = (q_1, \ldots, q_n)$. This vector belongs to the consumption set defined as the non-negative space R^n_+ and formed by the non-negative quantities of the *n* consumption goods which maximises utility, where these quantities do not imply an expenditure higher than available income. Thus, assuming the existence of a mathematical function which represents the preferences of the consumer, that is to say, the utility function *u(q)*, we can formulate the consumer equilibrium as the solution of a restricted problem, *Max u(q) s. to y = pq*, whose first-order conditions allow us to derive the Marshallian demand system $q_i = q_i\,(p,y)$ $(i = 1, \ldots, n)$.

As already mentioned, and in order to particularise this general and observable demand system, let us now consider the QUAIDS model as a generalisation of PIGLOG preferences (Muellbauer, 1975 and 1976), which are defined from the following indirect utility function:

$$ln\ V = \left\{ \left[\frac{\ln y - \ln a(p)}{b(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \tag{1}$$

where:

$$log\ a(p) = \alpha_0 + \sum_i^n \alpha_i \ln p_i + \frac{1}{2} \sum_k^n \sum_j^n \gamma_{ij} \ln p_i \ln p_j \tag{2}$$

$$b(p) = \prod_i^n p_i^{\beta_i} \tag{3}$$

$$\lambda(p) = \sum_i^n \lambda_i \ln p_i \tag{4}$$

All *a(p)*, *b(p)* and $\lambda(p)$ are defined to be homogeneous functions of degree zero in prices and, by applying Roy's identity to (1), after having substituted (2), (3) and (4), we can obtain the Marshallian demand equation of the QUAIDS model in terms of budget shares:

$$w_i = \alpha_i + \sum_i^n \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{y}{a(p)} \right) + \frac{\lambda_i}{b(p)} \left\{ \ln\left[\frac{y}{a(p)} \right] \right\}^2 \tag{5}$$

with the adding-up theoretical restriction, $\sum_i^n w_i = 0$,implying that:
$\sum_i^n \alpha_i = 1, \sum_i^n \gamma_{ij} = \sum_i^n \beta_i = \sum_i^n \lambda_i = 0$. As can be seen, these expenditure shares, which are

quadratic in the logarithm of income, have been derived from the PIGLOG preferences. Therefore, they maintain the relevant properties of its linear counterpart, the AIDS, thus allowing for exact aggregation over households. It is evident that these QUAIDS budget shares reduce to those of AIDS if $\lambda_i = 0$, for all *i*, in which case the rank three Engel curves of the QUAIDS model reduce to rank two Working-Leser Engel curves.

The demographic effects of household composition are introduced into this model by way of the specific price scaling technique proposed by Ray (1983), according to which income is deflated by the equivalence scale:

$$m_0(h) = 1 + \sum_{d=1}^{D} \theta_d h_d \tag{6}$$

where θ_d is the scale parameter and h_d contains the demographic variables which define the household type *d*. Thus, allowing the demand parameters to vary according to these characteristics, and since our data refers to a single time period for which prices are fixed and, furthermore, assumed to be one, the rank three price scaled demographic demand equations for household type *h* reduce to:

$$w_{ih} = \alpha_{ih} + \beta_{ih} \ln\left(\frac{y}{m_0}\right) + \lambda_{ih}\left(\ln\frac{y}{m_0}\right)^2 \tag{7}$$

As mentioned above, given that the QUAIDS is a rank three model, its Engel curves have the possibility of displaying a greater variety of shapes than the rank two AIDS model. In other words, contrary to the AIDS model, where goods are luxury or necessities throughout the whole income or expenditure range, the income elasticities of the QUAIDS model are:

$$e_i = 1 + \frac{\beta_i}{w_i} + \frac{2\lambda_i}{w_i}\ln\left(\frac{y}{m_0}\right) \tag{8}$$

and imply that the character of the goods depends on the level of total income. Thus, with a positive β_i and a negative λ_i, the elasticity will be greater than one at low levels of income. However, if total income increase, and the second term in the right-hand side becomes more important, the income elasticity eventually becomes less than one. Therefore, this expression allows for certain goods to be luxuries at some income levels and necessities at others.

DATA AND ESTIMATION METHOD

The data base we have used in this article is the LSMS corresponding to 1997 which includes 3,610 feasible observations. Table 1 contains the definition, mean values and standard deviations of all the variables included in the analysis. With respect to the dependent variables, we have used the budget shares corresponding to six aggregated consumption goods: Food, Tobacco, Health, Transport, Leisure and Miscellaneous Goods.

We can note that 45% of total income is allocated to Food, whereas 13% is devoted to Transport, 12% to Leisure, 3% to Health, 1% to Tobacco, and the rest, 26%, to Miscellaneous Goods. As regards the independent variables, we include the age and education level of the family head, as well as the presence of children in the household, the housing region and the poverty level of the family.

Table 1. Definition of variables and sample characteristics

Variable	Definition	Mean (Stad. Deviation)
Food	Family budget share on food	0.455 (0.298)
Tobacco	Family budget share on tobacco	0.009 (0.023)
Health	Family budget share on health goods and services	0.029 (0.060)
Transport	Family budget share on transp ort and communications	0.130 (0.138)
Leisure	Family budget share on leisure goods and services	0.119 (0.140)
Miscellaneous	Family budget share on miscellaneous goods and services	0.258 (0.195)
Income	Available family income (in New Soles, 2.69 Soles/1$)	1,022.227 (904,605)
Age	Age of the family head	47.492 (15.163)
Education level	This takes values according to the education level of the family head (0: no studies, 1: primary, 2: secondary, 3: high school, 4: university)	1.128 (1.266)
Size of housing	Number of family members	5.145 (2.265)
Children	This takes the value 1 if there are children younger than 14 in the household and 0 otherwise	0.741 (0.437)
Region	This takes values according to the region of residence (1: Lima,2: urban coast, 3: rural co ast, 4: urban mountain, 5: rural mountain, 6: urban forest, 7: rural forest)	3.365 (1.997)
Poverty	This takes values according to the poverty level of the household (1: extreme poverty,2: poverty, 3: no poverty)	2.438 (0.693)

When considered jointly with table 2, in which we present the demographic variables, we can note that the mean age of the head of household is 47, with almost 70% falling between the ages of 29 and 58. The education level of the head is desegregated in

five classes: (0) No studies, (1) Primary, (2) Secondary, (3) High School and (4) University. The mean value of this education variable is 1.12, whilst the distribution shows that almost 50% of heads have no studies, as compared to 7.4% who have university studies. The remaining variables correspond to the type of the household. Thus, the housing size indicates that almost 60% of households have 5 or more members, with the highest percentage of household, 19.4%, having precisely this number. With respect to the number of children younger than 14, the Table reveals that 75% of households have such children present in them, of which some 60% have two or less. We also consider seven geographical areas: (1) Lima, (2) urban coast, (3) rural coast, (4) urban mountain, (5) rural mountain, (6) urban forest, (7) rural forest. The distribution shows that 25.6% of the population of Peru lives in the capital city of Lima, with almost 70% living in urban areas, whereas only 30% of the total population lives in rural areas. Finally, the poverty level is desegregated into three categories: (1) extreme poverty, (2) poverty and (3) no poverty, with a mean value of 2.43. Almost 12% of the population lives in extreme poverty, whereas a further 32.2% suffer other levels of poverty.

With respect to the estimation procedure, the adding-up condition is maintained in the estimation and, therefore, one equation is omitted given the singularity of the system. Thus, the stochastic version of the model can be written as:

$$w = f(\theta, x) + e \qquad (9)$$

where w is the vector of dependent variables, namely n-1 expenditure shares, θ is the vector of all parameters to be estimated, x corresponds to the exogenous variables and e is the vector of error terms. As regards these, we assume that the model satisfies the standard assumptions on the error terms, that is to say, that they are normally distributed, serially uncorrelated and contemporaneously correlated. Given these stochastic assumptions, the model is estimated by Maximum Likelihood (ML) techniques using the TSP package. This estimation considers the overall model in its totality, instead of estimating each equation individually. In this way, it takes advantage of the interrelations among the error terms of the different equations so as to finally provide consistent and asymptotically efficient estimations.

EMPIRICAL RESULTS

In table 3 includes the estimation of the parameters of the income deflator defined in terms of the following variables: i) with respect to the household head: age, age squared and education level and, ii) with respect to the household: the presence of children younger than 14, the housing region and, finally, the poverty level of the family. Our results show that if the education level of the head increases, or the economic situation of the household improves, with both variables being statistically significant at the 5% level, then the deflated income will be higher. By contrast, the age of the head, the presence of children and the housing region, with only this latter variable being individually significant, have a positive effect on the deflator.

Table 2. Demographic characteristics

Variable	Percentage	Accumulated Percentage
Head of the family		
Age		
18-28	9.0%	9.0%
29-38	24.0%	33.0%
39-48	24.6%	57.6%
49-58	18.3%	75.9%
59-68	13.6%	89.5%
More than 69	10.5%	100.0%
Education level		
No Studies	47.7%	47.7%
Primary	14.4%	62.1%
Secondary	25.7%	87.8%
High School	4.8%	92.6%
University	7.4%	100.0%
Housing		
Size		
1	2.9%	2.9%
2	7.6%	10.5%
3	13.0%	23.5%
4	18.7%	42.2%
5	19.4%	61.6%
6	14.5%	76.1%
7	9.9%	86.0%
8	6.1%	92.1%
9	3.6%	95.7%
10	2.1%	97.8%
More than 10	2.2%	100.0%
Number of children		
0	25.9%	25.9%
1	22.0%	47.9%
2	22.9%	70.8%

(Table 2, continued)

Variable	Percentage	Accumulated Percentage
3	14.2%	85.0%
4	8.4%	93.4%
More than 4	6.6%	100.0%
Region		
Lima	25.6%	25.6%
Urban coast	15.4%	41.0%
Rural coast	6.6%	47.6%
Urban mountain	15.9%	63.5%
Rural mountain	13.7%	77.2%
Urban forest	12.1%	89.3%
Rural forest	10.7%	100.0%
Poverty		
Extreme poverty	11.9%	11.9%
Poverty	32.2%	44.1%
No poverty	55.9%	100.0%

Thus, a clear policy recommendation that emerges from these results, one that is in line with previous literature (Gertler and Glewwe, 1990; Rodríguez, 1994; Escobal et al. 1999), is to improve access to a public education system, with the objective of increasing the education level of the population. In this way, it would be possible to reduce the still very high inequality levels observed in access to this public service. A second policy initiative, again in line with the literature, would be to design public policies aimed at making the population and, above all, the female population, more aware of the importance of birth control (Escobal et al. 1999). Reducing family size would be positive for the redistribution of the available household income amongst the family members.

Table 3. Estimation of income deflator

Head of the family			Housing		
Age	Age^2	Education	Children	Region	Poverty
0.0001	0.0000	-0.0089**	0.0006	0.1492***	-0.37148***
(0.4700)	(-0.5865)	(-2.1936)	(0.3458)	(4.27155)	(-33.8613)

Asymptotic t-statistics in parentheses

*** indicates individual significance at the 1% level

** indicates individual significance at the 5% level

* indicates individual significance at the 10% level

Table 4 shows the estimations of the QUAIDS model, as well as the income elasticities. First, we can see that the lambda parameters, which characterise this quadratic model, are individually significant in four of the six equations at the 5% level, that is to say, all save for those corresponding to Health and Transport. This result indicates than the rank two AIDS model is rejected in favour of the rank three QUAIDS model in modeling the demand behaviour of consumers in Peru. Moreover, we have also performed a Wald test of joint significance for these parameters, whose value shows a p-value of 0.000, thereby again confirming the QUAIDS model as being superior to its less flexible counterpart, the AIDS model.

The income parameters of the estimated model are highly significant. In particular, with respect to the linear parameter, five of the six parameters are individually significant at the 5% level, with four of them being at the demanding 1% level. As regards the quadratic coefficients, five of the six are significant at the 10% level, with four of them also being significant at the 1% level. With respect to the goodness of fit of our equations, as measured by the R^2 values, we have obtained acceptable values taking into account the type of data used, that is to say, one cross-section, with three of the five values being around 10%.

As regards the income elasticities, computed at the sample means, we can first observe the high level of significance previously demonstrated by the income parameters. In particular, we have found that all of these are individually significant at the 5% level, with five of the six being at the demanding 1% level. With respect to their particular values, we have observed that all of these satisfy the theoretical expectations, in the sense that all elasticities exhibit a positive sign. This, in turn, denotes normal goods, i.e., the impact of income on the six demands is positive.

Additionally, we have found that the particular elasticities of Transport and Leisure are clearly higher than one, with this meaning that these goods behave as luxuries. That is to say, the effects of income on these demands are more than proportional, in this way indicating a relatively low frequency of demand. By contrast, Tobacco, Health and Miscellaneous appear to be clearly necessities, with elasticities between null and one. This indicates that the impact of income on these consumptions is less than proportional, which is indicative of a higher frequency of buying. Finally, Food has an elasticity close to one, and thus appears to be in a transition phase from luxury to necessity.

With respect to the policy recommendations that we can derive from these income elasticities, we should first place emphasis on the importance of the Health good in the habitual consumption decisions. This once again highlights the importance of providing access to public health services (Gertler et al., 1987; Cortez, 2000; Savedoff and Schultz, 2000). This relevance is even greater given the necessity character we derive for the Tobacco good. The frequent consumption of this addictive good supposes an unhealthy lifestyle which, in turn, implies that at some time in the future the need will arise to have access to health services to treat the damage caused by smoking (e.g. heart and pulmonary diseases or cancers of the lung and oesophagus, among others).

As regards the policy implications that flow from our results corresponding to the Transport and Leisure goods, which clearly appear as luxuries, their low frequency of demand implies a more insistent recommendation than in the previous cases. It is clear that the provision on the part of the State of public resources which enable the population to have access to transport goods and services will facilitate both the trade in goods and the mobility of individuals, all of this with the final purpose of improving the family economy and, consequently, increasing the living standards of the population as a whole. As regards Leisure goods, and taking into account that cultural goods represent an important percentage of this aggregate, our results also confirm the need to devote public funds to improving the cultural level of the population. This result is once again in line with those of the earlier-mentioned articles, which emphasize the importance of easy access to a public education system in order to facilitate the escape from poverty.

Table 4. Estimation of the QUAIDS model and income elasticities

	α_i	β_i	λ_i	R^2	e_i
Food	0.4621*** (5.8032)	0.0395** (1.9661)	-0.0043*** (-3.3415)	0.0924	1.0772*** (26.5364)
Tobacco	0.0182*** (3.7062)	0.0032*** (-2.6688)	0.0001*** (2.8112)	0.0040	0.4738*** (2.3977)
Health	0.0216* (1.8507)	-0.0008 (-0.3254)	0.0001 (1.1317)	0.0058	0.9701*** (9.7714)
Transport	-0.0706** (-2.1801)	0.0294*** (3.9861)	-0.0006* (-1.6280)	0.0827	1.2419*** (20.8454)
Leisure	0.1455*** (-3.7687)	0.0396*** (4.7886)	-0.0011*** (-2.6051)	0.0924	1.4212*** (16.3650)
Miscellaneous	0.7141*** (14.2192)	0.1045*** (-7.7241)	0.0057*** (6.3568)	--	0.6297*** (13.2169)

Asymptotic t-statistics in parentheses
*** indicates individual significance at the 1% level
** indicates individual significance at the 5% level
* indicates individual significance at the 10% level

Finally, table 5 includes all the income elasticities calculated for the different demographic variables considered in this paper. All these values, computed at the mean point of the households' sub-samples, provide some interesting results on the specific

effects of demography in the income elasticities. Our first result in this table points to the very high individual significance exhibited by the great majority of the elasticities of the demographic variables. In particular, all the parameters corresponding to the six aggregates, save for some in the case of Tobacco, are significant at the demanding 1% level. Turning to the situation of the head of the family, we have obtained income elasticities relative both to the age of this family head and to his/her education level. With respect to the former, we can further note that increases in this variable result in Food becoming more luxury, Health less necessity, and Tobacco more necessity from the age of 49 onwards. The highest value for Transport appears in the 29-38 age group, whereas the lowest effect is in the 59-68 age category. With respect to the education level of the head, we can note that Food becomes more of a luxury good, and Transport and Leisure less of a luxury, as the education level increases.

With respect to the housing variables, we have also obtained some interesting results. Thus, we can note that Food becomes more of a luxury good, and Tobacco and Health are regarded less as necessities, when there are no children in the household, whist both Transport and Leisure goods are regarded more as luxury goods in the households with children. As regards the region of residence, we find that Food, Tobacco and Health exhibit the highest values in Lima and, in general, higher values in the urban areas than in the rural ones. By contrast, the lowest values for Transport and Leisure appear in Lima. Finally, with respect to the poverty level, the values for Food, Tobacco and Health increase with the economic level of the household, with the opposite being the case for Transport and Leisure.

Table 5. Income elasticities for demographic variables

Variable	N	Food	Tobacco	Health	Transport	Leisure	Miscella-neous
Head of the family							
Age							
18-28	251	1.0714*** (28.5419)	0.5880*** (3.8009)	0.9646*** (8.2123)	1.2842*** (18.3467)	1.4446*** (17.7577)	0.6097*** (12.1390)
29-38	818	1.0728*** (28.0658)	0.4195* (1.9248)	0.9631*** (7.8911)	1.2998*** (17.5832)	1.4325*** (16.0529)	0.6293*** (13.1862)
39-48	905	1.0748*** (27.3414)	0.3741 (1.5920)	0.9641*** (8.0977)	1.2420*** (20.8393)	1.4461*** (15.7227)	0.6224*** (12.8119)
49-58	690	1.0811*** (25.3790)	0.5594*** (3.3819)	0.9710*** (10.0903)	1.2151*** (22.9241)	1.3942*** (17.1493)	0.6281*** (13.1240)
59-68	523	1.0813*** (25.5545)	0.4884*** (2.5427)	0.9724*** (10.6118)	1.2094*** (23.4469)	1.4292*** (16.1489)	0.6295*** (13.2054)
More than 69	423	1.0875*** (23.6541)	0.4737*** (2.3966)	0.9819*** (16.3153)	1.2267*** (21.9696)	1.3793*** (17.6375)	0.6565*** (14.8498)

(Table 5, continued)

Variable	N	Food	Tobacco	Health	Transport	Leisure	Miscella-neous
Education level							
No Studies	1679	1.0661*** (30.6181)	0.4176* (1.9092)	0.9695*** (9.4995)	1.3232*** (16.6451)	1.5894*** (13.0919)	0.60147** (11.7324)
Primary	526	1.0753*** (27.2352)	0.3604 (1.5007)	0.9649*** (8.3355)	1.2376*** (21.1203)	1.4443*** (15.7512)	0.61809** (12.5696)
Secondary	948	1.0874*** (23.6900)	0.5413*** (3.1429)	0.9697*** (9.6677)	1.2044*** (23.9062)	1.3469*** (18.8229)	0.6457*** (14.1621)
High School	178	1.1002*** (20.8692)	0.4027* (1.7954)	0.9693*** (9.4863)	1.1856*** (25.9501)	1.3270*** (19.6911)	0.6872*** (17.0768)
University	279	1.1526*** (14.2957)	0.6510*** (4.9649)	0.9804*** (14.8240)	1.1448*** (32.2068)	1.2203*** (26.9315)	0.6986*** (18.0340)
Housing							
Children							
Without	932	1.0900*** (22.8861)	0.5624*** (3.4206)	0.9760*** (12.0334)	1.1983*** (24.6307)	1.3125*** (20.4293)	0.6450*** (14.1384)
With	2678	1.0731*** (27.8908)	0.4365** (2.0630)	0.9678*** (9.0255)	1.2614*** (19.6022)	1.4780*** (15.0029)	0.6255*** (12.9813)
Region							
Lima	980	1.1033*** (20.3199)	0.6131*** (4.2198)	0.9715*** (10.2728)	1.1545*** (30.3396)	1.2740*** (22.5505)	0.6301*** (13.2369)
Urban coast	590	1.0738*** (27.6864)	0.2845 (1.0591)	0.9769*** (12.7455)	1.2606*** (19.6408)	1.4956*** (14.6368)	0.6216*** (12.7640)
Rural coast	253	1.0652*** (31.0930)	-0.1237 (-0.2932)	0.9726*** (10.7241)	1.2826*** (18.4189)	1.7700*** (11.1462)	0.5848*** (10.9455)
Urban mountain	613	1.0842*** (24.5702)	0.3578 (1.4841)	0.9695*** (9.6658)	1.2491*** (20.3156)	1.4308*** (16.0858)	0.6792*** (16.4460)
Rural mountain	527	1.0606*** (33.1453)	0.3664 (1.5393)	0.9545*** (6.2284)	1.5243*** (11.8394)	1.6639*** (12.1810)	0.6074*** (12.0370)
Urban forest	387	1.0761*** (26.9370)	0.5727*** (3.5706)	0.9691*** (9.5074)	1.2778*** (18.6521)	1.4323*** (16.0563)	0.6398*** (13.7972)
Rural forest	260	1.0598*** (33.6551)	0.5556*** (3.3300)	0.9638*** (7.9900)	1.4634*** (12.8299)	1.7183*** (11.6068)	0.5684*** (10.2370)
Poverty							
Extreme	424	1.0569*** (35.4920)	0.4238** (1.9694)	0.9408*** (4.8431)	1.6197*** (10.5837)	2.3906*** (8.3227)	0.5868*** (11.0261)
Poverty	1180	1.0657*** (30.9399)	0.4552** (2.2261)	0.9647*** (8.3071)	1.2904*** (18.0048)	1.6639*** (12.1401)	0.5824*** (10.8299)
No poverty	2006	1.0955*** (21.8894)	0.4898*** (2.5578)	0.9745*** (11.6101)	1.1974*** (24.5694)	1.3099*** (20.4721)	0.6579*** (14.9385)

(Table 5 , continued)

Asymptotic t-statistics in parentheses
*** indicates individual significance at the 1% level
** indicates individual significance at the 5% level
* indicates individual significance at the 10% level

All these results can be valuable for the purpose of policy analysis. Thus, the knowledge of elasticities may help in forecasting and simulating the impact of policy instruments at consumer level. Moreover, the specification of a detailed segmentation among households can provide a more complete picture of consumption patterns in Peru. Thus, our segmentation into education levels, housing regions or poverty levels can assist in the design of a range of possible policy interventions, for example, the provision of income supplements to less educated households or to households suffering from the most extreme poverty levels.

SUMMARY AND CONCLUSIONS

In this paper we have modelled the demand behaviour of consumers in Peru, estimating the QUAIDS model using the Peruvian Household Survey on the Quality of Life corresponding to 1997. We have desegregated total consumption into six goods, namely Food, Tobacco, Health, Transport, Leisure and Miscellaneous Goods. We have also considered various demographic characteristics, that is to say, the age and educational level of the family head, as well as the presence of children younger than 14, the housing region and, finally, the poverty level of the family.

Our results first indicate that the rank two AIDS model is rejected in favour of the rank three demographic QUAIDS model. Secondly, we have also noted that the presence of children in the household and the residence of the household in the capital city of Lima have a negative effect on household real income. Moreover, Transport and Leisure are luxury goods, Food appears with a value of around one and Tobacco, Health and Miscellaneous are necessity goods.

Finally, with respect to the elasticities calculated by demographics, we have observed that, in general, the values for Food, Tobacco and Health increase and those corresponding to Transport and Leisure decrease, with the age and educational level of the head, if there are no children in the household, if the region of residence is Lima or an urban area and, finally, with the economic level of the family.

Our policy recommendations for Peru, when viewed as a developing country, indicate that policy makers should not focus exclusively on economic variables. Similarly, whilst it is important to continue with the implementation of social programmes related to health and education issues, it is also crucial to restate that those benefited should be the targeted households, that is to say, the more vulnerable. This opinion is shared with other authors who also show that, although annual increases in the Peruvian GDP, e.g. by 5%, improve the economic situation of households, this is not enough to reduce poverty in a stable way. It is just as important to define social policies (education, health, …) that har-

moniously redistribute income, as well as to improve their efficiency in such a way that the individual becomes more productive (Francke, 1996a, 1996b; Moser, 1997; Altman, 2001).

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