Wealth Effects and Consumption:
A Multivariate Evaluation

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Abstract: Events of recent years have revived interest in whether wealth effects exist in consumption. Recent studies have obtained contrasting results on wealth effects. Findings and procedures across studies can be categorized as falling in to the "Endogenous Consumption" and "Endogenous Wealth" groups. This paper examines the long-run and short-run dynamic relationship between aggregate consumption, real disposable personal income, and real wealth, including evaluation of potential structural breaks. This study uses methods consistent with the Endogenous Wealth literature. Yet results indicate that consumption is endogenous, and wealth effects exist in consumption. In contrast to past studies, results here also indicate that long-run adjustments to restore equilibrium takes place in all variables, with endogenous wealth and disposable income movements also being a part of the short run dynamic adjustments.

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Section 1. Introduction

In the late 1990s, the strong growth in equities and housing prices resulted in strong growth in aggregate total wealth. Over this same period, real GDP in the US showed notable growth, eclipsing recent historical growth rates. Expanding consumption fueled a significant portion of this growth. This episode triggered renewed attention to the "wealth effect." A long tradition of research on the wealth effect suggests a link between wealth and consumption. The empirical research dates back to Ando and Modigliani (1963), and posits that increases in wealth may create changes in consumption beyond the effect of disposable income. Several recent estimates of the relationship between wealth and consumption find that a one-dollar increase in household wealth creates a *permanent* increase in new consumption spending (around four cents of new consumption spending) (Davis and Palumbo, 2001 or Mehra, 2001). In contrast, recent research by Ludvigson and Steindel (1999), estimating a similar long-run relationship between wealth and consumption, argue that any wealth effect on consumption is, at best, temporary.

This raises the timely question – to what extent was the robust increase in consumption experienced in the 1990's attributable to the large growth of household wealth over this same period? The average growth in real wealth between 1995:1 and 1999:4 was 4.3 times higher than that for the period between 1952:2 and 1994:4. Over this same late 1990s period, real consumption grew at an average rate that was 2.3 times higher than that for the 1952:2 to 1994:4 period. Since consumption constitutes about two-thirds of total GDP, large increases in wealth that cause increases in consumption can have important impacts on overall GDP. For example, Poterba (2000) notes that the rise in household wealth from 1995-1998 could be responsible for increasing GDP by as much as two to three percent in 1999.

Beginning in late 2000, some analysts worried about a "reverse" wealth effect, and the possible drag it may create on total output. Equity prices started falling during the second quarter of 2000. While continued growth in housing prices over the same period moderated the impact on total wealth, the decline in equity values was significantly large to reduce aggregate wealth. Indeed, from the second quarter through the fourth quarter of 2001, aggregate output decreased, fostering concerns that the decrease in total wealth may be producing negative impacts on total output. Theoretically, the Life-Cycle/ Permanent Income Hypothesis (LCPIH) provides the link between consumption and wealth. Under the LCPIH, wealth is a resource available to the household to use for consumption. An increase in wealth increases lifetime resources, and can permanently increase consumption over the life on the household. Therefore, holding constant disposable income, an increase in wealth (as occurred during the late nineties) leads to increases in consumption. Results in Poterba (2000) and others support such views.

Across the recent empirical investigations of the wealth effect, two competing lines of argument have emerged. For purposes of discussion in this paper, the two competing lines of argument are referred to as the "Endogenous Consumption" view (including, for example, studies by Davis and Palumbo or Mehra) and the "Endogenous Wealth" view (for example, studies by Ludvigson and Steindel). Both groups start with the basic LCPIH. However, the conclusions from these two lines of research stand in contrast to each other. The Endogenous Consumption research finds empirical evidence of a long-run wealth effect in consumption, and concludes there is endogeneity in consumption. Their results (and others) on endogeneity of consumption indicates that a one dollar change in wealth *permanently* increases consumption by almost four cents in the long-run. Yet, the econometric specification of this body of literature restricts consumption to respond to wealth and income in the long-run, which can affect empirical estimates.

Conversely, Endogenous Wealth papers empirically find no evidence of a long-run wealth effect on consumption. Rather, in these studies, it is *wealth* that permanently responds to changes in consumption. Therefore they argue that it is wealth that is endogenous in the long-run. In this view, increases in wealth induce only short-run, or *temporary*, increases in aggregate consumption. The conclusions of these two bodies of research concerning the endogeneity (or long-run evolution) of consumption stand in contrast to each other. This paper evaluates evidence of wealth effects on consumption, paying particular attention to this ongoing debate.

Section 2. Econometric Issues

This study examines the dynamic relationship between consumption, disposable income, and wealth. The overall goals in this assessment of wealth effects are to: 1) Determine if a long-run relationship exists between consumption, wealth, and disposable income; and 2) Examine the timing and pattern of the consumption response (i.e., assess whether consumption is influenced by wealth in the short-run only, or in both the short-run and long-run).

Time series econometric techniques, including evaluation of cointegrating relationships, provide the means to evaluate the first point, the long-run response of consumption to changes in wealth. A Vector Error-Correction Model (VECM) provides evidence on the timing and question of short-run versus long-run impacts, and thus addresses the second issue. Evidence from a VECM also determines the endogeneity of consumption, income, and wealth. Finally, a robustness check evaluates whether the consumption measure used in the Endogenous Wealth literature imposes improper restrictions.

A key difference between these lines of literature has been methodology, with the Endogenous Wealth literature directing criticisms at what is regarded as restrictive procedures in the Endogenous Consumption papers. In particular, the Endogenous Wealth research notes that the empirical methods used by the Endogenous Consumption research restrict the long-run adjustment of wealth and disposable income to restore the long-run equilibrium to zero (as they demonstrate in their research). This paper spans the gap between the Endogenous Consumption and Endogenous Wealth research by employing the (less restrictive) empirical methodology of the Endogenous Wealth literature.[1] Thus, procedures here allows for endogenous response of all variables (consumption, wealth and income) in the long-run. Thus, the study provides information on a fuller set of dynamic adjustments over time to long run equilibrium between consumption, wealth, and income.

Several aggregate level studies show evidence of structural breaks in key macroeconomic relationships (see for example, Estrella, Rodrigues and Schich, 2000). Thus, the possibility of structural breaks warrant attention when estimating the cointegrating relationship. Lettau and Ludvigson (2003) conduct structural break testing, but conclude that no structural breaks exist. This study evaluates cointegration in the presence of structural breaks using the Gregory-Hansen (1996) method. Results here indicate possible structural breaks in the long-run. However, the finding of endogenous consumption is robust, even when allowing for structural breaks.

As with any empirical study based on time-series techniques, care must be taken. Granger and Newbold (1974) note that the use of OLS methods with non-stationary time-series data can produce misleading results and inappropriate conclusions regarding relationships between variables. These methods (including the ones employed here) avoid the problem of spurious correlation that may affect conclusions in earlier OLS-based studies. In particular,

[1] Another difference across studies is the measure of consumption used. The Endogenous Consumption literature uses aggregate personal consumption expenditures, which includes non-durable, durable, and services consumption. The Endogenous Wealth literature excludes durable consumption from their consumption measure (arguing that its inclusion in wealth is an adequate control). This study uses aggregate consumption expenditures, but also conducts sensitivity tests using the alternate measure of consumption. These results are footnoted, where relevant.

estimation procedures here use a vector error correction model (VECM).[2] For a VECM to be appropriate, all variables must be non-stationary, integrated of the same order, and have a long-run cointegrating relationship between variables.

Several initial diagnostic steps are necessary prior to estimating the model. Stationarity properties of the data must be evaluated via unit root tests. If unit root tests indicate that data are non-stationary, then the series must be evaluated for the existence of possible long-run (cointegrating) relationships. If the variables are cointegrated, this eliminates the possibility of spurious results. However, other problems (such as biased and inefficient results) arise. These potential problems are specifically noted for wealth effect studies in Dolmas (2003). Across a set of non-stationary data series, cointegration techniques such as Johansen's test (Johansen, 1991) for cointegration and Dynamic OLS (DOLS) (Stock and Watson, 1993), address these problems. The DOLS procedure is discussed further below, in the structural break section.

Data for the study span fifty years. Several recent aggregate level studies find evidence of structural breaks in macroeconomic relationships over this period. Since failure to address structural breaks can affect conclusions on cointegration and distort parameter estimates, it is important to evaluate the possibility of structural change over the sample period. To examine possible structural breaks and test for cointegration at the same time, Gregory and Hansen's test (1996a, 1996b) is used. This procedure recursively checks for cointegration in the presence of possible structural breaks. The long-run relationship is then re-estimated with any possible breaks using DOLS.

[2] As Enders (2003) notes, if a standard VAR is estimated in these circumstances, without incorporating information on the existing long-run relationships, then the model will be misspecified. The error correction term in the ECM adds information regarding the long-term (co-integrating) relationships between variables, and improves efficiency compared to a standard VAR technique.

After the long-run relationships are evaluated, attention (and empirical procedures) shifts to the short-run relationships and question of endogeneity of all variables. Multi-equation Vector Error-Correction Models (VECM) are used to estimate the pattern of dynamic short-run responses to changes in a measure of consumption, wealth, or disposable income. The long-run adjustment of consumption, wealth, and income to restore the long-run equilibrium are *all* possible in the VECM. These VECM results provide evidence on the timing of wealth effects (or the endogeneity of consumption). In other words, procedures evaluate whether consumption adjusts in the short-run (within a few quarters), or over the long-run to changes in a given variable. This gives evidence on the duration of consumption responses to wealth shocks: If consumption responds in the short-run only (indicating consumption is weakly exogenous), the duration of any possible wealth effects are temporary. A statistically significant adjustment parameter on consumption in the VECM indicates a permanent effect on consumption from a change in any variable. If consumption responds to changes in wealth in the long-run (as argued in the Endogenous Consumption literature), then changes in wealth have permanent effects on consumption. Attention turns next to data used in this empirical investigation of wealth effects.

To pursue this evaluation of wealth effects, data are needed for several key variables. They can be subcategorized into four groups: consumption, wealth, income, and deflators. Quarterly data for the period 1952:Q1 to 2002:Q2 are collected from two sources. The income, consumption, and deflator series come from the Federal Reserve Bank of St. Louis's FRED® website; wealth data are provided by the Board of Governors of the Federal Reserve.[3]

[3] The beginning date is dictated by the availability of the wealth series from the *Balance Sheet of the United States*; the 2002:Q2 end date was the last available observation when the research was begun. For data obtained from the FRED website, original data sources for these series are the Bureau of Economic Analysis and the Bureau of Labor Statistics. Following previous studies, the wealth variable is lagged one period, so that wealth in any quarter is the beginning of quarter values.

The consumption series include aggregate consumption and an alternative measure, "non-durable plus services" consumption, which is used in several previous studies. The income series is real disposable personal income. Consumption, income and wealth series are used in real, per capita terms, based on 1996 dollars (from the GDP deflator) and a civilian population measure (obtained from FRED).

The wealth measure is obtained from *The Balance Sheet of the United States*, and matches that used in the Endogenous Wealth and Endogenous Consumption studies.[4] Assets are broken into tangible assets and financial assets. Tangible assets comprise about one third of the asset measure, with housing being the dominant tangible asset. Financial assets account for two thirds of aggregate assets. Home mortgages (which include home equity loans) are the major liability. Appendix Table 3 presents components of the aggregate wealth measure.[5] Given these data, attention turns to evidence on the stationarity of each series, based on unit root testing.

Section 3. Empirical Results

Unit Root and Cointegration Tests

Two unit root tests are used to test if data are stationary in their levels: the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981) and the KPSS test (Kwiatkowski, et. al., 1992). The null hypothesis for the ADF test is that the series is non-stationary (has a unit root); for the KPSS test, the null hypothesis is one of stationarity. Both ADF and KPSS tests indicate

[4] *The Balance Sheet of the United States* includes the balance sheet for households and nonprofit organizations, non-financial corporate business, and non-farm non-corporate businesses. The balance sheet for households and nonprofit organizations is used by the Endogenous Wealth and Endogenous Consumption research and in this essay. Regarding the component assets, tangible assets include housing, such as owner-occupied homes, unoccupied secondary homes, homes for sale, and vacant property. Housing assets are measured at market value. Other tangible assets, such as equipment and durable goods, are valued at replacement cost. Financial assets include equities, mutual funds, demand deposits and currency, bonds (domestic corporate, government and foreign bonds) and other securities. These are listed at current market value. Liabilities include mortgages and home equity loans, consumer credit, bank loans, and other miscellaneous items.

[5] Descriptive Statistics are provided in Table 1A and the Correlation Matrix is in Table 1B. An example from the *Balance Sheet of the United States* is given in the Table 3.

all variables contain a unit root, which is common with time-series data.[6] First differencing yields stationary series, thus indicating that series are integrated of order one.

Given evidence that all series are ~I(1), the next question is whether a long-run (cointegrating) relationship exists between the variables. The Johansen test (Johansen, 1991) serves as the initial test for cointegration. A second test, the Gregory and Hansen (GH) test (1996a, 1996b), evaluates cointegration in the presence of a possible structural break. Gregory and Hansen advocate a strategy of pre-testing for cointegration (for example, via a Johansen test), prior to using the GH test. This is the strategy used here.

The Johansen test uses an adjusted Vector Autoregression (VAR) model to test for cointegration. Under the Johansen test, an unrestricted VAR model is transformed into Equation (1). Adequate lags must be used when conducting Johansen tests, to ensure that the residual matrix is white noise.[7] In Equation (1), Y_t is a (k x 1) matrix of variables, the A_i matrices are (k x k) matrices of coefficients, j denotes the number of lags, the Π matrix captures the dynamic adjustment of the variables, and is the product of two matrices, or $\Pi=\alpha\beta'$, and ε_t is ~ iid $(0,\Omega)$. The β matrix captures the long-run (cointegrating) relationship between variables; the α component captures the pattern of adjustment to the long-run equilibrium. These components are the key to the evaluation of cointegration below, variable adjustments, and questions of endogeneity and wealth effects.

$$\Delta Y_t = A_0 + \Pi Y_{t-1} + \sum_{i=1}^{j-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

[6] Appendix Table 2 A & B presents unit root test results. For tests on data in levels (Table 2A), all ADF tests fail to reject the null hypothesis of a unit root; all KPSS statistics reject the null hypothesis of stationarity. In follow-up tests on first differenced data, (Table 2B), all tests indicate series are stationary in the first differences.
[7] AIC and Schwarz criterion tests indicate two lags, as a starting point. However, there were indications that serial correlation may remain when j=2, which would invalidate results of the Johansen test. Use of three lags resolves the problem. Conclusions from cointegration tests are stable across use of three or more lags in the test VAR.

Results for Johansen tests using three lags (*j* = 3) are presented in Table 1. Results are stable across the use three or more lags. Johansen tests results indicate cointegration does exist, with one cointegrating relationship among the variables. Parameters for income and wealth in the estimated cointegrating relationship are reported at the bottom of Table 1. Estimated parameters for income and wealth are 0.723 and 0.039, respectively. This result is used to construct the Error-Correction Term (ECT) in the VECM (no structural breaks model) below.

Table 1
Aggregate Consumption
Johansen Cointegration Test Results

Number of Cointegration Equations (Null Hypothesis)	Eigen Statistic	5% Critical Value	Trace Statistic	5% Critical Value
r = 0	23.14**	20.97	28.54*	29.68
r ≤ 1	3.51	14.07	5.40	15.41
r ≤ 2	1.89	3.76	1.89	3.76

Cointegrating Relationship:

Total Consumption	Disposable Income	Wealth
1.000	-0.723 (0.022)	-0.039 (0.004)

Results are for three lags in the Johansen test. Results are stable for three or more lags.
** and * indicates rejection of the null at a 95% and 90% level of confidence. Standard errors are reported in parenthesis. Critical values provided by Osterwald-Lenum (1992), Table 1.

How do the cointegration results in Table 1 compare to previous results? Mehra (2001), using aggregate consumption in the cointegrating equation, estimates parameters on wealth of [0.03 to 0.04] and on disposable income of [0.57 to 0.62].[8] In the research here, the estimated wealth parameter (0.039) in the aggregate consumption equation lies inside these bounds. However, the parameter on disposable income (0.723) is substantially larger. Davis and

[8] In evaluating parameter results, it is important to note that the interpretation of the parameters depends upon the response of consumption in the long-run. If consumption is the only variable that adjusts to changes in wealth or disposable income in the long-run, then these cointegrating equations represent the long-run response of aggregate consumption to changes in wealth or disposable income only. However, if wealth is the only variable that adjusts to changes in the long-run (as the Endogenous Wealth literature finds), then it is incorrect to interpret the parameter values as the long-run marginal propensity to consume out of disposable income and wealth. Before any

Palumbo (2001) exclude income from transfer payments and estimate a disposable income parameter of 0.68, which is closer to that found here. Further, their estimated wealth parameter is 0.039, which matches across studies. Therefore, the results here for aggregate consumption in the "no structural breaks" specification generally are consistent with recent research. Attention turns next to cointegration, when allowing for possible structural breaks.

Structural Break Tests

The previous tests provide initial evidence about wealth effects on consumption. They presume a constant relationship between the variables over the sample period. It is possible that some structural breaks have occurred over the fifty-year span represented by the data employed here. To investigate this, Gregory and Hansen's (1996a, 1996b) test (GH) for cointegration in the presence of possible structural breaks is used. The general form of the test is given by Equation (2), where C_t is the measure of consumption, $RDPI_t$ and RW_t respectively denote real personal disposable income and real wealth; φ_t denotes a dummy variable, n is the number of observations, and τ indicates the period investigated. The variable τ lies in the interval [0.15, 0.85], as suggested by Gregory and Hansen. Finally, i indexes the measure of consumption investigated. The system is evaluated for a break in the constant (restricts $\varphi_{2\tau} = \varphi_{3\tau} = 0$) and also for adjustment in all parameters (no zero restriction on any $\varphi_{j\tau}$).

$$C_t^i = \alpha_{0\tau}^i + \alpha_{1\tau}^i RDPI_t + \alpha_{2\tau}^i RW_t + \alpha_{3\tau}^i \varphi_{1\tau}^i + \alpha_{4\tau}^i RDPI_t \varphi_{2\tau}^i + \alpha_{5\tau}^i RW_t \varphi_{3\tau}^i + \varepsilon_t^i$$

$$\text{where } \varphi_{j\tau}^i = \begin{cases} 0 \text{ if } & t \le [n\tau] \\ 1 \text{ if } & t > [n\tau] \end{cases} \quad j=1,2,3 \tag{2}$$

conclusions about the MPC out of wealth or income can be reached, adjustment of all variables to the cointegration relationships must be investigated further.

One version of the GH test statistic uses the bias-corrected first-order serial correlation coefficient from Equation (2) to test for cointegration in the presence of a structural break. The recursive test statistic is given by:

$$Z_\alpha(\tau) = n(\hat{\rho}_\tau^* - 1) \qquad (3)$$

where $\hat{\rho}_\tau^*$ is the bias corrected first-order serial correlation coefficient, and n is the number of observations.[9] Under the GH test, the null hypothesis is that of no cointegration. Thus, a significant test statistic indicates cointegration exists, when allowing for a structural break.

This test statistic relies on time-series estimation techniques that correct for parameter bias and serial correlation. Estimation here uses Stock and Watson's (1993) Dynamic OLS (DOLS) technique, which has several advantages over other methods. First, it provides a correction for regressor endogeneity (as do other methods). Second, it provides efficient estimation even when regressors are integrated of higher order, and it is computationally more convenient than other methods. Finally, DOLS is routinely used in empirical research, and is widely accepted.[10]

DOLS corrects for parameter and standard error bias through the addition of leads and lags of the first difference of all right-hand side variables, as shown in Equation (4). In Equation (4), C_t, $RDPI_t$, RW_t are as previously defined, k is the chosen lag length, based upon residual normality tests and information criteria (such as AIC or SC), and i denotes the measure of consumption used on the left-hand side (relevant in robustness tests below). When estimating

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9 An alternative version of the GH test uses the Augmented Dickey Fuller test statistic (ADF* test). Both tests were conducted, and give generally consistent results. However, Gregory and Hansen note that the ADF* tests suffer from low power compared to the alternative Z_α test. The text reports the Z_α test results; ADF* results are footnoted where relevant. Both tests give generally consistent results, identifying a break in the interval from late 1990 to early 1994.

10 This technique is used by Ludvigson and Steindel (1999), Davis and Palumbo (2001), Mehra (2001), and Lettau and Ludvigson (2003).

the GH test, Equation (2) is incorporated into Equation (4) through the inclusion of dummies and interaction terms.

$$C_t^i = \gamma_1^i + \gamma_2^i RDPI_t + \gamma_3^i RW_t + \sum_{j=-k}^{k} \phi_j^i \Delta RDPI_{t-k} + \sum_{j=-k}^{k} \xi_j^i \Delta RW_{t-k} + \varepsilon_t^i \qquad (4)$$

The GH test results for aggregate consumption are reported in Table 2. Both tests indicate cointegration exists, when allowing for structural breaks (break dates noted in parentheses). Break points vary some across specifications, but both point to a possible break between late 1990 and 1993. Thus, GH tests point to a possible break around the 1990 recession, preceding the large increases in wealth that occurred in the late 1990s.[11]

Table 2
Gregory and Hansen Tests for Aggregate Consumption

Break in:	Z_α Statistic
Constant	-78.41** (1993:2)
All Parameters	-89.80** (1990:3)

** signifies significance at the 95% level.
The critical value for the 95% confidence level is –46.98 for the Z_α test for breaks in the constant. The 95% level critical value is –58.33 for the Z_α test on a break in all parameters. Critical values are provided by Gregory and Hansen (1996), Table 1.

Recall that the initial Johansen tests indicated cointegration exists across the consumption, wealth and disposable income variables. The GH tests here indicate cointegration exists when allowing for a possible break. However, Gregory and Hansen note that structural break results should be used as advisory results. When cointegration is found, both excluding

[11] As noted, an alternative test is the ADF* test. In testing here, the ADF* test allowing a break in all parameters is significant at the 90% level; the ADF* test on the constant narrowly missed the 90% confidence level. As Gregory and Hansen note, the ADF* test suffers from low power compared to the alternative Z_α test. The Z_α tests here (consistently stronger than the ADF*) are well beyond critical values, indicating cointegration exists, when allowing for a possible structural break. Consistent with the Z_α tests, ADF* tests identify break points surrounding the 1990 recession and recovery.

and including structural breaks, Gregory and Hansen note that it is "inappropriate" to disregard the cointegration results excluding structural breaks (1996a, pg. 114). GH also note that one should examine the results for the post break period for economically viable results. Given this admonition from Gregory and Hansen, aggregate consumption is evaluated with "break" and "no break" specifications for the relationship. The next section examines results for cointegration in the presence of structural breaks and compares results with the findings in the previous section's "no breaks" results.

Cointegration Results—Allowing for Possible Structural Breaks

As noted previously, conclusions on cointegration can be distorted if no allowance is made for possible structural breaks over time. The GH test results suggested two possible structural breaks: 1990:3 (all parameters) and 1993:2 (constant only). Thus, the DOLS specification is modified to allow for a potential break, and the long-run relationship is re-evaluated. For both break specifications, the GH test results reject the null hypothesis of no cointegration; results indicate cointegration remains across variables, even when allowance is made for structural change. The Z_α statistic in Table 2 of –78.4 and –89.8 suggest rejection of the null given ninety-five percent critical values of –46.9 and –58.3 respectively.

Table 3 reports results for the break in the constant after 1993:3. Recall that the results in Table 1 for the Johansen procedure (no structural breaks) indicated parameters for real wealth and disposable income, of 0.039 and 0.723, respectively. Results here indicate the long-run disposable income parameter is 0.775, which is somewhat larger than the initial (Table 1) result. The estimated long-run wealth parameter is smaller than initial estimates (0.023 here, versus

0.039 in Table 1).[12] Results for the alternative break treatment are presented in the Appendix. Subsequent analysis builds upon key specifications identified so far. For tractability of discussion, results reported in the text are based upon the 1993 break. However, more comprehensive estimation examines robustness of results, based on alternate break specifications. Key findings are very robust across specifications; and presented in the Appendix.

Table 3
Cointegration Results –Aggregate Consumption
(1993 Break in Constant)

Variable	Parameter Estimate	Standard Error
Real Disposable Personal Income	0.775**	0.011
Real Wealth	0.023**	0.003
Constant	31.61**	14.62
φ_t * Constant (1993:3)	111.94**	14.39
** indicates significance at a 95% level of confidence		

In addition to the existence of a long-run relationship, another key interest is in the adjustment process to restore the long-run equilibrium, or long-run versus short-run behavior of the variables in the system. The next section examines these adjustment processes.

[12] Appendix Table 5A reports results for the specification that allows all parameters to change after 1990:3. Panel A of this table reports the pre-break parameters, followed by the estimated *changes* in parameters for post-1990:3. Panel B presents the implied post-break parameters. Parameters for the pre-break period are highly consistent with those in Table 3 (0.024 for wealth and 0.769 for disposable income). For the post-1990:3 period, some large estimates for parameter change result in some unusual post-break parameters (Panel B). The resulting wealth parameter is statistically zero; the post-break parameter on disposable income is large (1.375) (although, recall that interpretation as the MPC out of disposable income critically depends on the adjustment of consumption and non-adjustment of wealth and disposable income in the long-run. Thus, this should not be taken to represent an MPC.) In the post break period, data for the economy are dominated by the economic expansion phase of the cycle (not capturing the full cyclical picture). This may be resulting in amplified parameter change estimates in the specification allowing all parameters to change. It is important to emphasize that, across treatments, the conclusions on endogeneity issues are robust--and that is the crux of many debates. Further, in the subsequent evaluation of short-run dynamics reported in Appendix Table 5B, VECM results are highly robust, regardless of whether the structural change is on the constant only (Table 3) or all parameters. Given this, analysis proceeds with the Table 3 results on the long-run relationship. Results for the alternative specification (1990:3 break in all parameters) are presented in the Appendix for interested readers.

Vector Error Correction Model Results

The VECM captures the adjustment of variables to restore long-run equilibrium. The adjustment of consumption and wealth is the center of the Endogenous Wealth and Endogenous Consumption debate. The classic notion of the wealth effect denotes the long-run response of consumption to changes in wealth, and the exogeneity of wealth and income. The next step in the analysis is to evaluate the adjustment of all variables in the cointegrating relationships to changes in the long-run equilibrium. These adjustment parameters provide evidence concerning the endogeneity of consumption, and also on the endogeneity of wealth and income.

To evaluate the dynamic adjustment patterns, two Vector-Error Correction Models (VECM) are estimated: VECM A evaluates aggregate consumption, disposable income, and wealth, excluding any breaks. VECM B evaluates aggregate consumption, disposable income, and wealth, including the 1993 break in the constant. The no break specification (VECM A) serves as a benchmark, both for VECM B and for comparison to existing literature.[13]

The VECM is given in Equation (5). The first representation of Equation (5) matches Equation (1) (presented earlier); terms are as defined previously and for the VECM estimations here, k=3 (three variables); each model uses j=4 lags, which is a general specification. The matrix Π is the product of two separate matrices, or $\Pi=\alpha\beta'$. The long-run (or cointegrating) relationship (β) was addressed in the previous section. It is the Π matrix that identifies the pattern of adjustment of all variables (α).

$$\Delta Y_t = A_0 + \Pi Y_{t-1} + \sum_{i=1}^{j} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (5)$$

[13] To speed exposition, the results for aggregate consumption including a break in 1990 is provided in the Appendix. Overall, results for this VECM are robust to those of VECMs A and B.

$$\text{or } \Delta Y_t = A_0 + \alpha\beta' Y_{t-1} + \sum_{i=1}^{j} \Gamma_i \Delta Y_{t-i} + \varepsilon_t$$

The main interest here is the statistical significance of the elements in the matrix of adjustment parameters (α). In results below, the parameter on the ECT (Error-Correction Term) gives the long-run adjustment (α) to changes in the equilibrium relationship between the variables. A statistically significant adjustment parameter denotes permanent changes in that variable after changes in any variable in the cointegration relationship (i.e. indicates it is endogenous). If a variable does not adjust (or has a statistically insignificant adjustment parameter), then changes in any of the variables can create transitory responses only (i.e. the variable is weakly exogenous). Specifically, if the adjustment parameter for consumption is statistically significant, then this indicates the consumption series adjusts to changes in either disposable income or wealth in the long-run—changes in income and wealth have a permanent effect on consumption; i.e., consumption exhibits a wealth effect.

As an example, suppose consumption is exogenous and evolves as a random walk. In this case, wealth and/or disposable income must adjust to the exogenous consumption variable, since the three are cointegrated. In their study, Ludvigson and Steindel (1999) conclude that consumption is exogenous; they find that their measure of consumption (non-durable plus services consumption) does not respond to changes in wealth or disposable income in the long-run. In this case, wealth can only influence consumption in a temporary manner, or not at all. Alternatively, if consumption does adjust to changes in the cointegration relationship, then wealth and income changes have a permanent impact on consumption.

Recall that the Endogenous Wealth studies have criticized the Endogenous Consumption methods, noting that it restricts to zero the long-run adjustment of wealth and income. In the Endogenous Wealth literature, when the zero restrictions are removed, the resulting conclusion was that consumption was exogenous; wealth does the adjusting to restore the long-run equilibrium between the variables. Here, the VECMs allow for simultaneous adjustment of *all* variables in the cointegration relationships. Thus, methods are consistent with the Endogenous Wealth studies; restrictions on income and wealth adjustments (as imposed in the Endogenous Consumption procedures) are lifted.

The VECMs are estimated using Full Information Maximum Likelihood (FIML).[14] Beginning with a general model, VECMs A and B are reduced to a parsimonious model. Insignificant lags (t-statistics less than one in absolute value) that follow significant lags are eliminated. Each table of VECM results reports the joint parameter value and significance of the included *j* lags for each variable.[15]

The specification excluding a structural break (VECM A) is examined as a benchmark. Results are reported in Table 4.[16] Given prior evidence of cointegration (or a long run relationship), the error correction terms (ECT) capture adjustments to the long-run equilibrium in the system, when a shock disrupts the long run relationship. It could be seen as the short run adjustment process, back to long-run equilibrium. The parameter on the ECT, also called the speed of adjustment parameter, captures whether a given variable adjusts (via the significance of the parameter) and how fast is the adjustment (or how much of the short-run disequilibrium is closed each period). In VECM A, the error correction term in the consumption equation is

[14]This accounts for endogeneity, and allows for system reduction to a parsimonious model. In a just identified model, FIML, two-stage least squares (2SLS), and instrumental variables (IV) estimation produce the same parameter estimates. However, FIML is superior to 2SLS and IV in over-identified systems, since it produces the most efficient estimates. Therefore, FIML is the best approach when a restriction of parameters produces an over-identified system, which is the case here. For further discussion, see Hamilton (1994).

[15] The joint significance of the included lags determines Granger-Causality in the short-run sense. As a cross check on model reduction methods, the joint significance of the parameters restricted to zero (through reduction to a parsimonious model) is reported near the bottom of each table.

[16] The long-run relationship used to derive the Error-Correction Term (ECT) comes from the Johansen results using three lags (in Table 1). Recall in this long-run relationship, the long-run parameters on income and wealth are 0.723 and 0.039 respectively.

statistically significant, indicating that consumption is an adjusting factor, when off long run equilibrium; in the terminology of the literature, consumption is endogenous. The value of the ECT is -0.071, indicating consumption does adjust, but not rapidly. This is consistent with other evidence, both from empirical studies and the Life Cycle/Permanent Income theory, indicating that consumption behavior is not that of harsh and rapid adjustments; rather, consumption adjustments are made gradually over time.

Table 4
VECM A
Aggregate Consumption
(No Structural Breaks)

Variable	**Δ C Equation**		**Δ RDPI Equation**		**Δ RW Equation**	
	Joint Significance (p-value)	# of Lags	Joint Significance (p-value)	# of Lags	Joint Significance (p-value)	# of Lags
$\Sigma\Delta C_{t-i}$ i=1 to j	(0.000)	3	(0.000)	4	(0.037)	1
$\Sigma\Delta RDPI_{t-i}$ i=1 to j	(0.041)	4	(0.000)	4	—	0
$\Sigma\Delta RW_{t-i}$ i=1 to j	—	0	(0.004)	2	(0.059)	3
Constant	(0.000)	—	(0.214)	—	(0.388)	—
ECT_{t-1}	**-0.071* (0.067)**	—	**-0.341** (0.000)**	—	**2.735** (0.000)**	—
Joint Significance of Restrictions (p-value):	0.987					
* and ** indicate significance at a 90% and 95% level of confidence respectively						

This "no break" result may be compared to other recent studies. Davis and Palumbo (2001), using a sample from 1960:1 through 2000:1, estimate the dynamic response of aggregate consumption in a single-equation format. They find that aggregate consumption responds to changes in disposable income and wealth, with speeds of adjustment between –0.13 to –0.21. Mehra (2001) estimates an adjustment parameter of –0.15, using an almost identical sample as Davis and Palumbo. However, both papers use a single-equation Error Correction Model (ECM), and thus restrict wealth and disposable income to be weakly exogenous. In other words, they restrict to zero the wealth and income variables' adjustment back to long-run equilibrium. Essentially, this forces consumption to do the adjusting, and potentially may create errors in variables problems in empirical estimation. Evidence here suggests that this does have substantial consequences for the results.

Procedures here are less restrictive than Davis and Palumbo or Mehra. The multivariate approach here allows for possible endogenous responses by disposable income and wealth. Table 4 indicates that, under this less restrictive procedure, consumption is still found to respond to changes in wealth (as well as income) in the long-run. Essentially, using the methods of the Endogenous Wealth research, results here point to a conclusion more consistent with the Endogenous Consumption studies. However, the speed of adjustment found here is smaller than values found in these recent papers. The predicted adjustment parameter on consumption is approximately one-third to two-thirds smaller than that in found in the Davis and Palumbo and the Mehra papers (-0.071 here versus –0.13 to –0.21 in Davis and Palumbo). Further, in the wealth and disposable income equations, the parameters on the ECT terms are highly significant. These significant ECT terms indicate that all variables are involved in the adjustment back to long-run equilibrium. In other words, wealth and disposable income are in fact endogenous, adjusting in the short-run to restore long-run equilibrium. Results here indicate that restricting to zero the wealth and income adjustment (as in the Endogenous Consumption literature) is not an appropriate treatment.[17] It may produce distorted estimates for remaining parameters.

[17] The pattern of Granger-Causality in VECM A is as complex as the long-run relationship between the variables. Consumption is the only variable that Granger-Causes all series in the short-run. The direction of causality between consumption and wealth is unidirectional, running from consumption to wealth. Also, wealth Granger causes disposable income in the short-run, but disposable income does not Granger-Cause wealth. Finally, wealth Granger-Causes itself.

Table 5 **VECM B** **Aggregate Consumption** **(Break in 1993)**						
Variable	**Δ C Equation**		**Δ RDPI Equation**		**Δ RW Equation**	
	Joint Significance (p-value)	# of Lags	Joint Significance (p-value)	# of Lags	Joint Significance (p-value)	# of Lags
$\Sigma\Delta C_{t-i}$ i=1 to j	(0.000)	3	(0.000)	4	(0.013)	1
$\Sigma\Delta RDPI_{t-i}$ i=1 to j	(0.038)	4	(0.000)	4	(0.278)	2
$\Sigma\Delta RW_{t-i}$ i=1 to j	—	—	(0.006)	2	(0.063)	3
Constant	11.34 (0.000)	—	2.33 (0.483)	—	64.52 (0.184)	—
ECT_{t-1}	**-0.084* (0.067)**	—	**-0.468** (0.000)**	—	**1.883** (0.037)**	—
Joint Significance of Restrictions (p-value): 0.996						
* and ** indicates significance at a 90% and 95% level of confidence respectively						

Results for VECM B (which incorporates a break) are reported in Table 5. Results here are very consistent with VECM A. The pattern of results, in terms of endogeneity and short-run Granger-Causality, match those of VECM A — consumption is endogenous. Therefore, allowing for a break in the cointegrating relationship does not alter basic results for dynamics of the system. (In robustness checks, the results from VECM A are representative of basic patterns found across the several structural break specifications evaluated.) Thus, the evidence across the several specifications indicates that wealth effects in consumption exist in the short-run and the long-run. Like VECM A, results here indicate that no single variable (neither consumption, nor wealth alone) does all the adjusting to restore long run equilibrium. As with VECM A, results for VECM B indicate wealth and income are endogenous too, through the statistically and economically significant adjustment of the two series to restore long-run equilibrium.

Results from these VECMs provide some interesting evidence, relative to other recent studies. First, as in the Endogenous Consumption literature, there appears to be a long-run response in aggregate consumption to changes in wealth and disposable income. Even when allowing for structural breaks, results here indicate cointegration exists across consumption, wealth and disposable income. Yet, the estimated wealth parameter (in the cointegrating relationship) is not as large as other studies that find evidence of endogenous consumption (for example, studies by Davis and Palumbo or Mehra). The estimated wealth parameter here is between 0.023 to 0.039 cents per dollar increase in wealth. This is consistent with other studies, but toward the smaller end of the range of estimates. In addition, in the VECM estimates, the results here find a smaller adjustment parameter on consumption, compared to those obtained in other studies finding endogenous consumption. However, the single equation error correction models used in those studies load the adjustment onto consumption. This may lead to amplified parameter values in such studies. Allowance here for adjustments from *all* variables does lead to a smaller value on the consumption adjustment parameter, intimating a more gradual adjustment of consumption to restore long-run equilibrium. Results here indicate that significant wealth and disposable income adjustments also occur.

Note that previous studies have pointed to a single "accommodating" factor, when the economy is knocked off long-run equilibrium. In the Endogenous Consumption studies, by construction, consumption is the only accommodating factor (due to restrictions implicit in the single equation procedure characteristic of these studies). Other studies use less restrictive procedures, and conclude from findings that wealth is the accommodating factor (endogenous wealth). Note that the studies that use less restrictive procedures find disposable income and consumption are (weakly) exogenous; disturbances from long run equilibrium are restored by adjustments in *wealth*, not consumption or income.

In this study, using the techniques from the Endogenous Wealth literature, results here show that consumption is endogenous—as well as income and wealth. Results here also reject the argument that disposable income is (weakly) exogenous. Results here demonstrate that multiple adjustments occur when the economy is disturbed from its long run equilibrium, with disposable income and wealth responding to changes in the relationship too.

Thus results here give evidence on several key points: 1) Consumption is endogenous; 2) Wealth and disposable income also display endogenous responses; 3) Restrictions in single equation error correction procedures are inappropriate, and can distort parameter results; and 4) The adjustment process is complex, and not achieved by a single variable (which has been the assertion of several previous studies).

Section 4. Conclusions

This paper bridges the gap between two competing lines of research regarding the timing and duration of wealth effects. The current debates centers on the long-run endogeneity of consumption to changes in wealth, disposable income, and itself. The Endogenous Wealth literature purports that wealth, and only wealth, adjusts to changes in the cointegration relationship between the three variables, or is endogenous.

The findings here, using the methods of the Endogenous Wealth literature, show that consumption is indeed endogenous in the long-run. In addition, this long-run endogeneity exists, while allowing for the endogenous response in disposable income and wealth in the long-run. However, the relationship is complex. Representations of a sole accommodating factor (whether consumption or wealth) are not appropriate. When a shock disturbs the long run equilibrium, this triggers a multifaceted adjustment process that can extend for many periods. Findings in this study are, in fact, more consistent with indications of the Life Cycle/Permanent Income hypotheses, which predict consumption adjusts gradually over time, and is based on multi-period assessment of disposable income and wealth.

The findings here reinforce the idea that aggregate wealth plays an important role in determining consumption in the long-run. The size of the wealth effect is slightly smaller than previously estimated once any structural breaks enter the long-run relationship, but the effects can still be substantial. Therefore the rise in equity and housing prices as experienced in the late 1990's can add significantly to aggregate demand, and the subsequent fall in equity prices can also have important negative effects on aggregate demand.

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APPENDIX

Appendix Table 1A Descriptive Statistics		
Variable	Mean	Standard Deviation
Δ Aggregate Consumption (RC)	19.872	27.147
Δ Disposable Personal Income (RDPI)	21.008	42.032
Δ Wealth (RW)	118.035	506.364

Appendix Table 1B Correlation Matrix			
	ΔRC	ΔRDPI	ΔRW
Δ RC	1	0.423	0.268
Δ RDPI	0.423	1	0.330
Δ RW	0.268	0.330	1

Appendix Table 2A Unit Root Tests				
PANEL A: Variables in Levels				
Variable	Constant Only		Constant and Time Trend	
	ADF Test Statistic (5% CV = -2.88)	KPSS Test Statistic (5% CV = 0.46)	ADF Test Statistic (5% CV = -3.43)	KPSS Test Statistic (5% CV = 0.15)
Aggregate Consumption	1.59	2.27	-0.57	0.32
Disposable Personal Income	1.13	2.31	-1.17	0.15
Wealth	0.65	1.99	-1.25	0.42
ADF and PP tests the null of a unit root, while KPSS tests the null of a stationary series.				

Appendix Table 2B Unit Root Tests				
PANEL B: Variables in First Differences				
Variable	Constant Only		Constant and Time Trend	
	ADF Test Statistic (5% CV = -2.88)	KPSS Test Statistic (5% CV = 0.46)	ADF Test Statistic (5% CV = -3.43)	KPSS Test Statistic (5% CV = 0.15)
Δ Aggregate Consumption	-4.04	0.39	-4.42	0.09
Δ Disposable Personal Income	-4.11	0.22	-4.27	0.08
Δ Wealth	-3.67	0.30	-3.86	0.08
ADF and PP tests the null of a unit root, while KPSS tests the null of a stationary series.				

Appendix Table 3
Balance Sheet of the United States[1]
For the Year Ended December 31, 2001
(Billions of U.S. Dollars)

Assets				
Households[2,3]	12,576.70			
Nonprofit Organizations	1,204.00			
Real Estate		13,780.70		
Equipment and Software Owned by Nonprofit Organizations[4]		120.10		
Consumer Durable Goods[4]		2,829.70		
Tangible Assets			16,730.60	
Foreign Deposits	53.50			
Checkable Deposits and Currency	349.10			
Time and Savings Deposits	3,250.60			
Money Market Fund Shares	1,174.30			
Deposits		4,827.60		
Open Market Paper	53.30			
U.S. Government Securities	844.00			
Municipal Securities	596.70			
Corporate and Foreign Bonds	763.80			
Mortgages	112.20			
Credit Market Instruments		2,370.00		
Corporate Equities[2]		6,076.60		
Mutual Funds Shares[2]		2,955.20		
Security Credit		454.30		
Life Insurance Reserves		880.00		
Pension Fund Reserves		8694.00		
Investment in Bank Personal Trusts		912.00		
Equity in Non-corporate Business[6]		4,877.10		
Miscellaneous Assets		354.90		
Financial Assets[4]			32,402.00	
Total Assets				**49,132.00**

Appendix Table 3, Continued			
Liabilities			
Home Mortgages[7]	5,379.40		
Consumer Credit	1,703.30		
Municipal Securities[8]	154.30		
Bank Loans n.e.c.	55.50		
Other Loans and Advances	263.20		
Commercial Mortgages[8]	124.70		
Credit Market Instruments		7,680.40	
Security Credit		196.40	
Trade Payables[8]		144.70	
Deferred and Unpaid Life Insurance Premiums		19.10	
Total Liabilities (less)			**8,040.6**
Total Net Wealth			**41,091.80**

1. Includes households, farm households, and nonprofit organizations. 2. At market value. 3. Includes owner-occupied homes, farmhouses, mobile homes, second homes not rented, vacant homes for sale, and vacant land. 4. At replacement (current) cost. 5. Value based on market value of equities held and the book value of other assets held by mutual funds. 6. Net worth on noncorporate businesses and owner's equity in farm business and unincorporated security brokers and dealers. 7. Includes loans made under home equity lines of credit and home equity loans secured by junior liens. 8. Liabilities of nonprofit organizations.

Appendix Table 4A
Aggregate Consumption, Parsimonious Results
VECM A
No Breaks, ECT Derived from Johansen Test using 3 lags

Variable	ΔC Equation		ΔRDPI Equation		ΔRW Equation	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
ΔC_{t-1}	0.220**	0.070	0.708**	0.095	2.988**	1.420
ΔC_{t-2}	0.217**	0.076	0.600**	0.102	—	—
ΔC_{t-3}	0.346**	0.083	0.153	0.109	—	—
ΔC_{t-4}	—	—	0.193*	0.112	—	—
$\Delta RDPI_{t-1}$	-0.067	0.051	-0.431**	0.068	—	—
$\Delta RDPI_{t-2}$	-0.122**	0.056	-0.095	0.076	—	—
$\Delta RDPI_{t-3}$	-0.084*	0.048	-0.135*	0.076	—	—
$\Delta RDPI_{t-4}$	-0.071	0.046	-0.076	0.062	—	—
ΔRW_{t-1}	—	—	0.003	0.005	-0.047	0.072
ΔRW_{t-2}	—	—	-0.015**	0.005	0.085	0.069
ΔRW_{t-3}	—	—	—	—	0.166**	0.072
Constant	11.38**	2.70	4.28	3.43	37.68	43.54
ECT_{t-1}	**-0.071***	**0.039**	**-0.341****	**0.053**	**2.735****	**0.770**
Joint Significance of Restrictions (p-value):					0.987	
* and ** indicates significance at a 90% and 95% level of confidence respectively						

Appendix Table 4B Aggregate Consumption, Parsimonious Results VECM B Break in 1993						
Variable	ΔC Equation		ΔRDPI Equation		ΔRW Equation	
	Parameter Estimate	Standard Error	Parameter Estimate	Parameter Estimate	Standard Error	Parameter Estimate
ΔC_{t-1}	0.236**	0.072	0.765**	0.093	3.766**	1.506
ΔC_{t-2}	0.224**	0.077	0.654**	0.099	—	—
ΔC_{t-3}	0.353**	0.085	0.235**	0.106	—	—
ΔC_{t-4}	—	—	0.269**	0.109	—	—
$\Delta RDPI_{t-1}$	-0.079	0.053	-0.468**	0.066	-1.009	0.940
$\Delta RDPI_{t-2}$	-0.131**	0.057	-0.120	0.073	-1.205	0.954
$\Delta RDPI_{t-3}$	-0.080*	0.048	-0.160**	0.073	—	—
$\Delta RDPI_{t-4}$	-0.064	0.046	-0.061	0.059	—	—
ΔRW_{t-1}	—	—	0.002	0.004	-0.085	0.072
ΔRW_{t-2}	—	—	-0.014**	0.005	0.087	0.073
ΔRW_{t-3}	—	—	—	—	0.158**	0.074
Constant	11.34**	2.72	2.33	3.31	64.52	48.35
ECT_{t-1}	**-0.084***	**0.046**	**-0.468****	**0.060**	**1.883****	**0.894**
Joint Significance of Restrictions (p-value):					0.996	
* and ** indicates significance at a 90% and 95% level of confidence respectively						

Appendix Table 5A Cointegration Results Aggregate Consumption (Break in all parameters in 1990)		
Panel A: Pre-break Cointegration Parameters and Dummy Parameters		
Variable	Parameter Estimate	Standard Error
Real Disposable Personal Income	0.769**	0.031
Real Wealth	0.024**	0.008
Constant	26.21	33.89
φ_t * Real Disp. Personal Income (1990:4)	0.606**	0.131
φ_t * Wealth (1990:4)	-0.040**	0.010
φ_t * Constant (1990:4)	-2204.43**	495.45
** indicates significance at a 95% level of confidence		
Panel B: Post-break Cointegration Parameters		
Joint Parameter Values and Significance		
Variable	Marginal Effect	p-value
Real Disposable Personal Income	1.375	0.000
Real Wealth	-0.016	0.169
Constant	-2178.22	0.000
Entries are parameter values plus all dummy interactions. p-value gives the joint significance of all parameters.		

Appendix Table 5B Aggregate Consumption, Parsimonious Results VECM C Break in 1990						
Variable	ΔC Equation		ΔRDPI Equation		ΔRW Equation	
	Parameter Estimate	Standard Error	Parameter Estimate	Parameter Estimate	Standard Error	Parameter Estimate
ΔC_{t-1}	0.211**	0.073	0.683**	0.085	3.837**	1.441
ΔC_{t-2}	0.199**	0.078	0.562**	0.093	—	—
ΔC_{t-3}	0.364**	0.086	0.258**	0.104	—	—
ΔC_{t-4}	—	—	0.322**	0.106	—	—
$\Delta RDPI_{t-1}$	-0.060	0.052	-0.433**	0.061	-0.969	0.931
$\Delta RDPI_{t-2}$	-0.126**	0.058	-0.207**	0.071	—	—
$\Delta RDPI_{t-3}$	-0.077	0.048	-0.186**	0.069	—	—
$\Delta RDPI_{t-4}$	-0.068	0.046	-0.085	0.057	—	—
ΔRW_{t-1}	0.005	0.004	0.011**	0.004	-0.107	0.072
ΔRW_{t-2}	—	—	0.000	0.004	0.007	0.075
ΔRW_{t-3}	—	—	0.007	0.005	0.104	0.075
ΔRW_{t-4}	—	—	0.007	0.005	—	—
Constant	11.46**	2.71	4.49	3.11	43.72	45.52
ECT_{t-1}	**-0.082***	**0.044**	**-0.524****	**0.055**	**2.300****	**0.856**
Joint Significance of Restrictions (p-value):					0.992	
* and ** indicates significance at a 90% and 95% level of confidence respectively						