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Liquidity constraints versus loss aversion in household consumption: a simple reconciliation

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Abstract

Various deviations from the Permanent Income consumption model with rational expectations have been discussed in the literature, including loss aversion and liquidity constraints. In the existing literature, however, these two types of consumption asymmetry have typically been considered as mutually exclusive and there is no consensus as to which form of asymmetry is more relevant empirically. Using a single data set for US personal consumption, income and wealth for the period 1953q1-2007q3, we show that evidence of either loss aversion or liquidity constraints can indeed be produced, depending on the theoretical and econometric framework applied. We then apply a simple new estimation framework that distinguishes short-run and long-run asymmetries and thereby helps reconcile the conflicting results from the previous literature. Our findings can also be interpreted in the context of the secular decline in the US personal savings rate before the outbreak of the financial crisis in 2007.

Keywords: Asymmetric error correction model, consumer economics, aggregate consumption and wealth.

JEL classifications: C22, D11, D12, E21

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1 Introduction

According to the rational expectations view of the Permanent Income Hypothesis, based on Hall (1978), consumption should depend solely on permanent income, given by human and other wealth. This benchmark model of consumer behaviour has never been unchallenged. From the very beginning, it has been argued that the traditional Keynesian link between current income and current consumption was still relevant in modern economies due to, for example, the existence of non-Ricardian rule-of-thumb consumers (Campbell and Mankiw, 1989) or to social norms and habits (Akerlof, 2007). Going one step further, the behaviouristic literature has produced considerable evidence suggesting that individuals tend to react differently to positive and negative changes in economic variables (Kahneman et al., 1991).

One type of consumption asymmetry, typically discussed in the context of the 'wealth effect on consumption', refers to the notion of liquidity constrained consumers: Whereas consumers can readily reduce consumption in response to falling asset prices, some consumers may find it difficult to borrow to increase consumption, when their wealth increases (*e.g.* Carroll, 2001). The opposite kind of consumption asymmetry is implied by the notion of loss aversion, whereby "losses loom larger than corresponding gains" (Tversky and Kahneman, 1991, p. 1039). As a consequence, consumers can be expected to be more reluctant to reduce their standard of living as income or wealth decline than to increase consumption following positive wealth or income changes.

In the existing empirical literature, liquidity constraints and loss aversion have typically been regarded as mutually exclusive. For instance, Shea (1995, p. 799) concludes that his "findings are inconsistent with myopia and liquidity constraints, but are qualitatively consistent with recent work incorporating loss aversion into intertemporal preferences". Similarly, Bowman et al. (1999, p. 156) hold that their evidence of loss aversion is "inconsistent with both the Permanent Income Hypothesis and with alternative explanations of other apparent violations of the Permanent Income Hypothesis, such as liquidity constraints or Campbell and Mankiw's (1989) rule-of-thumb behavior." (For a similar conclusion, see Romer, 2001, p. 323). Conversely, Apergis and Miller (2005, p. 17) find evidence of liquidity constraints and emphasise that their "results differ from those reached by Kahneman et al. (1991), Shea (1995), and Bowman et al. (1999)". The current state of the debate is that while saving anomalies have been well documented and asymmetries generally seem to play an important role, there is no consensus as to which types of asymmetry are most relevant empirically for aggregate consumption (see *e.g.*, Akerlof and Shiller, 2009, ch. 10, for a discussion).

In this paper, using a single data set for US personal consumption, income and wealth for the period 1953q1-2007q3, we show that evidence of either loss aversion or liquidity constraints can indeed be produced, depending on the theoretical and econometric framework applied. We then apply a simple new estimation approach recently put forward by Shin et al. (2010) that distinguishes short-run and long-run asymmetries and thereby helps reconcile the conflicting results from the previous literature. We find that in the short run consumption reacted more strongly to falling than to rising wealth but in the medium to long run the marginal propensity to consume was larger for rising than for falling income and wealth. This result can also be interpreted in the context of the secular decline in the US personal savings rate during the decades prior to the financial crisis starting in the fall of 2007.

The paper is structured as follows: In Section 2, we review different econometric tests of loss aversion and liquidity constraints and discuss the possibility that consumers face both liquidity constraints in the short run and exhibit loss aversion in the medium to long run. Section 3 presents the empirical results and Section 4 briefly concludes.

2 Loss aversion versus liquidity constraints

2.1 Some simple tests

A simple test of the Permanent Income Hypothesis against various alternative models of consumer behaviour was pioneered by Shea (1995) and implies estimating the following equation by two-stage least squares (2SLS):

$$\Delta c_t = \alpha + (\lambda^+ * POS * \Delta \hat{y}_t) + (\lambda^- * NEG * \Delta \hat{y}_t) + \epsilon_t \tag{2.1}$$

where c_t is the log of consumption, $\hat{y}_t$ is the log of expected income, and ϵ_t is a white noise process. *POS* and *NEG* are indicator functions which take a value of one for respectively positive and negative expected income growth, and a value of zero otherwise. It has been argued that equation (2.1) nests the following alternative hypotheses of consumer behaviour:

(i.) Permanent Income Hypothesis/Rational expectations: $\lambda^+ = \lambda^- = 0$

(ii.) Myopia: $\lambda = \lambda^+ = \lambda^- > 0$

(iii.) Loss aversion: $\lambda^+ < \lambda^-; \lambda^+, \lambda^- > 0$

(iv.) Liquidity constraints: $\lambda^+ > \lambda^-; \lambda^+, \lambda^- > 0$

Under the Random-Walk Hypothesis (Hall, 1978), predictable (expected) changes in future income should not have any effect on consumption, while under myopia consumption tracks current income and hence should respond symmetrically to expected income changes (see Campbell and Mankiw, 1989, 1990). However, the restriction of a unique coefficient λ will be inaccurate under both loss aversion and liquidity constraints (see Shea, 1995, p. 804; Bowman et al., 1999, p. 156): Under loss aversion, when a person receives good news regarding future income prospects, he or she may immediately adjust current consumption upward, thereby reducing the possibility of a further increase in future consumption. In contrast, learning today of a negative shock to income in the future may have no effect on current consumption, implying that future consumption will decrease significantly if the shock is realised. By contrast, liquidity constrained consumers may not be able to smooth consumption when expected income increases, so that the increase in consumption takes place only as the expected increase in income materialises. But when expected income declines, households will immediately reduce consumption in the current period.

Shea (1995) found evidence of loss aversion for the US, a result that was confirmed by Bowman et al. (1999) for five other OECD countries. Johannson (2002) confirmed this result for Sweden but found no statistically significant evidence of loss aversion using annual data for a larger panel of OECD countries. Altonji and Siow (1987) had found evidence of liquidity constraints using US household survey data. Dejuan et al. (2006, 2010) estimate equation (2.1) for German and Canadian regions using *innovations* rather than predictive changes in income and interpreted their results as evidence of liquidity constraints. Paz (2006) estimates equation (2.1) for Brazil and found again evidence of loss aversion.

One potential reason for these ambiguous results is that expected income growth in equation (2.1) is unobservable by definition so that it has to be pre-estimated using instrumental variables. However, as recognised by Shea (1995, p. 800), the estimates of λ^+ and λ^- "may be imprecise or even spurious if the instruments have low predictive power for income growth". Yet, it is in general "difficult to find appropriate variables with much predictive power for changes in income" (Romer, 2001, p. 322) and there is no agreement regarding the criteria of relevance (Shea, 1995, pp. 800 et seq.). Also, as acknowledged by Shea (1995, p. 804), equation (2.1) only offers a very rough test of loss aversion as it is implicitly based on a consumption-savings model with only two periods, as developed by Bowman et al. (1999). Therefore, it may indeed be misleading to draw conclusions about consumer behaviour over the longer term on the basis of empirical estimates from equation (2.1).

An alternative empirical framework derived from the Permanent Income model and advocated by, for example, Davis and Palumbo (2001) implies a long-run (cointegrating) relationship between consumption, income and wealth. While it is typically assumed that the long-run levels relationship is linear, short-run asymmetries can easily be introduced, as in equation (2.2):

$$\Delta C_t = \alpha + \rho C_{t-1} + \delta Y_{t-1} + \gamma W_{t-1} + \sum_{j=1}^{p-1} \varphi_j \Delta C_{t-i} + \sum_{j=0}^{q} \left(\eta_j \Delta Y_{t-j} + \phi_j^+ \Delta W_{t-j}^+ + \phi_j^- \Delta W_{t-j}^- \right) + \epsilon_t \tag{2.2}$$

where C_t, Y_t and W_t are respectively the levels of consumption, income and wealth, and ΔW^+ and ΔW^- respectively are positive and negative changes in wealth, and ϵ_t is a white noise process. After establishing a *symmetric* cointegrating relationship with long-run coefficients $L_Y = -\delta/\rho$, $L_W = -\delta/\rho$, a commonly performed test is whether $\sum_{j=0}^{q} \phi_j^- > \sum_{j=0}^{q} \phi_j^+$, which would be interpreted as evidence of liquidity constraints, limiting consumers' capacity to borrow against their net worth.

Shirvani and Wilbratte (2000) have argued that asymmetries may be particularly relevant in the case of the stock market wealth effect. They found evidence that stock market declines had a larger short-run effect on consumption than stock market increases in the US, Japan and Germany, noting that the asymmetry may stem from various factors, including liquidity constraints and capital gains taxation (see also IMF 2001, p. 66). Apergis and Miller (2006) confirmed this result for the US within the same framework. In a similar framework and using US data, Stevans (2004) found that consumption followed near random walk behaviour during times of stock market downturns but that actual consumer spending quickly adjusted to tarket spending during stock market booms. Carruth and Dickerson (2003) established a symmetric cointegrating relationship between consumption and income for the UK but found that income elasticities were higher when the disequilibrium error was positive than when it was negative.

As our selective review of the theoretical and empirical literature clearly shows, no consensus has so far been reached as to the relevance of different kinds of asymmetry in aggregate consumption. In equation (2.3), we therefore propose a simple consumption model allowing for both long-run and short-run asymmetry in consumption behaviour:

$$\Delta C_t = \rho C_{t-1} + \theta^+ \mathbf{x}_{t-1}^+ + \theta^- \mathbf{x}_{t-1}^- + \sum_{j=1}^{p-1} \varphi_j \Delta C_{t-j} + \sum_{j=0}^{q} \left(\pi_j^+ \Delta \mathbf{x}_{t-j}^+ + \pi_j^- \Delta \mathbf{x}_{t-j}^- \right) + \varepsilon_t. \quad (2.3)$$

where $\mathbf{x}_t^+ = (Y_t^+, W_t^+)'$ and $\mathbf{x}_t^- = (Y_t^-, W_t^-)'$ are positive and negative partial sum processes, defined by:

$$\mathbf{x}_t^+ = \sum_{j=1}^{t} \Delta \mathbf{x}_j^+ = \sum_{j=1}^{t} \max\left(\Delta \mathbf{x}_j, 0\right), \ \mathbf{x}_t^- = \sum_{j=1}^{t} \boldsymbol{\Delta} x_j^- = \sum_{j=1}^{t} \min\left(\Delta \mathbf{x}_j, 0\right) \quad (2.4)$$

We refer to equation (2.3) as the asymmetric or non-linear ARDL (NARDL) model, following Shin et al. (2010). This approach has a number of advantages over alternative regime-switching models. Firstly, equation (2.3) can be estimated simply by OLS. Secondly, the null hypothesis of no long-run relationship between the levels of C_t, $\mathbf{x}_t^+$ and $\mathbf{x}_t^-$ (*i.e.* $\rho = \theta^+ = \theta^- = 0$) can be easily tested using the bounds-testing procedure advanced by Pesaran et al. (2001) and Shin et al. (2010), which remains valid irrespective of whether the regressors are $I(0)$, $I(1)$ or mutually cointegrated. Thirdly, (2.3) nests equation (2.2) as a special case and the long-run symmetry restriction $\theta^+ = \theta^- = \theta$ can be tested using standard Wald tests. Similarly, short-run symmetry restrictions can be easily tested.[1] Finally, the asymmetric ARDL model can be used to derive the asymmetric cumulative dynamic multiplier effects of a unit change in $\mathbf{x}_t^+$ and $\mathbf{x}_t^-$ respectively on C_t, defined by:

$$\mathbf{m}_h^+ = \sum_{j=0}^{h} \frac{\partial C_{t+j}}{\partial \mathbf{x}_t^+}, \ \mathbf{m}_h^- = \sum_{j=0}^{h} \frac{\partial C_{t+j}}{\partial \mathbf{x}_t^-}, \ h = 0, 1, 2... \quad (2.5)$$

Notice that, by construction, as $h \to \infty$, $\mathbf{m}_h^+$ and $\mathbf{m}_h^-$ tend to approach the respective asymmetric long-run coefficients, given by $L^+ = -\theta^+/\rho$, $L^- = -\theta^-/\rho$. The ability of the dynamic multipliers to illuminate the traverse from initial equilibrium, via short-run disequilibrium following a shock, to a new long-run equilibrium makes them a powerful tool for the combined analysis of short-run and long-run asymmetries in aggregate consumer behaviour. This flexibility may indeed prove helpful in reconciling the apparently conflicting evidence from the existing literature.

[1] Shin et al. (2010) identify two different types of short-run symmetry restrictions: strong-form (pairwise) symmetry and weak-form (additive) symmetry. While additive symmetry is a much weaker restriction, the power of the Wald test may be rather low in small samples, in which case the use of bootstrapped confidence intervals would be preferable.

2.2 Liquidity constraints in the short run and loss aversion in the longer run?

While in equations (2.1) and (2.2) liquidity constraints and loss aversion are mutually exclusive by construction, the NARDL model in equation (2.3) allows for the possibility that short-run and long-run consumption asymmetries are in opposite directions. For instance, it may be the case that consumers strongly reduce their consumption expenditures immediately after a decline in either their income or wealth occurs, while they take much longer to increase consumption as their income or wealth increases. In the longer run, however, consumers may under certain conditions be able to contain the decline in their standard of living following from a decrease in their income or wealth, while at the same time benefiting rather strongly from a rise in incomes and wealth by raising consumption.

Several arguments explaining such a traverse from short-run *negative asymmetry* to long-run *positive asymmetry* can be invoked:

(i.) Economic recessions and declining asset prices may cause sudden but temporary 'panic' in the banking and household sectors. Households will become more risk averse and save more, while at the same time refinancing conditions worsen as banks will be subject to increased insecurity and find it more difficult to distinguish good from bad borrowers. But this dampening effect on consumption may be alleviated in the longer run, as consumption demand and the supply of credit to households gradually recover.

(ii.) Consumers' reaction to increases in income and wealth may be slow initially but substantial in the longer run, as it takes time to learn about new consumption opportunities and to acquire new habits as purchasing power increases.

(iii.) Stepping down the 'pyramid of needs' and giving up a previously achieved level of self-actualisation may be experienced by individuals as a very harsh loss in overall satisfaction. It can therefore be expected that consumers will try to avoid such a regression. Yet, it may take some time for consumers to find additional sources of funding (lower saving and/or higher debt) after a decline in their incomes and wealth.

(iv.) In a society where social norms, advertising, etc. convey the idea of consumption being an important part of the self-actualisation process and social status depends on conspicuous consumption, it can be expected that individuals will benefit from any increase in income or wealth to expand consumption and 'keep up with the Joneses', but will be reluctant to reduce consumption risking to 'fall behind the Joneses'. Again, this phenomenon is likely to be more relevant for explaining medium-term rather than short-term asymmetries.

(v.) In a context of mental accounting, individuals may 'undersave' as financial innovation increases liquidity and eliminates implicit self-commitment opportunities. The secular trend towards lower saving may be reflected by long-run positive asymmetry in our model, and financial innovations may have contributed to insulating consumers from negative income and wealth shocks, at least over the medium term.

3 Empirical results

We estimate several variants of equations (2.1), (2.2) and (2.3). We use quarterly data for the period 1953q1 to 2007q3.[2] Data for consumption and disposable income are taken from the National Income and Product Accounts (NIPA, Bureau of Economic Analysis). Consumption equals personal consumption expenditures (PCE) on nondurables and services. This series is scaled up so that the sample mean matches the sample mean of total PCE. Data for personal wealth are taken from the Flow of Funds Accounts (Federal Reserve Board). We distinguish between stock market wealth, including directly held equity, mutual fund shares, security credit and life insurance and pension fund reserves, and non-stock wealth, defined as total net worth less stock market wealth.[3] All variables are measured in per capita terms and are deflated with the PCE price index.

Table 1 reports the estimates for equation (2.1) for both the symmetric case (imposing $\lambda^+ = \lambda^-$) and the asymmetric case, using different instrument lists. The results of previous works are largely confirmed. Hall's (1978) Random Walk Hypothesis is strongly rejected, and the estimates of λ come close to those reported by Campbell and Mankiw (1989, 1990, 1991) who concluded that around 50 per cent of consumers were 'rule-of-thumb' consumers. Also, there is evidence of loss aversion, although λ^- is estimated rather imprecisely, which is not surprising given the well-known difficulties of finding strong instruments for (negative) expected income growth. In particular, some of the estimates of λ^- are unrealistically large, as in Shea (1995) and Bowman et al. (1999). The low adjusted R^2s are also familiar from all previous studies.

The results for equation (2.2) are reported in Table 2.[4] For comparability with the existing literature, we are particularly interested in asymmetric stock market wealth effects. Therefore, in models 2.2.2 and 2.3.2, private net worth, NW, is decomposed into stock market wealth, S, and net non-stock wealth, NS. The estimated long-run marginal propensities to consume out of wealth fall in the upper range of commonly cited estimates (*e.g.* Altissimo et al., 2005; Boone et al., 1998).[5] In all models, negative changes in wealth have a very strong negative effect on consumption in the short run, whereas the effect of positive changes is weaker. Both the Wald tests for additive short-run asymmetry (not shown) and the bootstrapped confidence intervals indicate that negative asymmetry is significant during approximately two years after a shock. This finding again confirms previous results: Shirvani and Wilbratte (2000, p. 48) observed that the inequality of stock market wealth effects seemed to disappear as the lag length extends beyond seven quarters (see also Apergis and

[2] Davis and Palumbo (2001, p. 32) argue in favour of using the longest available time span in aggregate consumption equations. Yet, the outbreak of the recent financial crisis is likely to have led to a structural break in consumption patterns in the US and inclusion of more recent data significantly affected the results reported below.

[3] For details about the construction of scaled personal consumption and non-stock wealth, see Lettau and Ludvigson (2004, p. 294).

[4] Equations (2.2) and (2.3) were estimated by general-to-specific modelling, starting with a number of 8 lags and then sequentially dropping insignificant regressors at the 10 per cent significance level.

[5] When we use total consumption instead of scaled non-durable consumption, the long-run coefficient on net worth is 0.056 in model 2.2.1.

Miller, 2006).

Table 2 also reports the results for equation (2.3). Note that the precision of estimation improves significantly and that the error correction coefficient increases rather substantially compared to equation (2.2). There is still evidence of negative short-run asymmetry for the wealth effect, but in the longer run the asymmetry points in the opposite direction.[6] As an illustration, Figure 1 shows the cumulative dynamic multipliers implied by model 2.3.2. A decline in stock market wealth first leads to a strong negative response in consumption, but the long-run impact is comparably moderate. Conversely, the effect of a stock market wealth increase is not statistically significant during the first quarters, but approaches its long-run value of approximately 5 cents on the dollar after 3 years or so. Note also that adjustment to target spending is relatively smooth after positive income and wealth changes, but more turbulent after negative changes (see Stevans, 2004, for a similar result in a different framework).

4 Concluding remarks

It is now commonly held that the Permanent Income Hypothesis with rational expectations is not an accurate description of aggregate consumption behaviour. Various deviations from the standard model have been discussed in the literature, including loss aversion and liquidity constraints. In this paper, we have applied different estimation approaches to a single data set and shown that, depending on the approach chosen, evidence of *either* loss aversion *or* liquidity constraints could be found. We have then proposed a simple asymmetric error correction model and found significant evidence that short-run and long-run consumption asymmetries pointed in opposite directions during the period before the financial crisis of 2007.

It seems that in the short run, a decline in income and wealth can have very substantial negative effects on consumption. However, in the longer run, US private households have apparently managed to translate income and wealth increases into comparably large increases in consumption expenditure, while they have been able to keep reductions in consumer spending, as a consequence of income and wealth declines, within relatively small limits. This helps to explain, for instance, why an equivalent level of the net worth-to-income ratio has been compatible with both a relatively low consumption-to-income ratio in the 1960s or 1970s and a much higher ratio in the 1990s or 2000s, when personal saving was near zero.

As is well known, the secular trend towards higher consumption relative to income in

[6]The insigificance and small size of the coefficient on non-stock wealth in models 2.2.2 and 2.3.2 may be due to its correlation with property income, which is included in disposable income (see also Boone et al., 1998). Some authors prefer using labour income instead of disposable income on theoretical grounds, because property income equals the return earned on financial wealth, and so should not be included in the proxy for human wealth. Yet, property income typically does not move in lock step with household net worth, somewhat mitigating the force of this issue (Davis and Palumbo, 2001, p. 32). When we use labour income instead of disposable income, the estimated coefficient on non-stock wealth increases in both models and turns significant in model 2.2.2, while the positive long-run asymmetry in income gets even stronger in model 2.3.2. All other results remain qualitatively unchanged.

the US has been accompanied by very substantial expansion of personal debt, and it seems that the observed asymmetries in consumption behaviour have been facilitated by financial deregulation and 'generous' lending practices. However, as the financial crisis starting in 2007 has shown, it is doubtful whether such a consumption pattern can be regarded as sustainable.

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Model	**Instruments**	$R^2{}_{\Delta}y$	$R^2{}_{\Delta}c$	λ	λ^+	λ^-	**F-Test** $\lambda^+ = \lambda^-$	**Quarters** $\Delta\hat{y}_t < 0$
2.1.1	None (OLS)		0.24	0.26 (8.19)	0.20 (4.55)	0.38 (4.74)	2.79 (0.10)	49
2.1.2	$\Delta i_{t-2}, ..., \Delta i_{t-6}$; $r_{t-2}, ..., r_{t-6}$	0.05	0.10	0.46 (4.06)	0.33 (2.68)	3.01 (3.33)	8.05 (0.01)	5
2.1.3	$\Delta i_{t-2}, ..., \Delta i_{t-8}$; $r_{t-2}, ..., r_{t-8}$; $\Delta c_{t-2}, ..., \Delta c_{t-8}$	0.07	0.16	0.48 (5.87)	0.35 (3.81)	1.34 (3.90)	6.69 (0.01)	12
2.1.4	$\Delta c_{t-2}, ..., \Delta c_{t-6}$; $r_{t-2}, ..., r_{t-6}$	0.04	0.08	0.47 (4.51)	0.45 (3.75)	0.84 (0.95)	0.17 (0.68)	9
2.1.5	$\Delta c_{t-2}, ..., \Delta c_{t-8}$; $\Delta y_{t-2}, ..., \Delta y_{t-8}$; $c_{t-2} - y_{t-2}$	0.05	0.06	0.34 (3.41)	0.27 (2.53)	2.37 (2.10)	3.26 (0.07)	5
2.1.6	$\Delta c_{t-2}, ..., \Delta c_{t-8}$; $\Delta y_{t-2}, ..., \Delta y_{t-8}$; $\Delta i_{t-2}, ..., \Delta i_{t-8}$; $r_{t-2}, ..., r_{t-8}$ $c_{t-2} - y_{t-2}$	0.08	0.14	0.38 (5.09)	0.25 (3.06)	1.37 (4.06)	9.11 (0.00)	14
2.1.7	$\Delta c_{t-2}, ..., \Delta c_{t-8}$; $\Delta y_{t-2}, ..., \Delta y_{t-8}$; $\Delta s_{t-2}, ..., \Delta s_{t-8}$; $r_{t-2}, ..., r_{t-8}$; $c_{t-2} - y_{t-2}$	0.03	0.05	0.32 (3.74)	0.31 (3.29)	0.42 (0.79)	0.03 (0.85)	11

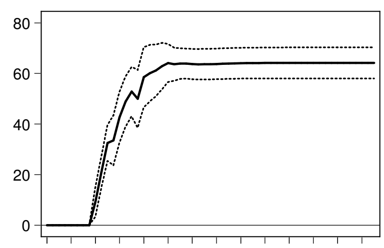
Note: i = nominal yield on 3-months treasury bills (Federal Reserve Statistical Release, H.15); r = real interest rate (nominal yield on 3-months treasury bills minus inflation calculated from PCE deflator); s = log of stock market wealth. λ, λ^+, λ^- are estimated coefficients with t-values in parentheses. The test statistics for the F-test for the null hypothesis of symmetric λs are followed by p-values in parentheses.

Table 1: Estimates of equation 2.1, using different sets of instruments

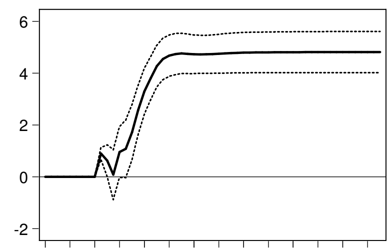
Model	**2.2.1**	**2.2.2**	**2.3.1**	**2.3.2**
ρ	-0.046 (-3.65)	-0.049 (-3.98)	-0.158 (-6.32)	-0.187 (-7.40)
L_Y	0.635 (10.76)	0.796 (11.23)		
L_Y^+			0.545 (25.47)	0.642 (21.19)
L_Y^-			0.289 (3.09)	0.361 (3.98)
L_W	0.077 (6.31)			
L_W^+			0.053 (11.28)	
L_W^-			0.032 (5.08)	
L_S		0.071 (6.40)		
L_S^+				0.048 (12.63)
L_S^-				0.028 (5.38)
L_{NS}		0.029 (1.05)		0.017 (2.18)
t_{BDM}	-3.65	-3.98	-6.32	-7.40
F_{PSS}	12.09	14.13	11.79	13.88
$\bar{R}^2$	0.527	0.547	0.550	0.602
χ^2_{SC}	4.52 (0.34)	5.27 (0.26)	2.78 (0.60)	7.00 (0.14)
χ^2_H	10.29 (0.59)	16.92 (0.20)	19.90 (0.28)	26.90 (0.36)
W_{LR}^Y			9.65 (0.00)	13.90 (0.00)
W_{LR}^{NW}			41.12 (0.00)	
W_{LR}^S				44.76 (0.00)
$SR_{asym,Y}$			NEG (0-2, insig)	NEG (0-2, insig)
$SR_{asym,W}$	NEG (0-8, 5)		NEG (0-7, 3-4)	
$SR_{asym,S}$		NEG (0-11, 0-8)		NEG (0-7, 0-5)

Note: L_Y, L_{NW}, L_S, L_{NS} are estimated long-run coefficients on, respectively, disposable income, net worth, stock market wealth and non-stock wealth, followed by t-values. t_{BDM} and F_{PSS} denote the test statistics of the t- and F-test proposed by Banerjee et al. (1998) and Pesaran et al. (2001). The 5% upper bound critical value for the t-test is -3.53 for k=2, -3.78 for $k = 3$, -3.99 for k=4 and -4.19 for $k = 5$, where k is the number of regressors. The 5% upper bound critical value for the F-test is 5.73 for k=1, 4.85 for k=2, 4.01 for k=4 and 3.79 for k=5. χ^2_{SC} and χ^2_H denote LM tests for serial correlation and heteroscedasticity, followed by p-values. W_{LR} is the Wald test for the null hypothesis of long-run symmetry, followed by the p-value. SR_{asym} indicates whether short-run asymmetry is positive (POS) or negative (NEG) and the numbers in parentheses indicate during which quarters after the simulated shock the asymmetry is present and statistically significant at the 95% level, based on bootstrapped confidence intervals, using Eviews 6.

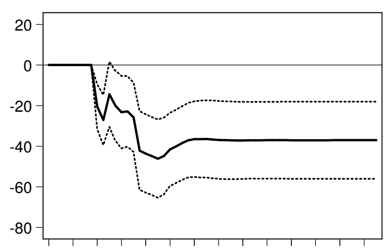
Table 2: Estimates of equations 2.2 and 2.3



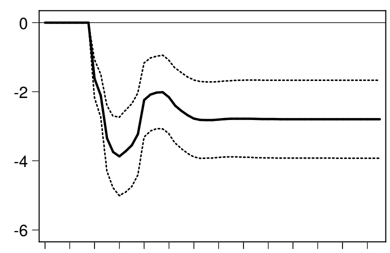
(a) 100 USD increase in Y



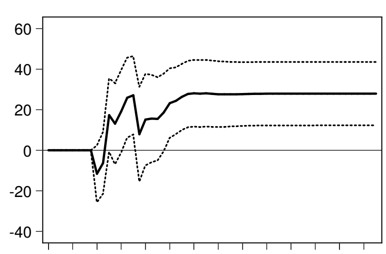
(b) 100 USD increase in S



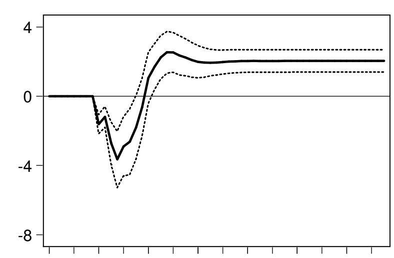
(c) 100 USD decrease in Y



(d) 100 USD decrease in S



(e) Difference between a) and c)



(f) Difference between b) and d)

Note: The figure shows the cumulative dynamic effects of permanent changes in respectively disposable income, Y, and stock market wealth, S, on private consumption expenditure together with bootstrapped 95 per cent confidence bounds, using Eviews 6.

Figure 1: Dynamic multipliers, model 3.2

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