MISCELLANIOUS

The national income identity:

$Y = C + I + G + X - M$ (1)

Y=GDP

C=Consumers' expenditure

I=Investment

G=Government spending

X=exports

M=imports

2 Consumers' expenditure. Let us set up a simple model

$C = a + bYD$ (2.1)

YD=personal disposable income = (1-t)Y (2.2)

Where a = autonomous consumption, b = the marginal propensity to consume, t = the tax rate, (1-t) = the proportion of every pound earned retained as income after taxes. The marginal propensity to consume represents the change in consumption (Δ C), following a change in disposable income (Δ Y). It is $\Delta C/\Delta Y$ and in the above equation equals b. This is an example of the simple Keynesian consumption function (after the economist John Maynard Keynes). An example of Keynesian economic policy would be when the government wished to increase Y by increasing C. It could do this by cutting t, increasing YD.

Alternatives to the Keynesian consumption function are provided by Milton Friedman's permanent income hypothesis and Ando and Modigliani's life cycle hypothesis. The former postulates that consumption can be modelled such:

$C_t = a + bYD^P_t$ (2.3)

Where YD^P is 'permanent income'. In practice Friedman proxied permanent income by a weighted moving average of past incomes:

$YD^P_t = \gamma_0 YD_t + \gamma_1 YD_{t-1} + \gamma_2 YD_{t-2} + \gamma_3 YD_{t-3} + \ldots\ldots\ldots\ldots\ldots..$ (2.4)

where $\gamma_0 > \gamma_1 > \gamma_2 > \ldots\ldots\ldots\ldots\ldots$ In practice, however we do not estimate:

$C_t = a + b(\gamma_0 YD_t + \gamma_1 YD_{t-1} + \gamma_2 YD_{t-2} + \gamma_3 YD_{t-3} + \ldots\ldots\ldots\ldots\ldots..)$ (2.5)

But $C_t = \beta_0 + \beta_1 YD_t + \beta_2 C_{t-1}$ (2.6)

(Note: t denotes the time period, t is current time period, t-1 previous one and so on. The use of β 's in an equation like (2.6) is standard in economics. Comparing (2.5) and (2.6) we can see that a= β_0.) In equation (2.5) the bigger the influence of the past, the bigger will be γ_1, γ_2,.. etc in relation to γ_0. In equation the influence of the past is picked up by β_2. The closer this is to 1.0 (its upper bound), the greater the influence of past consumption on present. In terms of Keynesian economic policy, a cut in taxes which increases YD_t will have a much more muted impact on C in (2.6) than in (2.1). Friedman's whole career has been spent on trying, with considerable success, to prove that Keynesian economic policy is (i) harmful and (ii) ineffective in controlling Y.

The consumption function is one of the most researched concepts in economics and still the research goes on. To(2.6) we might consider adding (i) the real rate of interest (r_t) and (ii) the rate of inflation ($\dot{p}_t$):

$$C_t = \beta_0 + \beta_1 YD_t + \beta_2 C_{t-1} + \beta_3 \dot{p}_t + \beta_4 r_t \qquad (2.7)$$

The impact of the rate of interest is obvious, it represents the returns to savings. If people respond to these returns (i.e. they are 'incentive savers') then a higher rate of interest will increase savings and thus reduce consumers expenditure (β_4<0). But there are alternative possibilities. They may be 'target savers', saving for a specific amount (£1000 for a holiday) an increase in the rate of interest will allow them to reach their target more easily, hence they need save less and consume more (β_4> 0). The impact of inflation was first suggested by Angus Deaton - then at Bristol. He showed that empirically the evidence is strong that an increase in inflation tends to reduce consumers expenditure (β_3 <0), but he failed to provide a satisfactory explanation as to why this should be so. Probably the best explanation is that inflation tends to erode people's wealth (or at least that which does not increase with inflation) to restore this to its desired level people save more and spend less.

The Bank of England's Model from:
http://www.bankofengland.co.uk/publications/Documents/other/beqm/1999/new_app.pdf

(iii) Consumers' expenditure

Consistent with the permanent income hypothesis, consumers' expenditure (*C*) is a function of real wealth (*WEL*/*PC*) and real labour income (*LY*). The level of nominal short rates also affects consumers' expenditure, reflecting both credit constraints and intertemporal substitution. Changes in the unemployment rate are included in the dynamics, as a proxy for changes in consumer confidence.

$$\begin{aligned}\Delta c_t = &-0.004 + \underset{(3.02)}{0.19}\Delta ly_t + \underset{(3.48)}{0.09}\Delta\left(ydij_{t-1} - pc_{t-1}\right) - \underset{(-3.14)}{0.07}\Delta ur_{t-1} \\ &-\underset{(-3.21)}{0.15}\left[c_{t-1} - 0.87ly_{t-1} - 0.13\left(wel_{t-1} - pc_{t-1}\right) + 0.67\left(RS_{t-1}/100\right)\right]\end{aligned} \qquad \textbf{(A2.5)}$$

The consumption function looks odd. It is estimated in first differences because these are stationary. The key part in many respects is the part in [.]. This is the ***long run equilibrium*** equation for consumers expenditure which can be written as:

c = 0.87ly + 0.13(Log(WEL) –Log(PC)) -0.67RS/100

Log(C) = 0.87ly + 0.13Log(WEL/PC) -0.67RS/100

[The low case numbers, e.g. c denotes the log of the variables (e.g. consumption). WEL is nominal wealth, PC a price index, divide one by the other to get real wealth. The equation shows that if the log of income goes up by 1 unit then log of consumption goes up by 0.87. As both are logs this is an elasticity: a 1% increase in real labour income increases consumption by 0.87% in the long run equilibrium. Consumption also increases with real wealth and decreases with short term interest rates. Now if consumption is greater than 0.87LY + 0.13Log(WEL/PC) -0.67RS/100, then consumption is greater than its equilibrium value. I said earlier this is done in first differences because the variables are stationary. But so too is the term in [.] which denote differences from the equilibrium value.

The equation says consumption will fall in period t if this was the case in t-1 (-0.15 coefficient). The rest of the equation gives what we call the short-run dynamics. An increase in the unemployment rate (log of) reduces consumption by 0.19. But it is an impact restricted to period t alone (and a little bit in later periods as it has repercussions in moving c away from equilibrium), but no long-run impact. Same with the other short-run dynamics. This is called an **error correction model**. It is the way we tend to estimate relationships involving time series, with the change in consumption on the left hand side, changes in other variables reflecting the short-run dynamics and the difference between C and its equilibrium value in the previous period. The coefficient -0.15 reflects the speed of adjustment to previous 'errors'. If it is 0, no adjustment takes place. If it is -1 adjustment is immediate and full. The greater is this parameter the more rapid is adjustment. The following appears at the beginning of the document:

A number of conventions are applied. Lower-case letters indicate natural logs. The subscript *t* denotes time: data are quarterly. Δ indicates a first difference. Each relationship is written so as to distinguish the long-run solution of the equation from the short-run dynamics. Long-run solutions appear in square brackets, and follow from the usual practice of estimating 'error-correction models'. T-values and coefficients are shown in italics. Single-equation dynamic responses are given for some key variables.

The t statistics are given in (.) in equation A2.5. Ignore plus or minus sign. A rough rule of thumb is that if greater than 1.96 then we are 95% the variable should be in the equation (5% level of significance). All of the t statistics in A2.5 are comfortably above this.

This long run consumption function is not so different to ours:

$$C_t = 100 + 0.6YD_t + 0.3C_{t-1} - 5\,\dot{p}_t$$

This has lags in behaviour (from the error correction element), ours does via lagged consumption. We have real disposable income this has real labour income, this has wealth, we have inflation which erodes wealth.

Single-equation dynamic responses:

Response of consumers' expenditure (*C*) to a 1% shock to RHS variables

Quarters ahead	Per cent Real labour income	Real wealth	Unemployment rate	Real dividend income
1	0.29	0.02	-0.07	0.09
4	0.52	0.06	-0.04	0.06
8	0.70	0.09	-0.02	0.03
Long run (LR)	0.87	0.13	0.00	0.00
50% of LR by	3 quarters	5 quarters	n/a	n/a
90% of LR by	14 quarters	15 quarters	n/a	n/a

n/a = not applicable.

It is usual too to show the short-run dynamic responses. This is done in the above table. Just look at income. If that changes by 1% in the second quarter of 2013 then by the next quarter consumption will have increased by 0.29%. After 8 quarters (two years) it will have increased by 0.70%, still some way short of the full long run impact of 0.87%. This just goes to show the long lasting impact of shocks to the economy and indeed government policy variables. That makes policy making difficult. Changes made now impact well into the future.

See: http://www.bankofengland.co.uk/publications/Pages/other/beqm/modcobook.aspx

Investment Expenditure

One can distinguish between

inventory investment (investment in inventories or stocks of finished goods and raw materials),

residential investment (investment in housing, i.e. new housing), and

business investment or gross fixed capital formation (includes public sector investment, roads, hospitals, and machines).

In general we will be focusing on the latter, unless specified otherwise. The main factors influencing I will include the *real rate of interest* [r] and *Expected* future retained (i.e. net of company taxation) profits. The real rate of interest is (using the Fisher equation) equal to nominal interest rates (i) less expected inflation $\dot{p}_t^e$:

$$r_t = i_t - \dot{p}_t^e \qquad (3.1)$$

It is standard to denote inflation with a dot (•) above the p. The use of the superscript to denoted expectations is fairly standard.

Expected profits net of taxation indicate the potential importance of company taxation in determining investment. Taxes apart profits will depend upon how well the economy is doing and how well it is *expected* to do. How to model such expectations? One possibility – similar to the permanent income hypothesis is that we model expected profits (Π^e) as a weighted moving average of past profits:

$$\Pi^e_t = \gamma_0 \Pi_t + \gamma_1 \Pi_{t-1} + \gamma_2 \Pi_{t-2} + \gamma_3 \Pi_{t-3} + \ldots\ldots\ldots\ldots\ldots.. \qquad (3.2)$$

Hence (again similar to when we wanted to model lags in the consumption function) we can use the following equation:

$$I_t = \beta_0 + \beta_1 \Pi_t + \beta_2 r_t + \beta_3 I_{t-1} \qquad (3.3)$$

The lags involved in investment can be very long indeed, investment projects take a lot of planning, etc and it may be two years or longer before a change in interest rates has its full impact on investment. One version of the investment function which bypasses the link between profits and GDP is the accelerator model. The naïve accelerator is:

$$I_t = \gamma (Y_t - Y_{t-1}) \qquad (3.4)$$

Where γ is the capital-output ratio. A slightly more sophisticated version is:

$$I_t = \beta_0 + \beta_1(Y_t - Y_{t-1}) + \beta_2 r_t + \beta_3 I_{t-1} \qquad (3.5)$$

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Foreign Trade depend upon some measure of export demand, e.g.World output and competitiveness of Slovak (to be parochial) goods. The latter is reflected by the real effective exchange rate. Imports will also depend upon the real effective exchange rate and a demand variable, e.g. Slovak GDP. The balance of trade is the difference between exports and imports (X-M). It is in surplus when $X>M$ and in deficit when $X<M$. A trade deficit can be financed by (one way or another) 'borrowing' money from abroad. This may be explicit as for example borrowing from the IMF or on the World capital markets. Or it might be implicit when firms borrow on the world capital markets (where they may be able to obtain cheaper loans than in Slovakia) or when a foreign firm invests in Slovakia.

The Multiplier

An important contribution of Keynes' General Theory. If we increase government spending, GDP will rise, disposable income will rise, people will spend more consumption rises, pushing GDP up still further, disposable income will rise again, pushing up consumption again and so on. The potential is there for an increase in government spending of say 100 million Euros to generate an increase in GDP of much more than that. This is called the multiplier. However many economists would argue that it will lead to an increase in interest rates and possibly inflation. This will *crowd out* private sector expenditure. The potential is there for the multiplier to equal zero. In this case an increase in government spending of 100 million euros does not increase GDP at all.