An Estimation of Deep Parameters Describing Argentine Consumer Behaviour

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Abstract

This paper investigates the microfoundation of consumer decisions in Argentina. Structural parameters are estimated following the Euler Equation-GMM approach. Attention is focussed on parameter instability, an empirical difficulty for applying this method often pointed out in the literature. The rates of return on assets are approximated by the real interest rate and the rate of growth of real exchange rate as they have been considered as the main variables explaining variations of Argentine "wealth". The results show that parameter estimates have the expected values and signs. Overidentifying restrictions are tested and the null hypothesis of validity of instruments is not rejected. Estimates are also robust for different specifications of the weighting matrix. However, parameter constancy is jointly rejected. Recursive estimates show that the risk aversion coefficient appears as more unstable than the impatience parameter, which is also the less uncertain within sample. Observed changes in estimates seem to be an appropriate response to different macroeconomic frameworks.

Key words: consumer behaviour – Euler-Equation – Generalised Method of Moments – parameter instability – recursive estimation.

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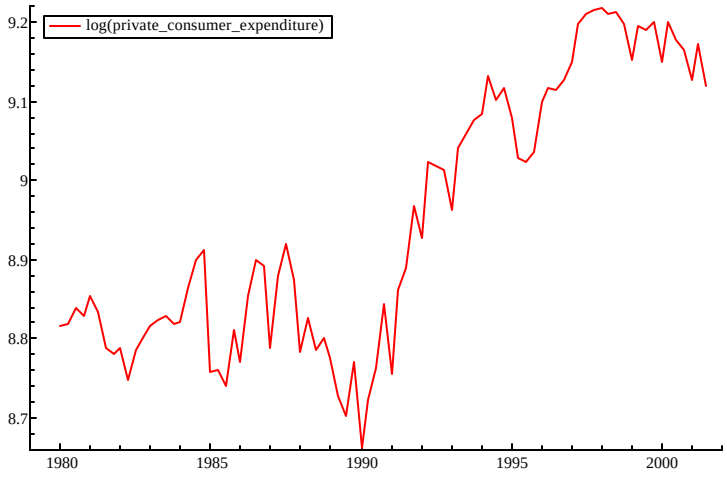
1. Introduction

Argentina has been a notorious case of macroeconomic instability even before the disrupting episodes of early 2002 when the government announced the default on its sovereign debt and the abandonment of the Convertibility regime. While in developed countries economists try to forecast the increase or decrease in the trend rate of growth of consumption, in Argentina the sign of this trend is uncertain, as can be appreciated in the next figure where the time-series of private consumers' expenditure is plotted.

Figure 1. Time series of Argentine consumption in logs



Briefly, the eighties were characterised by low activity and consumption levels along with high-inflation and even outbreaks of hyperinflation. The nineties, however, showed a period of income and consumption expansion after price-stability was obtained under the Convertibility regime, although unemployment and external indebtedness also increased. The relative tranquillity of this period was temporarily interrupted in 1995 due to the regional effects of the Mexican devaluation (known as "Tequila effect") and also in 1998 and 1999, with the Russian

and Brazilian crisis. These episodes changed the “mood” for “sustainability” of emerging markets. Although the Convertibility withstood this external shock, it was a first evidence of the vulnerability of this monetary regime. Can “rationality” in consumer behaviour be assumed for an economy subject to a macroeconomic variation like this?

This paper investigates the microfoundation of consumer decisions following the Euler Equation-Generalised Method of Moments (GMM) approach as proposed by Hansen and Singleton (1982), who enriched empirical rational expectations models (see also Hamilton (1994)). Thus, the estimation is focussed on the deep parameters describing tastes of consumers in a model assuming intertemporal optimisation and rational expectations.

A critical point when applying this approach is that the parameters of such a model should be supposed invariant to policy regimes. As Favero (2001, p.227) points out “in general the parameters estimated on aggregate time–series data by implementing GMM on Euler Equations derived by different intertemporal optimisation problems are unstable over time”. He also indicates “such instability is clearly incompatible with their nature as parameter describing tastes and technology suggested by theoretical models”. Therefore, the stability of the deep parameter estimates in the Argentine case is a key issue to address.

The outline of the paper is as follows. Next section discusses some methodology issues. Section 3 presents econometric results divided into: 3.1, estimation results and 3.2, parameter stability. Section 4 concludes.

2. Some methodology issues

As Muellbauer and Lattimore (1995) indicate "1978 was a milestone for research on the aggregate consumption function". Hall (1978) proposed an alternative econometric approach to the traditional study of the life cycle–permanent income hypothesis (LC-PIH)[1]. Modelling an intertemporal consumption decision by a "representative consumer" with "rational expectations", he concluded that the evidence[2] supports a modified version of the LC-PIH in which the consumption follows an approximate random walk as derived from the Euler equations (first order conditions of the consumers´ maximisation problem) in the simplest model.

Empirical modelling of Hall's hypothesis was further developed based on the estimation of a dynamic rational expectation model by using the Generalised Method of Moments (GMM). Hall (1978) had obtained his conclusions estimating directly, from aggregate data, the first order condition being consumers as well informed as the econometricians studying their behaviour. If expectations were formed rationally, the errors in forecasting would be uncorrelated with the information people had available at the moment of the forecast. When econometricians could observe the subset of information people used, the rational expectations approach suggests the orthogonality conditions to be used for GMM.

An application of this approach to the consumption function using GMM was presented by Hansen and Singleton (1982). They considered a model for U.S. per capita aggregate real consumption expenditure as a measure of the level of spending on consumption goods by a particular stockholder. They used lagged consumption growth rates and lagged rates of return on invested assets as

[1] In this year, the first estimation of a consumption function using an "Equilibrium Correction" model was also published (Davidson, et. al. (1978)).
[2] This implication is tested with time-series data for the post-war United States (1948-1977).

instruments, which are assumed to be uncorrelated with the errors to estimate by GMM the unknown parameters describing preferences.

Two critical issues related to this approach should be considered. Firstly, the GMM estimation of a standard Euler Equation would not be appropriate when liquidity constraints were introduced in the intertemporal optimisation problem (see Muellbuer and Bover (1986), Muellbauer and Lattimore (1995) and Favero (2001)). Secondly, an empirical question is posed: whether or not is valid to suppose the behaviour of an individual agent for aggregate data (see also Muellbauer and Lattimore (1995) and Favero (2001)).

Ahumada and Garegnani (2003) provide some evidence about these questions, which would not be critical in the Argentine case. Firstly, their econometric results from the "solved out" consumption function showed that consumers' behaviour could not be interpreted in terms of models of liquidity constraints as suggested by Muellbauer and Bover (1986) and DeJuan and Seater (1999). Muellbauer and Bover (1986) justify the inclusion of an equilibrium correction term as a way of testing the existence of liquidity constraints. The restriction implied for their expectational form of the equilibrium correction (the estimated coefficient of Δy_t and y_{t-1} should be equal) was tested and rejected. From a different view, DeJuan and Seater (1999) propose verifying an asymmetric response of consumption to rising or falling income. Under the hypothesis of liquidity constraints, consumers´ response to positive changes in income should be greater than that to negative changes. The hypothesis of equal response of consumption to increases and decreases of income was not rejected according to the linear restrictions tests applied to Argentine data. Regarding the second issue, results did not change using aggregate or per capita variables (but controlling by population) so aggregate data could describe the (mean) representative consumer behaviour as well.

Therefore, from the evidence provided by the consumption function approach, liquidity constrained consumers and the assumption of a representative consumer do not appear as limitations to apply the standard Euler-Equation approach to the Argentine case.

As suggested by Favero (2001), the stability of deep parameter estimates on aggregate time–series data obtained by GMM on Euler Equations is a central issue. However, testing parameter constancy is related to another question involving GMM estimates. Since simulation studies that investigated the small sample distribution of GMM estimators and associated statistics (see for example Hayashi (2000)), have found that usual statistics to test zero coefficients rejects the null too often, such finding could also affect parameter stability tests. “Highly precise” estimates could make confidence intervals too narrow and could increase the probability of detecting parameter changes. The Argentine case would contribute to the study of this issue by comparing the recursive estimates of each deep parameter, which showed very different sample uncertainty.

Next section presents the results of estimating Euler Equations for Argentina’s consumer expenditure.

3. Econometric results

3.1. Estimation results

In this study, the sample period starts in the first quarter of 1980 and ends in the third quarter of 2001, just before the economic and political turmoil experienced by the country previously to the announcement of the default on public debt and the abandonment of Convertibility (at the end of 2001 and beginning of 2002).

Table 1 presents the estimates[3] of the deep parameters of an Euler Equation when the utility function is of a constant relative risk aversion form,

$$E_t\{b(1+r_t)c_{t+1}^{-g}\} = c_t^{-g}$$

where c is the per capita private consumer's expenditure, β is the impatience parameter, and γ is the (absolute value of) risk aversion parameter; r represents the returns on assets: the real interest rate on time deposits and the rate of growth of real exchange rate. The instruments used are lagged values of all these variables dated t-1.

In the Argentine case, the rates of return on assets are approximated by the real deposit interest rate and the rate of growth of the real exchange rate[4] since, from the econometric study of the consumption function, they appear as the main variables explaining the variation of "perceived wealth" (see Ahumada and Garegnani (2003)).

Since GMM estimates can be very sensitive to the choice of the method to estimate the weighting matrix, different options are compared in Table 1.

Table 1. GMM Estimates and Standard Errors (S.E) of Deep Parameters

GMM estimates	Weighting Matrix Estimator			
	Newey-West Fixed (4)*	Newey-West Fixed (3)*	Andrews (3.12)*	Variable Newey-West (6)*
b	0.9912	0.9906	0.9904	0.9919
S.E	*0.0026*	*0.0026*	*0.0027*	*0.0027*
g	0.4123	0.3778	0.3631	0.4100
S.E	*0.0788*	*0.0944*	*0.1265*	*0.0860*
J-statistic	0.1266	0.1430	0.1711	0.1074

*Lag truncations are in brackets

[3] Eviews was used. See user's guide for a description of each weighting matrix estimator.
[4] Since the exchange rate was nominally fixed under Convertibility, it was approximated in real terms by the ratio of wholesale to consumer prices given the greater weight of non-tradables in the last index.

The estimates of β and γ do not differ across these alternatives. As expected β is between 0 and 1, greater values of this parameter mean that the consumer places a greater weight on future events and γ, is positive representing concave preferences measuring the (absolute) value of the relative risk aversion coefficient.

Since the number of orthogonality conditions exceeds the number of parameters to be estimated, the validity of the overidentifying restrictions are tested using the statistic suggested by Hansen (1982)[5]

$$T.J-statistic \sim \chi^2(p-q)$$

where T is the number of observations, p is the number of orthogonality conditions and q is the number of parameters. Given the observed value,

$$T.J-statistic = 9.02 \quad (6)$$

the null hypothesis of validity of instruments is not rejected at traditional significance level[6].

3.2. Parameter stability.

In order to analyse the structural stability of the model a Wald test (proposed by Andrews and Fair (1988)) is firstly used (see also Hamilton (1994)). The following chi-square statistic under the null evaluates the hypothesis, $H_0 : q_1 = q_2$ where q_1 (q_2) is a (q x 1) parameter vector that characterises the first T_0 (the last $T-T_0$) observations.

[5] This statistic is computed for the results obtained using the Variable Newey-West estimator of the weighting matrix (the less restricted form).

$$\lambda_T = T(\hat{\theta}_{1,T_0} - \hat{\theta}_{2,T-T_0})'\{\pi^{-1}\hat{V}_{1,T_0} + (1-\pi)^{-1}\hat{V}_{2,T-T_0}\}^{-1}(\hat{\theta}_{1,T_0} - \hat{\theta}_{2,T-T_0}) \sim \chi^2(q)$$

where π is the fraction of observations contained in the first subsample T_0/T, $\hat{\theta}_{1,T0}$ ($\hat{\theta}_{2,T-T0}$) is the parameter vector estimates with the first T_0 (the last $T-T_0$) observations and $\hat{V}_{1,T_0}$ ($\hat{V}_{2,T-T_0}$) is the estimated coefficient covariance matrix with the first T_0 (the last $T-T_0$) observations.

As this type of statistics requires the definition of a break-point, T_0 was set so that the second period started with the beginning of the Convertibility Regime (see Figure 1). Two periods, 1980:1-1991:1 and 1991:2-2001:3, could be clearly distinguished according to the behaviour of the private consumers' expenditure. Between 1980 and 1989, consumption experienced no defined trend and even a strong fall was observed in 1985 and during hyperinflation period (1989-1990). Since the beginning of the Convertibility plan (1991:2) and during the periods of economic reforms carried out by the economic authorities in a context of exchange rate and price stability, the private consumers' expenditure presented a positive trend.

Parameter estimates for the two samples are presented in Table 2. Results are only reported for the "Variable Newey-West" estimator of the weighting matrix. Although results do not differ across different methods, the selected estimator is more flexible and shows the minimum value of the J-statistic in comparison with the obtained for the other options.

[6] If the instruments were dated t-2 the results are similar with a lower estimation of the risk aversion parameter and

Table 2. GMM Estimates for Different Subsamples

GMM estimates	1980:1 1991:1	1991:2 2001:3
b	0.9847	0.9969
S.E.	*0.0033*	*0.0009*
g	0.5129	-0.0286
S.E.	*0.1099*	*0.0805*
l_T = 976.1526 (2)		

Weighting matrix estimator: Variable Newey-West

Jointly tested, parameter constancy over the last two decades is clearly rejected for Argentina. Estimates for the first subsample show similar results to those obtained for the whole sample. Instead, using the second subsample, estimates are quite different, in particular in the case of the risk aversion parameter (γ) which shows the opposite sign but it is not significant.

Constancy can also be evaluated using recursive estimates of each structural parameters in the model, without the need to define a break-point[7]. The individual analysis also allows the stability comparison of estimates which are quite different in sample uncertainty (see the S.E for β and γ in Table 1 and 2).

Figures 2 and 3 show the recursive estimates of β and γ along with their 95% confidence intervals. The recursive estimates of the risk aversion parameter (γ) are clearly outside the limits of the previous intervals. Estimates appear as more stable for the impatience parameter, which are, at the same time, the more precise and therefore, have the narrower intervals.

a greater value of J-statistic.

[7] There would be a "degrees of freedom" problem when the sample is broken by a T_0.

Figure 2. Recursive graphic of the impatience parameter estimates

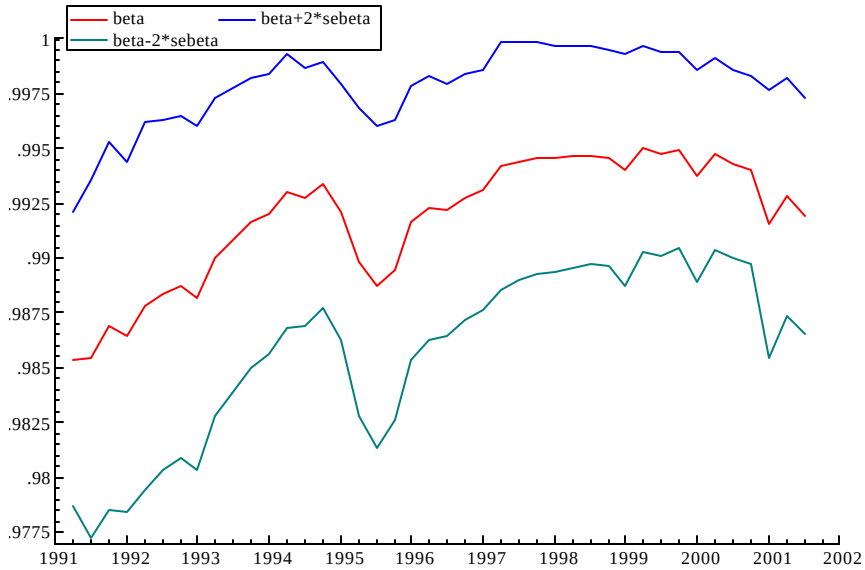
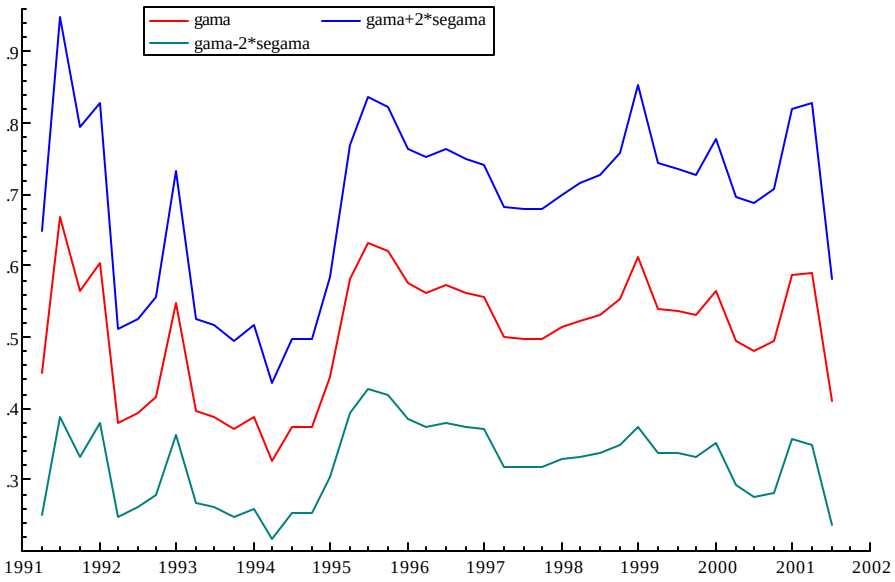


Figure 3. Recursive graphic of the risk aversion parameter estimates



Given such behaviour, analysing the evolution of both parameters over time is worthwhile. Regarding the risk aversion coefficient, the representative agent seems to have diminished the degree of aversion after Convertibility was adopted in the early nineties but, sharply reverted to initial values following the Mexican devaluation ("the Tequila effect") which cast doubt on the permanence of the monetary regime and the solvency of the financial system. As for the impatience

parameter, it shows some evidence that more weight of future consumption was put on the utility function during the first years of Convertibility, although it temporarily decreased (more impatience) during the Mexican crisis. Even though results could be different for larger shocks that imply economic disruption, recursive estimation can help to understand the non-constancy of the deep parameters for a representative consumer living in Argentina during the last decades.

4. Conclusions

This paper has dealt with the estimation of the structural parameters of consumer behaviour following the Euler Equation-GMM approach for an economy subject to great macroeconomic instability: Argentina (1980:1-2001:3).

The results show that parameter estimates have the expected values and signs. Overidentifying restrictions have been tested and the null hypothesis of validity of instruments (one-lagged values of all variables of the model) was not rejected. Estimates are robust to different specifications of the weighting matrix.

The critical question of parameter stability has been evaluated in two forms: jointly by a Wald test and by recursive estimation of each parameter. Deep parameters appear as unstable when jointly tested cutting the sample in the period when the Convertibility regime started. Recursive estimates show that the coefficient of risk aversion is clearly not constant but the impatience parameter, which has the less uncertain estimates, would be the more stable. However, their variations can be interpreted as an appropriate response to different macroeconomic frameworks. When the new rules under the Convertibility regime were perceived, the representative consumer turned less impatient and less risk averse but, when the Mexican crisis cast doubt on the permanence of this monetary arrangement and the

solvency of the financial system, this representative consumer of Argentina became, again, more risk averse.

Appendix 1: Data definitions and sources

Private Consumption: Private consumers' expenditure. Ministry of Economy and ECLAC Bs.As.

Real exchange rate: Ratio of wholesale to consumer prices. INDEC.

Interest rate: Deposit rate. International Financial Statistics-IMF.

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