Modelling consumption behaviour in centrally planned developing countries

Part 2

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the rise in total employment associated with the process of industrialisation. It is also interesting to note that the share of farmers' income in total income is relatively low by LDC standards. For example, it was only 14.7% in 1979 and had fallen to 12.7% by 1984. If we exclude farmers' wages these two figures would be 8.1% and 7.8% respectively.[9]

Table 3 shows how the Algerian consumer allocates its expenditure between food, manufactured goods, and services in 1963, 1969, and 1980. Although one would expect a shift in spending away from food towards the other two categories as part and parcel of the process of industrialisation, the practice of rationing manufactured goods and services, soaring inflation, and the demographic characteristics of the Algerian family, including large family sizes and high dependency ratios, helps to explain the 'perverse' increase in the share of food in total consumption between 1969 and 1980. These aggregate figures do, however, conceal differences in rural and urban per capita consumption. Data from a survey carried out by the Algerian National Statistical Office covering the period 1979/1980 suggest that average expenditure per capita was significantly higher in the urban sector than in the rural sector.

Inevitably the pursuit of rapid industrialisation and policies neglecting agriculture led to high urbanisation rates and heavy price inflation. The urban population increased from 20% of the total population in 1966 to about 44% in 1984. This largely resulted from the familiar pattern of rural to urban migration within LDCs, with about one million people moving to the cities between 1966 and 1977.[10] The result was excess demand for consumer goods and an acceleration in price inflation, especially in the 1970s. As table 4 suggests, food prices

	1963	1970	1977	1984
			%	
Wages	49.0	47.4	54.7	63.4
Property income	31.0	35.0	29.3	25.0
Transfers	20.0	17.6	16.0	11.6
Total	100	100	100	100

Price indexes (1969=100) [1]	1963-73	1974-84	1963-84
Consumer goods	1.90	10.70	6.10
Food	4.07	12.14	8.62
Manufactured goods	2.56	10.28	6.70
Services	1.74	7.13	4.11

1. Average annual percentage changes.

	1963	1969	1980
		%	
Food	47.3	45.7	55.7
Manufactured goods	30.0	37.2	31.7
Services	22.7	17.1	12.6
Total	100	100	100

rose particularly fast compared with the prices of manufactured goods and services. The authorities responded by imposing price controls and regulating the distribution of agricultural produce as well as expanding public sector retail outlets and imports of durable consumer goods.

[4] Estimation of consumption functions for Algeria 1963-1984

In this section we estimate 12 equations relating to aggregate consumption behaviour in Algeria spanning the time period 1963 to 1984. These equations are drawn from the literature reviewed in section [2] above. We begin by considering some data and methodological problems, followed by a specification of the equations selected from the consumption function literature, and an analysis of the results.

[4.1] Data problems

As far as data sources are concerned, we were confronted with a number of problems relating to the series on expenditure and income which necessitated considerable manipulation of the official data series on our part. Although development planning began in Algeria in the middle of the 1960s at the macroeconomic level, national income and product data is available only for short periods in annual form and flow of funds data is almost non existent. In fact most of the relevant series begin 1967 and there is a four year lag in producing data in real terms. The most serious deficiency, however, from the point of view of this study is the lack of a reliable estimate of personal disposable income. In order to gain some degrees of freedom we chose to start our series from 1963 by compiling data from a number of different sources even though this meant some loss of continuity. Appendix I elaborates on these problems and explains in more detail how we derived the series used in our empirical work.

We also encountered an important methodological problem arising from the status of Algeria as a CPE. The official estimate for aggregate

[2] Ct = a + b1 Yt + b2 d1Yt

Equation [3] modifies [1] by including a variable Lt representing holdings of liquid assets in line with the views of Tobin (1952). For Algeria we used real cash balances as a proxy.

[3] Ct = a + b1 Yt + b2 Lt

Equation [4] follows Klein's (1947) inclusion of the liquidity variable in the income change model above.

[4] Ct = a + b1 Yt + b2 d1Yt + b3 Lt

In contrast to the models above which use current income as the major explanatory variable, equation [5] is based on the life cycle hypothesis which emphasises the importance of the stream of expected or 'normal' income in the consumption decision. In their original formulation of the life cycle hypothesis Ando and Modigliani (1963) suggested that current real consumption be related to expected labour income and aggregate net worth. Since 1963 there have been a number of attempts to test this hypothesis and we chose the version presented by Modigliani and Tarantelli (1975) in which At represents real per capita cumulated personal savings (as a proxy for wealth) and Ut is the level of unemployment. The latter is included because of the effects of industrialisation on the APC as suggested in our review of the literature above.

[5] Ct = b1 Yt + b2 At + b3 Ut

Equations [6] to [9] all focus attention on 'permanent income' as

consumption is calculated as a residual from the total expenditure accounting identity[4]. Hence the consumer expenditure deflator is also derived from this identity. This methodology inevitably biases the deflator downwards since many of the components of this identity, such as government consumption and public investment, are traded predominantly within the public sector and are insulated from market forces. Since, however, consumer goods are largely traded in the private sector where price controls are relatively weak, the official prices of consumer goods deviate somewhat from the actual prices at which these goods are traded, which are generally of a higher order. The use of the consumption deflator would, therefore, almost certainly overstate the degree of disequilibrium in the market. As a result we decided to construct our own price index based upon a published index of a basket of goods traded in Algiers. Further details on this index have been relegated to Appendix I.

[4.2] The equations

Equation [1] tests a simple Keynesian absolute income hypothesis where current consumption is a function of current personal income. Both Ct and Yt are in real per capita terms in this and all subsequent equations and the income variable is defined as real disposable income. The actual variables used in the estimated equations are listed in Appendix II together with their sources.

$$[1] \quad Ct = a + b\,Yt$$

Equation [2] adds an income change variable to [1] along the lines suggested by Friend (1946) and Mach (1948), the symbol d indicating a first difference operator.

Yw and real per capita income from property Yp on consumption with the a priori expectation that the MPC out of Yw will exceed that out of Yp.

[10] Ct = a + b1 Ywt + b2 Ypt

Equation [11] extends this model by including a lagged dependent variable and [12] follows Song's (1981) formulation which includes the level of unemployment.

[11] Ct = a + b1 Ywt + b2 Ypt + b3 Ct-1

[12] Ct = a + b1 Ywt + b2 Ypt + b3 Ut

proposed by Friedman (1957) or 'habit persistence' in consumer behaviour. [6] can, therefore, be viewed either as a test of Friedman's permanent income hypothesis after a Koyck transformation has been applied, or alternatively as a test of Brown's (1952) habit persistence hypothsis.

$$[6]\quad Ct = a + b1\ Yt + b2\ Ct-1$$

Equation [7] follows Zellner's (1957) addition of a liquidity variable to Friedman's permanent income hypothesis.

$$[7]\quad Ct = a + b1\ Yt + b2\ Ct-1 + b3\ Lt$$

Equation [8] incorporates a suggestion by Houthakker and Taylor (1970) that a proper specification of the habit formation process requires both lagged consumption and lagged income as well as an income change variable.

$$[8]\quad Ct = a + b1\ dlYt + b2\ Ct-1 + b3\ Yt-1$$

Finally, in this context, equation [9] follows Modigliani's (1949) specification of a consumption function which includes a lagged income variable with a current income variable.

$$[9]\quad Ct = a + b1\ Yt + b2\ Yt-1$$

Equations [10] to [12] all attempt to distinguish between different income recipients along the lines first suggested by Kaldor (1960). This tests separately for the influence of real per capita labour income

for forecasting performance. In addition, the real balances variable in equation [4] was insignificant and the coefficient associated with the income change variable was negative, contrary to expectations. In view of the data problems associated with real balances in the context of Algeria, we decided to reject these two equations.

Equation [5] was designed to evaluate the life cycle model of Modigliannl and Tarantelli. However, the coefficients on the unemployment variable Ut and the wealth variable At were very small, being 0.003 and 0.049 respectively. This might be because it excludes savings in real as opposed to financial assets and savings in gold, which are important components of personal saving in Algeria.

Equations [10], [11] and [12] which distinguish between property income and wage income also turn out to be unsatisfactory. The coefficient on the property income variable was very small and statistically insignificant in all three cases (and negative in [10]) and the marginal propensity to consume out of wages was correspondingly high and close to unity in [10] and [12]. This is in clear contradiction to the forced savings assumption and the fact that property income contributes between a quarter and a third of personal income.[14] In addition, the inclusion of the unemployment variable in [12] to account for the secular decline in the average propensity to consume due to the large increase in wages did nothing to correct the discrepancy between the MPC out of wages (0.984) and the MPC out of property income (0.03).

Table 5 presents the short-run and long-run MPC's for the five remaining consumption functions which were judged satisfactory on statistical and theoretical grounds. The MPC from the Keynesian

[4.3] Estimation and results

Equations [1] to [12] were estimated by ordinary least squares over the time period 1963 to 1984 in real per capita terms using Hendry's (1986) PC-GIVE econometrics package. The variables are defined in Appendix II and the results are listed in Appendix III together with some appropriate statistics.[12] Where autocorrelation was detected on the basis of the Durbin-Watson or Lagrange multiplier tests, or the Durbin h-statistic if a lagged dependent variable was present in the equation, appropriate corrections were made via the maximum liklihood method (equations 1,2,3,4,7,9,10). We also exposed the equations to a battery of other statistical tests from PC-GIVE covering residual autocorrelation and normality, heteroskedasticity, functional form misspecification, parameter constancy and forecasting performance.[13] For brevity we have not reported all the relevant statistics here and in the discussions which follow we refer only to those equations which fail one or a number of these tests or which appear unsatisfactory on theoretical grounds.

Although the Keynesian absolute income equation [1] generally produced satisfactory results (despite an insignificant intercept term), the addition of an income change variable into this model in equation [2] proved to be unsatisfactory. Although the coefficient was significant it had the wrong sign. Consequently, this equation was was dropped from the list.

Equations [3] and [4] which introduced real cash balances into the simple Keynesian model and the income change model also proved unsatisfactory. Both equations failed the Chow test for parameter constancy over the period 1968-1984 and only marginally passed the test

		short-run MPC	Long-run MPC	Income elasticity
[1]	Keynesian	0.738	-	0.905
[6]	Friedman/Brown	0.337	0.840	0.957
[7]	Zellner	0.205	0.439	0.485
[8]	Houthakker/Taylor	0.372	0.837	0.925
[9]	Modigliani	0.472	0.80	0.909

absolute income hypothesis of 0.738 is a little lower than one might expect for a developing country where it is usually closer to 0.9. However, given high forced savings ratios and high capital to output ratios in Algeria over this period associated with planned industrialisation and a deliberate policy of giving priority to capital goods production, perhaps this is not so surprising. The savings ratio is likely to fall in the 1980s under the First Five Year Plan 1980 to 1984 where greater emphasis is being placed on investment in small-scale industry in the consumer goods sector and upon reviving agriculture.

The dynamic models all generate substantially lower short-run MPC's ranging from 0.205 from the Zellner model to 0.472 from that of Modiglianni. Moreover, with the somewhat surprising exception of the Zellner model, the long-run MPC lies in the vicinity of the Keynesian short-run MPC, ranging from 0.80 in the Modigliani case to 0.84 in the Friedman/brown model. In all cases except the Zellner model the income elasticity lies close to unity.

Finally, table 7 compares the equations in terms of their forecasting performance according to their root mean square errors and Theil inequality coefficients calculated from a historical simulation over the whole period; and the Akaike information criterion. All three criteria suggest that the Zellner model performs best and the Keynesian model worst, although generally the other four models appear to perform satisfactorily overall.

	RMSE	THEIL	AKAIKE
[1] Keynesian	0.648	0.971	46.750
[6] Friedman/Brown	0.374	0.556	24.294
[7] Zellner	0.334	0.508	21.440
[8] Houthakker/Taylor	0.372	0.552	26.060
[9] Modigliani	0.512	0.757	33.072

[5] Conclusion

In this paper we have considered the relevance of conventional consumption function analysis to an economy such as Algeria which combines the features of a centrally planned economy and those structural features usually associated with developing countries.

Of the 12 aggregate functions drawn from our review of the consumption function literature pertaining to both developed and developing countries, five were judged to be satisfactory on statistical and theoretical grounds. This suggests that even in an economy characterised by a high degree of imperative planning and rationing of consumer goods, with high priority given to saving and industrial development, the partial effect of such planning still enables sufficient market behaviour to make the estimation of aggregate consumption functions a useful part of economic planning.

In addition, the lack of adequate data to test some of the more sophisticated theories of consumer behaviour, together with the observation that financial and money markets are relatively limited in Algeria over our time period, seems to suggest that more success is likely to be achieved with the simpler forms of consumption function. Our empirical work supports this contention.

One final problem relates to the interpretation to be given to our findings. We have implicitly been assuming that our estimated equations are valid representations of the demand side of the consumer goods market. If, however, there were to be sustained excess demand over the entire period so that all the observations would have related to the supply function and not the demand function, then fitting a demand curve

to these observations would have been meaningless. As Portes and Winter (1978) have pointed out, however, a combination of a good statistical fit for the demand equations and some a priori information about the history of the Algerian economy between 1963 and 1984, enables us to make a reasonable judgment about the interpretation to be given to our results. If, for example, the fitted consumption function substantially over-predicts actual consumption, then one would suspect strong excess demand leading to forced saving. If on the other hand, the residuals underpredict consumption, then this may suggest that abnormally high spending by consumers was satisfied by planners running down stocks, allocating additional supplies to the consumer goods sector, or allowing price increases.

In terms of Algeria, in the pre-development era (1963-69) one would have expected predicted consumption to have fallen below actual consumption as a result of restrictions on wage growth and the existence of high unemployment. In the development era, however, when rationing policy was in force, one would have anticipated that actual consumption would have fallen short of intended consumption as a direct consequence of rationing policy. In the period since 1980, on the other hand, one would have expected a narrowing of the gap between actual and expected consumption insofar as credit controls were relaxed and there was a significant increase in imports of durable consumer goods.

Table 6 calculates the ratio of expected to actual consumption on the basis of residuals taken from the 'satisfactory' models estimated above, and the results conform to a priori expectations about the planning regime in Algeria since 1963. From 1963 to 1966 there are negative values for this ratio indicating expected consumption below actual consumption; this is reversed during the planning period 1970-79, and

	1963-69	1970-79	1980-84
[1] Keynesian	-2.73	2.55	-1.87
[6] Friedman/Brown	-1.54	0.67	-0.60
[7] Zellner	-1.43	1.24	-0.43
[8] Houthakker/Taylor	-0.40	0.40	-0.43
[9] Modigliani	-2.65	2.77	-0.78

1. These ratios are calculated as averages of the difference between expected and actual consumption as a percentage of average actual consumption.