An Assessment of Wealth Effects on Consumption in Canada

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Abstract

The paper examines the empirical relationship between wealth and consumer spending in Canada, focusing in particular on the role of housing wealth. Canadian households have benefited from the recent strength of housing prices through an increase in their wealth, and recent developments in the financial markets seem to provide an easier access to housing equity. This study uses a vector-error-correction model in which permanent and transitory shocks are identified using the restrictions implied by cointegration proposed by King, Plosser, Stock and Watson (1991) and Gonzalo and Granger (1995). Similarly to results obtained with US data, the housing wealth effect is estimated to be larger than the financial wealth effect since housing wealth is mainly driven by permanent innovations in contrast to financial wealth.

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1 Introduction

Over the recent years, the analysis of wealth effects has continued to cause much ink to flow. The equity price peak in 2000 has been followed by a boom in the housing market. The rise in housing prices has implied a significant increase in household wealth. As shown in Figure 1, Canadian data seem to suggest that increased household wealth may have played a role in maintaining consumer spending over the past decade. In fact, despite the declining ratio of disposable income to gross domestic product (GDP), the ratio of consumption to GDP has stayed relatively stable during this period. Pichette and Tremblay (2003) have examined the effect of wealth appreciation on consumer spending, focusing in particular on two components of wealth: stock market and housing wealth. They found that housing wealth have a significant effect on consumption while stock market wealth does not affect consumer spending significantly.

Given Pichette and Tremblay (2003) results and the recent surge in housing prices, this paper focuses on housing wealth effect. Recent developments in the mortgage market, which lead to an offer of a larger variety of products, in particular, in terms of opportunities for housing equity withdrawal, also arouse a growing interest in the analysis of housing wealth effect.

This study examines the empirical relationship between wealth and consumer spending in Canada, focusing in particular on the role of housing wealth. We carry on with the work done in Pichette and Tremblay (2003) by extending the sample and using Fisher chained index data. Following Lettau and Ludvigson (2004), we use a vector-error-correction model (VECM) in which permanent and transitory shocks are identified, using restrictions implied by long-run relationships as proposed by King et al. (1991) and Gonzalo and Granger (1995). The results are similar to those obtained by Kishor (2006) with U.S. data, that is, the housing wealth effect is estimated to be larger than the financial wealth effect since housing wealth is mainly driven by permanent innovations in contrast to financial wealth. However, we do not interpret the estimated relation between wealth and consumption as a marginal propensity to consume as it was done in several studies. The chosen approach shows that the variables are cointegrated, that is, they move together, but there is no evidence of a causality link.

The paper is organized as follows. Section 2 highlights the recent developments in the housing market. Section 3 provides a brief survey of the literature. Section 4 includes all the empirical analysis; this section describes the data and the econometric framework, and it reports the main results.

2 Recent Developments

As shown in Figure 2, housing wealth has risen significantly since 2001. This increase might be attributable to two main factors: the surge in house prices and the increased access to homeownership. After a long decade of stagnation, real house prices have kept a strong pace since 2002 with average annual rates of 2.5

per cent and 7 per cent for new housing price index and resale prices, respectively. This raised the value of real assets hold by homeowners.

These upward pressures on prices come from the buoyant housing market. Robust fundamental factors as employment growth, sustained labour income, and demographic changes have contributed to feed the demand. Despite the high level of activity in the residential construction sector, the supply could not catch up the demand, and the market stayed favourable to sellers. Historical low level of mortgage rates has obviously also played an important role in this booming market. Some households moved in a more expensive house, and others decided to buy their first home. According to the 1999 Survey of Financial Security published by Statistics Canada (Canada 2003), two-thirds of Canadian households own their residence. This is the most recent data on the home ownership rate, but there are some reasons to believe that more households own a home in 2006 than there were at the time of this survey.

First, at the beginning of the 2000's, most major Canadian urban areas were grappling with shortages in the rental market while the vacancy rate reached a through at 1.6 per cent.[1] Therefore, rental housing became relatively more expensive, and, encouraged by low mortgage rates, many people made the switch from renting to owning. Second, beyond the fundamental factors mentioned above, developments in the residential mortgage market have also been favourable for the first-time home buyers. Because of the growing competition in the banking sector, households have access to a broader range of products which are more flexible (e.g. skip-a-payment, early mortgage renewal and flexible payment schedules). CMHC also helps Canadian households to finance their home purchase by providing a mortgage loan insurance that enables homebuyers to access mortgage financing with as little as 5 per cent down payment. Recently, CMHC has even gone further in making the home ownership more accessible by eliminating the homeowner high-ratio application fees, and by offering insurance for mortgages with more flexible repayment option (as interest-only products) and longer amortization periods (up to 30 and 35 years). With these new measures, home ownership clearly becomes more affordable and accessible. The recent work done by Doms and Krainer (2007) for the United States shows that these innovations in the mortgage markets have in fact benefited households, especially those that are cash constrained.

It is not obvious that total net worth has increased in response to higher housing prices since home buyers had to spend more to get their home. However, the relative position of specific cohorts may change as a result of these wealth tranfers, and this can have macroeconomic effects if propensities to spend differ across cohorts. Also, given that house prices are still on an upward slope, whenever these households purchased their residence, they have more or less benefited from the recent rise in prices through an appreciation of their home equity.

How does this increase in housing wealth affect consumer spending? There are roughly three possible

[1] Source: CMHC, CHS – Rental Market Survey 2005.

ways to use the increased home equity: (1) home turnover; (2) mortgage refinancing cash-outs; and (3) increases in home equity lines of credit (HELOC). The first one is quite expensive given the costs implied by a move, but it could have accounted for some cash-outs since a lot of baby boomers may have decided to buy a smaller house. The second one is not popular in Canada because transaction costs related to mortgage refinancing are still higher than in the U.S. There are some reasons to believe that the latter has been more important over the recent years due to financial innovations. Personal lines of credit have grown by over 20 per cent per year since 2000, and, according to the Canadian Financial Monitor [2], about 60 per cent of total outstanding personal line balances would be secured by assets including real estate. This suggests that the increased value of houses provided homeowners with an easier access to credit. It also implies that home equity is now more liquid, and these new developments might have changed the housing wealth effect over time.

CMHC (2004) presents two estimates of borrowing against home equity in Canada. First, according to CIBC World Markets (2003) estimate, homeowners borrowed $22 billions against home equity between the beginning of 2001 and April 2003. This includes increases of $10 billions in home equity loans and $12 billions in the principal of mortgages trough refinancing. The Residential Mortgage Survey, a quarterly survey conducted by Clayton Research/Ipsos-Reid and reported in the Financial Industry Research Monitor (FIRM), provided the second estimate. According to the results of the March 2003 survey, Canadian homeowners increased their borrowing against home equity by $33 billions in 2002. Two-thirds of this amount were new home equity lines of credit. While these two estimates are different and hardly comparable, they still give a good idea of the amount of money available from the increased home equity. It represents roughly 2 to 3 per cent of nominal GDP, which is not inconsiderable.

3 Literature Review

Given that we carry on with the work done in Pichette and Tremblay (2003), this section first summarizes the main results of this paper. Secondly, it reviews the results of Lettau and Ludvigson (2004) and, finally, it considers few possible extensions.

Pichette and Tremblay (2003) examine the empirical relationship between wealth and consumer spending in Canada, focusing in particular on the role of stock market wealth and housing wealth in explaining movements in aggregate consumption. As highlighted by the authors, there are many reasons to believe that marginal propensity to consume (MPC, thereafter) from housing wealth and stock market wealth could be

[2] The Canadian Financial Monitor is a micro-dataset produced by Ipsos-Reid providing balance sheet information on Canadian households beginning in 1999.

different. First, direct holdings of equities are concentrated in the hands of a relatively small proportion of households (less than one-third) while approximately two-thirds of Canadian households own their residence.[3] Second, changes in equity values tend to reverse themselves more often than changes in housing wealth. Third, because of transaction costs, housing wealth is less liquid than stock market wealth. However, as discussed in the previous section, recent financial innovations have increased the access to mortgage refinancing, and lead to a more frequent use of housing wealth as collateral. Finally, capital gains on wealth resulting from owner-occupied housing have a tax advantage over stock market gains since they are exempted from the capital gains tax.

Following the methodology proposed by Lettau and Ludvigson (2001), and using the measures of wealth developed by Macklem (1994), Pichette and Tremblay (2003) estimate that the MPC from stock market wealth is small and statistically insignificant (less than 0.5 cents per dollar) while the MPC from housing wealth reaches a significant 5.7 cents per dollar. These results are obtained through the estimation of a VECM, and the decomposition of the permanent and transitory components of each variable (King, Plosser, Stock and Watson, 1991, Gonzalo and Granger, 1995, and Gonzalo and Ng, 2001). This analysis suggests that movements in stock market wealth have a much larger transitory component than changes in housing wealth, and that most of the fluctuations in consumption are explained by permanent shocks.

These results are mostly in line with what was found in Lettau and Ludvigson (2001) using U.S. data. In a more recent publication, Lettau and Ludvigson (2004) explain that their findings imply "*that no single number, or "marginal propensity" (as it is referred to in textbooks and popular commentary), can accurately summarize the response of consumption to wealth*"[4]. In fact, their results suggest that fluctuations in aggregate consumption are dominated by permanent innovations while most of the variation in household wealth is generated by transitory shocks which are unrelated to consumer spending. Since only permanent changes in wealth have an effect on consumption, and only a small fraction of fluctuations in asset prices is permanent (about 12 percent), the traditional estimates of the wealth effect of about five cents exaggerates the true correlation between consumption and wealth.

Other questions have arisen over time on the analysis of wealth effects. Like Pichette and Tremblay (2003), Kishor (2006) finds that a dollar increase in housing wealth has a bigger impact on consumption than a corresponding dollar increase in financial market wealth. The author uses the same methodology as Lettau and Ludvigson (2004) and Pichette and Tremblay (2003) except that he goes a step further asking whether the estimated wealth effect has changed over time due to financial market deregulation. The results obtained from a time-varying parameter model show that the relative importance of permanent component for housing wealth has increased over the last thirty years. Therefore, owing to efficiency gains in the housing market, the impact of an increase in housing wealth on consumer spending has been more important over

[3] Statistics Canada, 2003, 1999 Survey of Financial Security.

[4] Lettau and Ludvigson (2004), p.277.

the recent years than it had been thirty years ago.

Case, Quigley and Shiller (2005) also examine the relationship between consumer spending and wealth allowing for different effects from stock market and housing, but they use a different approach. They consider various specifications (in levels, first differences, and in error-correction model forms) with two panels of data: a panel of annual observations for 14 developed countries and a panel of quarterly observations on U.S. states. They find that housing market wealth has a large and significant effect on consumption while the estimated effect of financial wealth is small and, in some cases, insignificantly different from zero. Case, Quigley and Shiller (2005) also investigate any evidence of asymmetric effects. Their analysis suggests that, in fact, consumers react differently to increases in housing wealth compared to decreases. More precisely, increases in housing wealth have a positive and significant effect on consumption while decline in housing wealth have no impact. They attribute these asymmetries to loss aversion of home sellers (Genesove and Mayer, 2001). Case, Quigley and Shiller (2005) also consider a potential break in the relation between wealth and consumption in 1986 when the Tax Reform Act has been adopted. This change in the tax law, by eliminating the deductibility of all other interest payments for consumer credit, has greatly advantaged the use of housing equity for consumption. The results show that the housing wealth effect is two to ten times larger after the introduction of this reform.

4 Empirical Analysis

4.1 The Data

The data used in this paper are quarterly series and cover the period 1965Q1 to 2006Q2. The specification is slightly more parcimonious than in Pichette and Tremblay (2003) since the number of variables is reduced to four: consumption of non-durable goods and services (c), human wealth (hw), financial wealth (fin) and housing wealth (hsg).[5] All the variables are expressed in real term per capita. Disposable income is omitted because it is part of the definition of human wealth, a variable developed by Macklem (1994). Human wealth is a measure of permanent income; it depends on the present value of current and future disposable income, as well as on the expected real interest rate. It is computed in the following manner:

$$HW_t = X_t \left[1 + E_t \left[\sum_{i=1}^{\infty} \prod_{j=1}^{i} \left(\frac{1 + x_{t+j}}{1 + r_{t+j}} \right) \right] \right] = X_t \kappa_t \tag{4.1}$$

where $X = (L - G)$, L being labour income, and G, real government expenditures on goods and services. $(L - G)$ can be considered as a measure of labour income net of taxes, since, under the Ricardian equivalence

[5] Appendix A gives a detailed description of the data.

proposition, the value of government debt held by households is offset by future tax liabilities. x is the disposable income growth rate, r is the real interest rate and, therefore κ is a cumulative growth factor. Since this term depends on expectations, it is not observable. Lettau and Ludvigson (2004) use disposable income as a proxy for human wealth; this is a simple way to measure it when no data is available. In their empirical analysis, human wealth is equal to $k * Y$ where k is a constant and Y is disposable income. The intuition is the same as in the equation 4.1 , but in the case of Macklem's measure, k is not a constant, but is a function of future expected income growth and future expected interest rates.[6]

The composition of non-human wealth that we include in our analysis is a bit different than in Pichette and Tremblay (2003). Housing wealth is the same, that is the market value of residential structures net of mortgages, but stock market wealth is part of what we call here financial wealth. This also includes other financial assets such as currency and deposits, life insurance and pensions, foreign investments, etc... However, these are all financial assets since we exclude stock of durable goods which was considered as real assets in the definition of non-human wealth used in Tremblay and Pichette (2003). The share of durable goods has continuously decreased over the sample from about 23 per cent to less than 7 per cent at the end while the other components have really driven the fluctuations in total non-human wealth (see Figure 3).

The other variable included in the model is consumer spending. Standard consumer theory suggests that the appropriate measure of aggregate consumption focuses on the service flow from durable goods, rather than from the pruchase of such goods. To illustrate, the utility from owning a car derives not from the car itself, but from the services it provides (e.g. transportation and convenience). However, there is no straightforward method of computing the service flows obtained from durable goods, this is why real expenditures on non-durable goods and services are used as a proxy of total consumption in this study[7]. This approach assumes that real consumption of non-durable goods and services is a constant fraction of total real consumption. A cursory glance at the data seems to suggest that this assumption is not verified for Canada since the ratio has continually decreased over the sample. Nevertheless, given that no measure fo the service flow from durable goods is available, we use consumption of non-durable goods and services, and we will also test our model with total consumption to see if the results would be different.

4.2 The VECM

Our analysis is based on the following reduced-form VECM:

[6] The time series for human wealth in Canada is updated by the Bank of Canada on a regular basis. See Macklem (1994) for technical details.

[7] It should be noted that consumption of services includes actual and imputed rent, which is directly related to housing wealth.

$$\Delta X_t = \mu + \sum_{j=1}^{p} A_j \Delta X_{t-j} + \alpha\beta' X_{t-1} + \varepsilon_t \tag{4.2}$$

where X_t is an $n \times 1$ vector of cointegrated $I(1)$ variables, that is, $X = (c, hw, fin, hsg)$.[8] All these variables are expressed in log level. α and β are two $n \times r$ matrices with full rank, and $0 \leq r \leq n$ is the number of cointegrating vectors. The reduced-form shocks are assumed to have the following properties: $E_t[\varepsilon_t \varepsilon_{t-j}] = 0$ $\forall\ j \neq 0$, $E_t[\varepsilon_t] = 0$ and $Var[\varepsilon_t] = \sum_{\varepsilon}$.

Since ΔX_t is stationary, the above reduced form can be represented in Wold moving-average form as:

$$\Delta X_t = \mu^* + C(L)\varepsilon_t \tag{4.3}$$

where C_i are $n \times n$ matrices of estimated parameters, $C_o = I_n$ and $C(1)$ is a reduced rank $n \times (n-r)$ matrix if there exists one or more cointegrating relationships denoted by r (Granger Representation Theorem, Engle and Granger, 1987).

Two types of cointegration tests are used to assess the number of cointegrating relationships. The first one is a residual-based test designed to distinguish a system without cointegration from a system with at least one vector of cointegration. We follow the methodology proposed by Engle and Granger (1987). We first estimate the following equation using ordinary least squares (OLS):

$$c_t = \beta_0 + \beta_1 hw_t + \beta_2 fin_t + \beta_3 hsg_t + \xi_t. \tag{4.4}$$

The ADF unit root test is then applied to the residuals. If there exists a long-term relationship between these variables, the estimated residual $\left(\hat{\xi}\right)$ is stationary. The hypothesis of no cointegration is rejected at the 5 per cent level (see the result at the bottom of Table 2). We have also tested every combination of the variables and have not found any support for other cointegrating relationships.

The second type of cointegration test is a procedure developed by Johansen (1988, 1991) which allows to determine the number of cointegrating relationships in a multivariate system specified as the equation 4.2. Both statistics provided by this procedure, the trace and the maximum eigenvalue (L-max), indicate evidence of one cointegrating relationship as shown in Table 2. For the rest of the analysis, we therefore assume that there is one cointegrating vector linking consumption, human wealth, financial and housing wealth variables. This vector is estimated using non-linear least squares as developed by Phillips and Loretan (1991). To obtain an asymptotically efficient estimate of the long-run parameters, Phillips and Loretan (1991) propose to normalize the dependant variable, to add lags of the error-correction term as well as leads and lags of the explanatory variables. The number of leads and lags is chosen such that the serial correlation in the error term is all removed. The resulting long-run relationship is the following:

[8] The results of unit root tests are available in Table 1.

$$c_t = -17,41 + 0.17hw_t + 0.06fin_t + 0.14hsg_t \tag{4.5}$$

In equation 4.2, $\hat{\beta}' X_{t-1}$ is the error-correction term. When this term is not equal to zero, variables deviate from the long-run equilibrium. The matrix α includes the adjustment coefficients, which tell us which variables will adjust to restore the equilibrium. The results of the estimated VECM are shown in Table 3. According to the $\hat{\alpha}$, three variables contribute significantly to the adjustment to the long-run equilibrium: consumption, human wealth and financial wealth. The implications of these estimates will be further discussed in the next section.

4.3 The P-T Decomposition

The methodology used in this study allows us to distinguish permanent shocks from transitory shocks. Starting from the reduced-form Wold moving-average representation (equation 4.3), the following structural form has to be identified:

$$\Delta X_t = \mu^* + D(L)\eta_t \tag{4.6}$$

where η_t is an $n \times 1$ vector of unknown structural innovations with $E[\eta_t \eta_{t-j}] = 0, \forall j \neq 0, E_t[\eta_t] = 0$, and $Var[\eta_t] = \Sigma_\eta$. The D_j are $n \times n$ matrices that need to be identified and where d_{kl}, a typical element, measures the effect of the l^{th} structural shock on the k^{th} variable after j periods. Since the model includes four variables, which are linked with only one long-run relationship, we know from Stock and Watson (1988) that this cointegrated system is driven by three common trends. Therefore, there are three permanent shocks and one transitory shocks. We denote the structural innovations as $\eta_t = (\eta_{1t}, \eta_{2t}, \eta_{3t}, \eta_{4t})$, the first three innovations being permanent and the last one, transitory[9]. In other words, in equation 4.6, each element of ΔX_t is a function of three permanent shocks and one transitory shock. The objective now is to recover the structural innovations η_t from the information available in the VECM.

As described in Gonzalo and Granger (1995) and Gonzalo and Ng (2001), these structural shocks are identified using the estimated $\hat{\alpha}$ and $\hat{\beta}$ from the error-correction model. The distributed lag operator $D(L)$ is defined as being equal to $C(L)G^{-1}$, where

$$G = \begin{pmatrix} \alpha'_\perp \\ \beta' \end{pmatrix} \tag{4.7}$$

and $\alpha'_\perp \alpha = 0$. Following Gonzalo and Ng (2001), $\alpha_\perp$ is calculated using the eigenvectors associated with the $n - r$ smallest eigenvalues of the matrix $\alpha\alpha'$. As a result, $\eta_t = G\varepsilon_t$.

[9] Gonzalo and Granger (1995) define a shock, i, as being permanent if $\lim_{h\to\infty} \frac{\partial E(x_{t+h})}{\partial \eta_t^i} \neq 0$ and transitory if $\lim_{h\to\infty} \frac{\partial E(x_{t+h})}{\partial \eta_t^i} = 0$.

Intuitively, this transformation implies that variables that do much of the adjustment to restore the long-run equilibrium, and thus have a large α, will have a large weight on transitory innovations. These variables contain a transitory component, which makes them deviate from trend for the error-correction process. In contrast, variables for which the associated coefficient is small and insignificant will have a small weight on transitory innovations. As recommended by Gonzalo and Ng (2001), the values of parameters in α that are statistically insignificant at the 5 per cent level are set to zero. In the specific case of our model, only α_{hsg} is equal to zero.

Unlike Lettau and Ludvigson (2004) and Kishor (2006), we find that consumption does some of the adjustment in Canada to restore long-run equilibrium. This means that households' consumption decisions may vary in response to transitory shocks. However since $\hat{\alpha}_c$ is smaller than $\hat{\alpha}_{hw}$ and $\hat{\alpha}_{fin}$, consumption has a lower weight on transitory innovations than human wealth and financial wealth do. This result is confirmed by the forecast-error variance decomposition (see Table 4). The contribution of transitory innovation to the total forecast-error variance of consumption decreases faster than it does for the other two variables. After 4 quarters, only 6 percent of the variance of consumption is explained by transitory shocks while for human wealth and financial wealth the contribution is about 20 percent for the same horizon. According to Table 5, however, about 20 percent of the variance in consumption growth is attributable to the transitory shock at all horizon. This is just slightly less than for human wealth (25 percent) and financial wealth (22 percent).

Nevertheless, the results are quite similar to those obtained with U.S. data (Kishor, 2006), and to those reported in Pichette and Tremblay (2003). The housing wealth effect is estimated to be larger than financial wealth effect since housing wealth is mainly driven by permanent innovations in contrast to financial wealth. The long-run relationship tells us that a permanent one-dollar change in housing wealth may be associated with a four to eight cent change in consumption[10]. Similarly, a permanent one-dollar change in financial wealth may be associated with a one to two cent change in consumption. It is important to note that these numbers are not interpreted as *marginal propensity to consume* since the intuition is that cointegrated variables have a common trend. In other words, they move together, but there is no evidence of a causality link that can be demonstrated with this type of model. Moreover, our results suggest that consumption responds differently to transitory innovations than to permanent innovations; then, the relationships with the other variables in the model are not clear at all. For example, more than 20 percent of movements in financial wealth are transitory, this means that the long-run parameter only partially summarizes the relation between financial wealth and consumption.

Another interesting way to analyse the results is to plot the impulse response functions that show how each variables adjust following shocks. These responses are shown in Figure ? to ? with their 95 per cent

[10] This is obtained by multiplying the the estimated parameter in the long-run relationship by the latest value of the ratio consumption to housing wealth. (The second value takes the average ratio over the sample).

confidence intervals[11]. Figure ? supports the results described above showing that consumption adjusts rapidly following a transitory shock.

4.4 Stability Tests

According to Kishor (2006), the financial liberalization that has occurred over the last three decades in the United States might affect some estimated parameters in the model. Increased competition in the mortgage market, improvements in information processing and the resulting rise in mortgage refinancing would have implications for the error correction coefficient, in particular. His intuition is that these changes over time might have altered the importance of transitory innovations at different forecast horizons for housing wealth. To verify whether this intuition is correct, Kishor (2006) uses a time-varying parameter model, and finds that, in fact, the error correction coefficient for housing wealth has changed over time. During certain episodes, mostly before 1985, transitory shocks would have contributed significantly to fluctuations in housing wealth. The author interprets these results as an evidence that the financial liberalization might have increased the housing wealth effect. However, a time-varying vector autoregressive representation augmented by a stable cointegrated relationship such as used by Kishor is problematic. While the Granger Representation Theorem shows that cointegrated series can be represented by a time invariant vector error correction models, there exist no theoretical results that guarantee the compatibility between a time-varying error correction model with stable cointegrating vectors. In particular, cointegration implies restrictions on the long run behavior of the vector autoregressive parameters which are not imposed in the time-varying parameter model used by Kishor. This raises serious doubts on the validity of the estimation strategy advocated by Kishor and, a fortiori, on the interpretation of the results obtained with this time-varying error correction model.

Despite the methodological issues presented above, the idea that the relation between consumption and housing wealth have changed over time might seem intuitive based on the discussion in section 2 of this paper. This is why we test for possible instability in the parameters of the VECM. We use the SupF test proposed by Andrews (1993) which tries to identify a structural break with unknown timing by testing all possible dates. As shown by Sowell (1996), this structural change test has also no trivial power to detect instability characterized by time-varying parameters such as considered by Kishor (2006).[12] The results of these tests are shown in Table 6. The null of parameter stability cannot be rejected for all equations of the VECM except for the housing wealth. The identified breakpoint is early in the sample, and the test proposed

[11] The confidence bands are constructed by bootstrapping as explained in Gonzalo and Ng (2001).

[12] By no trivial power, we mean that the power of the test is greater than the chosen level under the alternative of time-varying parameters. See also Carrasco (2002) for the power of the structural tests as in Andrews (1993) to detect alternatives characterized by regime-switching or threshold representations.

by Andrews is able to identify only one structural change. This needs further investigation in order to see if there has been more than one structural change in our sample.

To bring more support to these results, we did two types of rolling regressions. The first procedure starts with an initial range of observations, and adds observations (one at a time) to the end of the sample. The second uses a moving window of about half of the entire sample. It simultaneously adds and drops observations so that the number of observations in each regression is constant. Both experiments do not show any evidence that coefficients have significantly changed over time.[13]

Moreover, we perform stability tests as proposed by Hansen (1992), who has considered models with integrated regressors. Three test statistics are presented: the SupF, the MeanF and the L_c. For all of these tests, the null hypothesis is the stability, while the alternative hypothesis are different. The SupF test verifies if there is a structural break, for which the timing is unknown. The other two tests are able to identify gradual changes in the parameters. As shown in Table 7, there is no evidence of instability in our estimated cointegrating relationship. These results also support the existence of the long-run relation that we estimated in our model.

Other tests for parameter constancy will be applied to confirm that recent developments in the motgage market have not changed the relation between consumer spending and wealth. Hansen and Johansen (1999) propose two tests for constancy of the long-run parameters. The first one is based on estimated eigenvalues obtained recursively, starting with an initial range of observations and adding observations , one at a time, to the end of the sample. The null hypothesis is parameter stability, and no specific alternative is formulated. As for Hansen (1992)' tests, the timing of a potential structural break is unknown. The second test is based on the LM type test for parameter instability developed by Nyblom (1989). The results of these tests are forthcoming.

Given that home equity withdrawal is a very recent phenomenon in Canada, it has increased significantly only since 200?, it is not surprising that we find no structural break. However, recent work by Andrews and Kim (2006) seems very relevant for this kind of situation. Andrews and Kim (2006) introduce tests for cointegration breakdown that may occur over a short time period, such as at the end of the sample. These tests may detect two types of breakdown: a change in the estimated parameters and/or a change in the errors from being stationary to being integrated. It is intended to explore this approach because of the growing interest in understanding the recent period.

[13] The results are available upon request to the authors.

5 Concluding remarks

This paper examines the empirical relationship between wealth and consumption. Following Lettau and Ludvigson (2004), we estimate a VECM in which permanent and transitory innovations are identified, using restrictions implied by long-run relationships as proposed by King et al. (1991) and Gonzalo and Granger (1995). Similarly to results obtained in Pichette and Tremblay (2003), the housing wealth wealth effect is estimated to be larger than the financial wealth effect since housing wealth is mainly driven by permanent innovations in contrast to financial wealth. This is also in line with Kishor (2006) who did a similar analysis with U.S. data. In contrast to previous studies, however, we find that consumer spending responds to transitory shocks, that is, when there is a deviation from the cointegrating relationship, consumption does some of the adjustment to restore the long-run equilibrium.

Because of the recent developments in the housing market, we were also interesting in testing if the relation between houisng wealth and consumer spending has changed over time. In this paper, we perform some preliminary tests of parameter stability without finding any evidence of a structural break. This is a work in progress, though, there are still some tests that might be useful in better understanding the dynamic between these variables.

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7 Tables and Figures

Table 1: Unit root tests (1964Q4 to 2006Q2)

Variable (real per capita in log)	ADF	GLS-detrended DF (ERS)
In level		H_0 = unit root
Consumption ex. durables (lcxd)	-2.27	-2.24
Human wealth (lhw)	–1.62	-1.67
Financial assets (lfin)	-3.06	-2.96
Housing wealth (lhsg)	-3.42	-2.84

Asymptotic critical values (at 5 percent confidence level) are respectively -3.44 and -2.96 for the Augmented Dickey-Fuller (ADF) test and the GLS-detrended DF test

Table 2: Cointegration Tests

Test		H_0	c,hw,fin,hsg	Critical values (at 95 percent)
Johansen	Trace	$r = 0$	**57.04**	54.08
		$r = 1$	27.15	35.19
		$r = 2$	13.68	20.26
	L-max	$r = 0$	**29.89**	28.59
		$r = 1$	13.47	22.30
		$r = 2$	10.87	15.89
ADF		$\varepsilon \sim I(1)$	**-5.50**	-4.35

Notes: Bold numbers indicate the rejection of the null hypothesis of no cointegration at the 5 per cent level.

Table 3: VECM Estimates

	Dependent Variable			
	Δc_t	Δhw_t	Δfin_t	Δhsg_t
Regressors				
$\sum \Delta c_{t-i}$	**0.362**	**-0.165**	**-0.385**	**1.508**
	(0.00)	(0.02)	(0.00)	(0.00)
$\sum \Delta hw_{t-i}$	**0.023**	**-0.173**	**0.584**	**0.413**
	(0.05)	(0.01)	(0.00)	(0.00)
$\sum \Delta fin_{t-i}$	**0.035**	-0.104	0.128	-0.169
	(0.00)	(0.14)	(0.07)	(0.06)
$\sum \Delta hsg_{t-i}$	-0.016	**0.156**	0.055	**0.181**
	(0.17)	(0.03)	(0.44)	(0.04)
$\beta\prime X_{t-1}$	**-0.125**	**0.812**	**0.718**	0.437
	(0.01)	(0.01)	(0.02)	(0.25)
$\bar{R}^2$	0.153	0.082	0.154	0.020

Notes: For $i = 1, ..., 4$. Bold numbers indicate significance at the 5 per cent level (p-values are in parentheses).

Table 4: Forecast-Error Variance Decomposition

	c_t		hw_t	
Horizon h	P	T	P	T
1	0.76	0.24	0.71	0.29
2	0.85	0.15	0.74	0.26
4	0.94	0.06	0.81	0.19
8	0.98	0.02	0.89	0.11
∞	0.999	0.001	0.995	0.005

	fin_t		hsg_t	
Horizon h	P	T	P	T
1	0.78	0.22	1.00	0.00
2	0.77	0.23	1.00	0.00
4	0.78	0.22	1.00	0.00
8	0.88	0.12	1.00	0.00
∞	0.997	0.003	1.000	0.000

Table 5: Forecast-Error Variance Decomposition

	Δc_t		Δhw_t	
Horizon h	P	T	P	T
1	0.76	0.24	0.71	0.29
2	0.86	0.14	0.71	0.29
4	0.83	0.17	0.73	0.27
8	0.81	0.19	0.74	0.26
∞	0.794	0.204	0.750	0.250

	Δfin_t		Δhsg_t	
Horizon h	P	T	P	T
1	0.78	0.22	1.00	0.00
2	0.78	0.22	1.00	0.00
4	0.77	0.23	1.00	0.00
8	0.77	0.23	1.00	0.00
∞	0.779	0.221	0.999	0.001

Table 6: Andrews Stability Tests

Dependent variable	*SupF* statistic
Δc_t	36.02
Δhw_t	23.34
$\Delta fina_t$	26.11
Δhsg_t	88.33

Note: The critical values are 39.55 and 44.84 at the 5 per cent and the 10 per cent significance levels, respectively.

Table 7: Hansen Stability Tests

Test	Statistic	p-value
L_c	0.122	≥ 0.20
MeanF	1.485	≥ 0.20
SupF	5.818	≥ 0.20

Figure 1: Disposable Income, Wealth, and Consumption

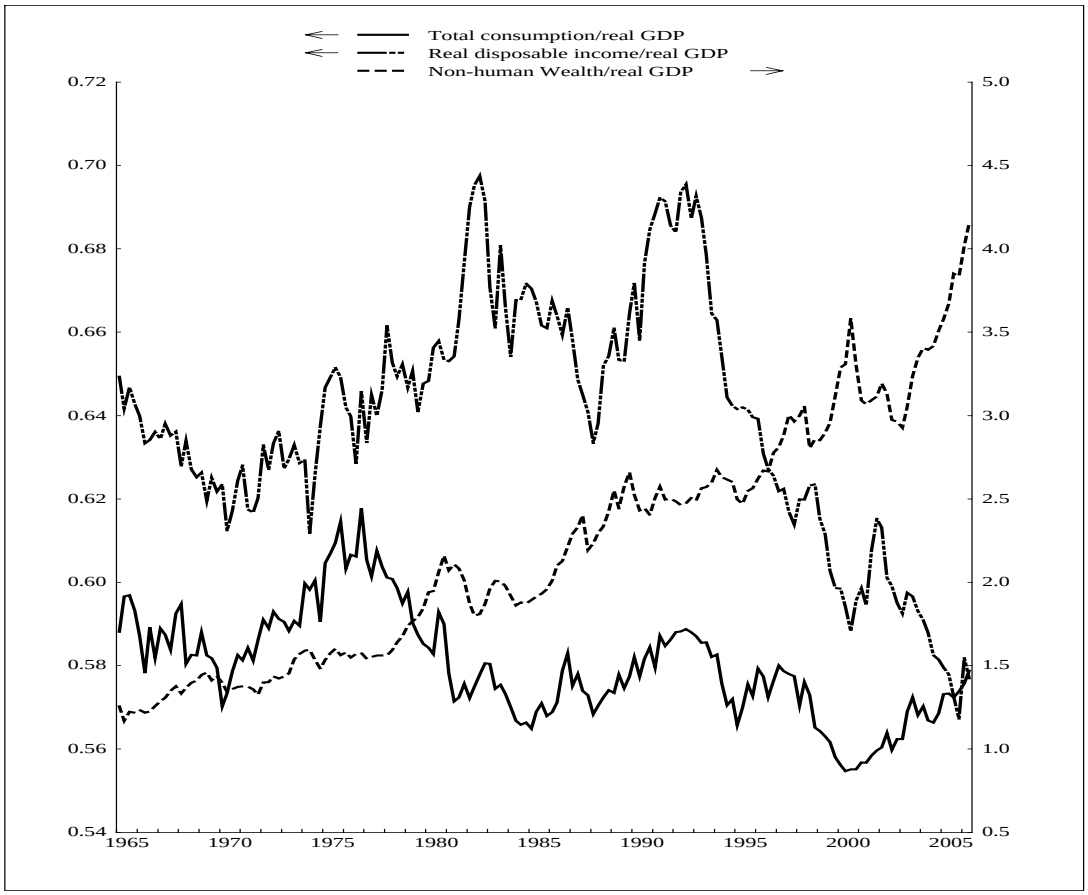


Figure 2: Real per capita Houisng Wealth and Real Housing Prices

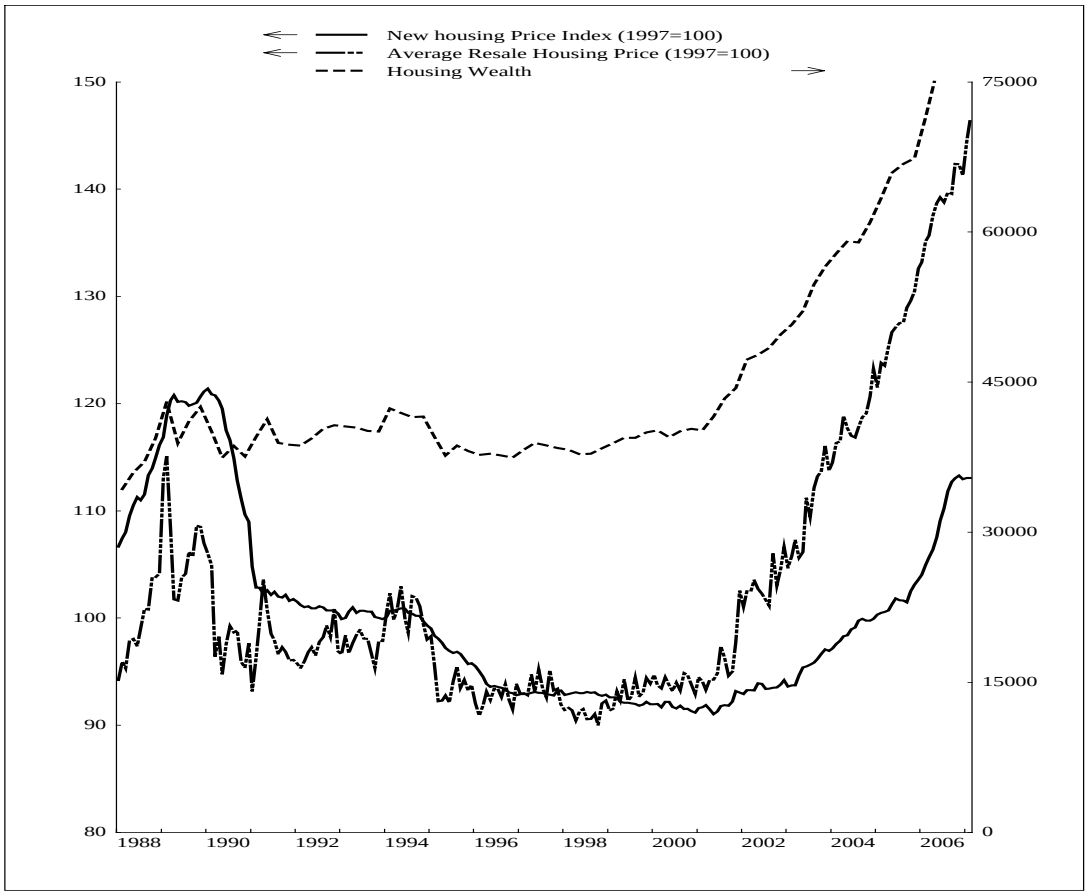
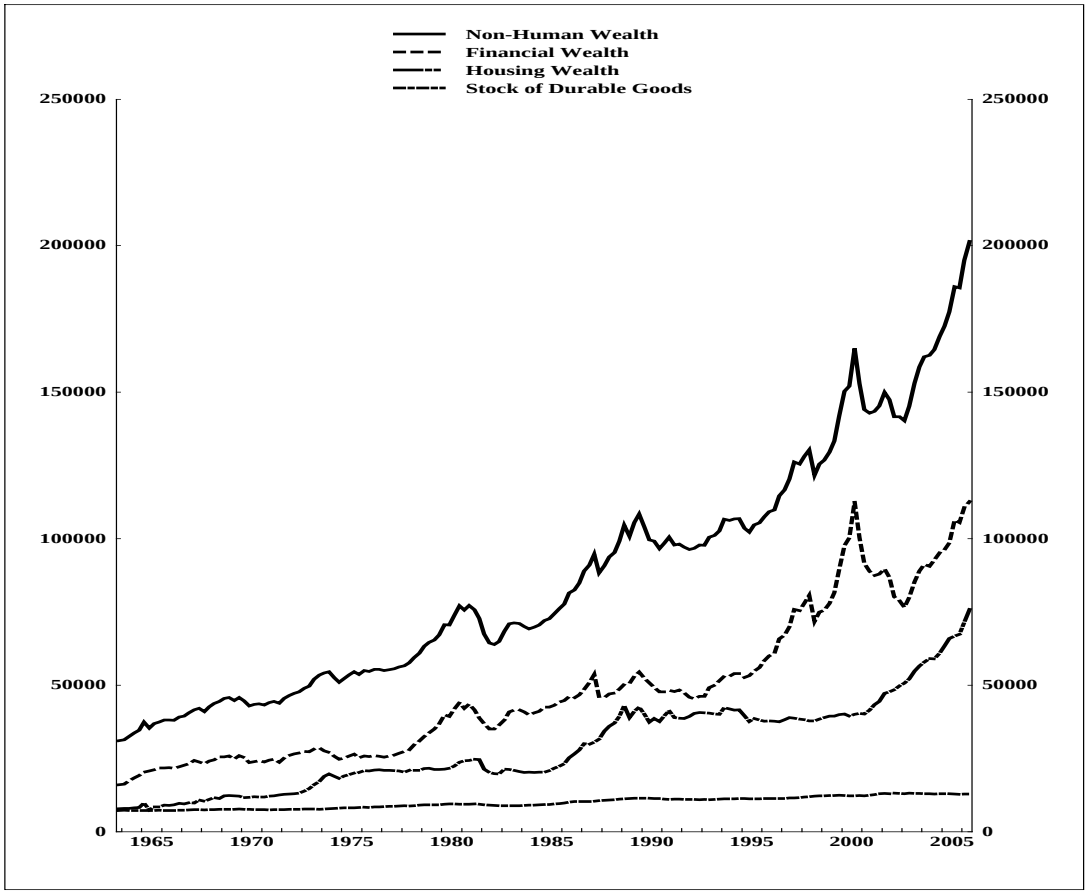


Figure 3: Non-Human Wealth and its Components (real per capita)



8 Appendix A: Data Description

Data used in this study are mainly drawn from CANSIM and cover the period 1964Q2 to 2006Q2. Variables included in the system are in logarithms.

Real per-capita consumption of non-durable goods and services chained 1997 dollars $c = (D100103 - D100104)/npop$. A procedure is used to adequately substract these variables based on the chained-weighted ideal Fisher index.

Population (15 years and over) $npop = V2091030/1000$. Data before 1976 are from the Bank of Canada.

Human wealth hw (see details in section 4.1)

L = real per-capita labour income.

G = real per-capita government expenditures on goods and services to be paid for by households.

r = real interest rate $= RR90 + 2.3/400$

$RR90 = R90/400 - EINF$

$R90 =$ nominal interest rate on 90-day prime corporate paper. B14017

$EINF =$ expected inflation estimated with a fourth-order autoregressive process.

Financial wealth $fin =$ the sum of financial assets held by persons and unincorporated businesses, less the liabilities of this sector, plus the value of the Canada and Quebec Pension Plans, and less the value of domestically held outstanding government debt.

Housing wealth $hsg = RSTRUC - MORTQ$

$RSTRUC$ = residential structures $= (PMLS/100) * KRC$

$PMLS$ = multiple homes listing price index

KRC = stock of housing in chained 1997 dollars $= (1 - \delta) * KRC_{t-1} + 0.25(D100261 - D100260)$

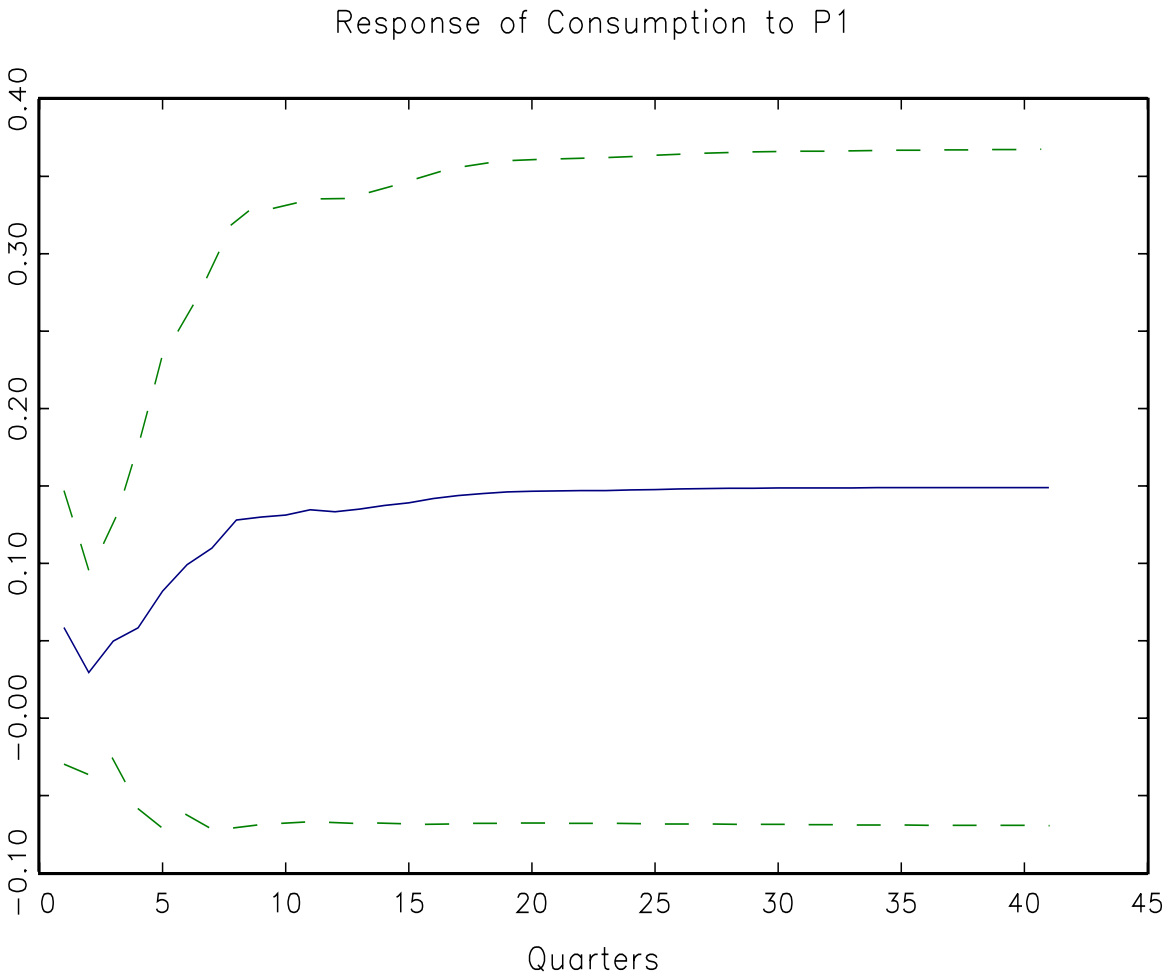
The initial stock of housing and the depreciation rate are calculated at the Bank of Canada.

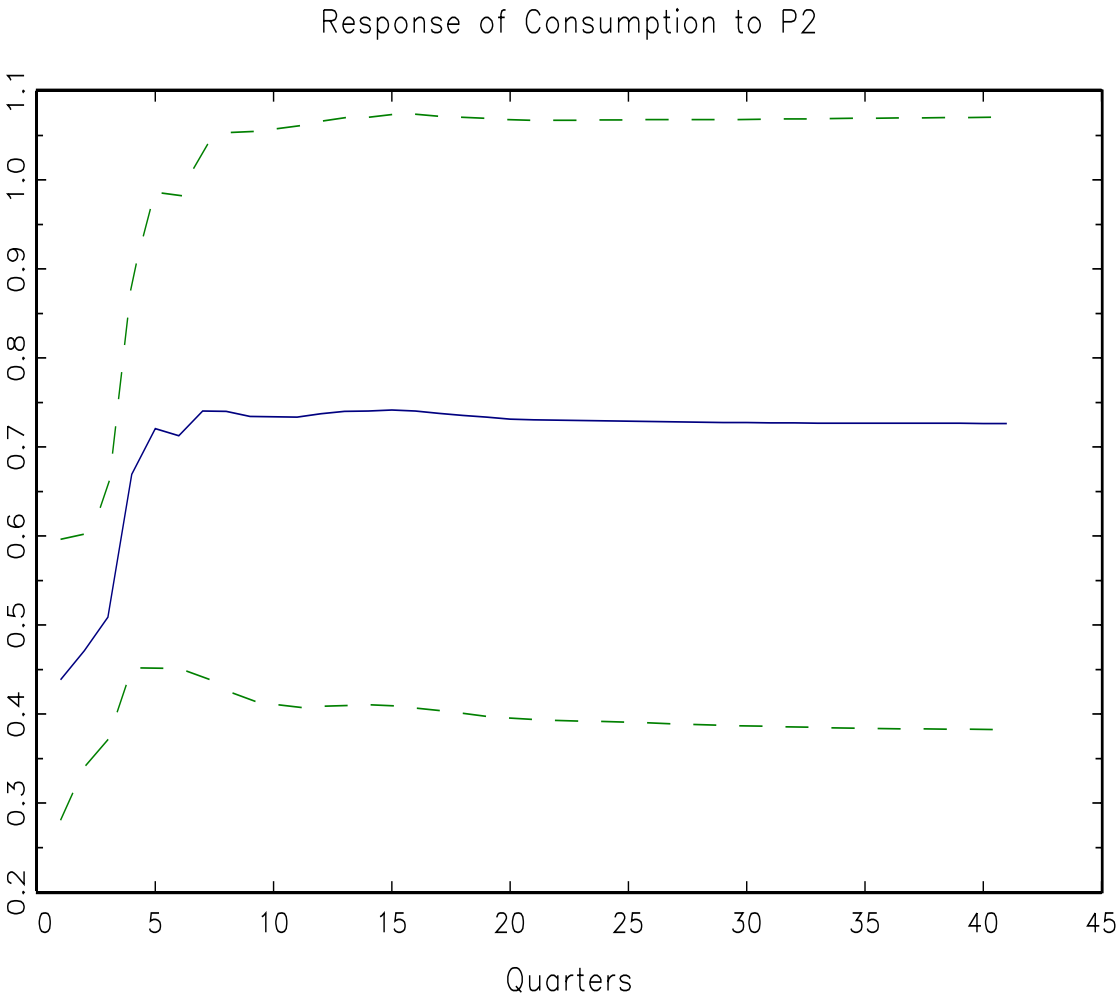
$MORTQ$ = mortgages. D160048, D150056

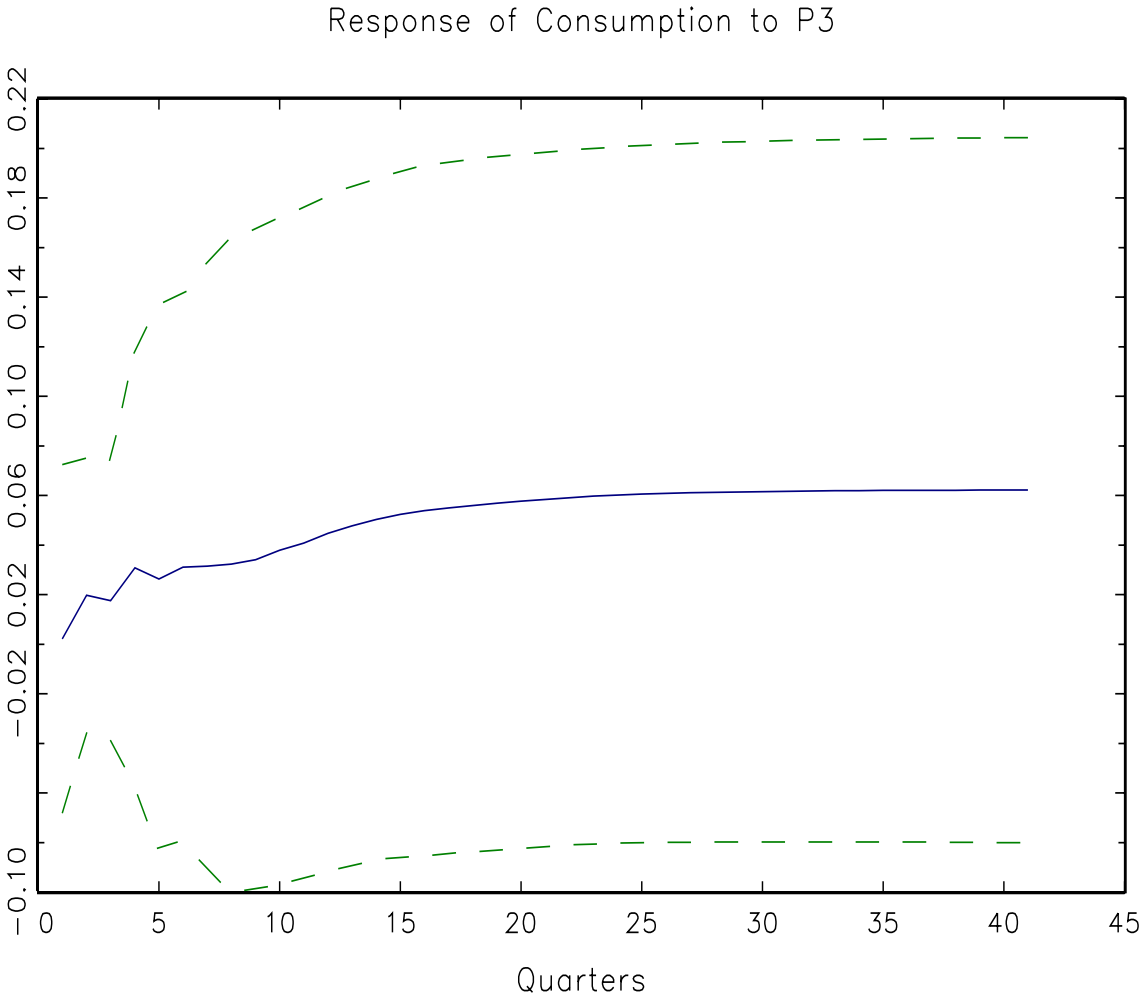
Another Look at Housing Wealth Effects in Canada

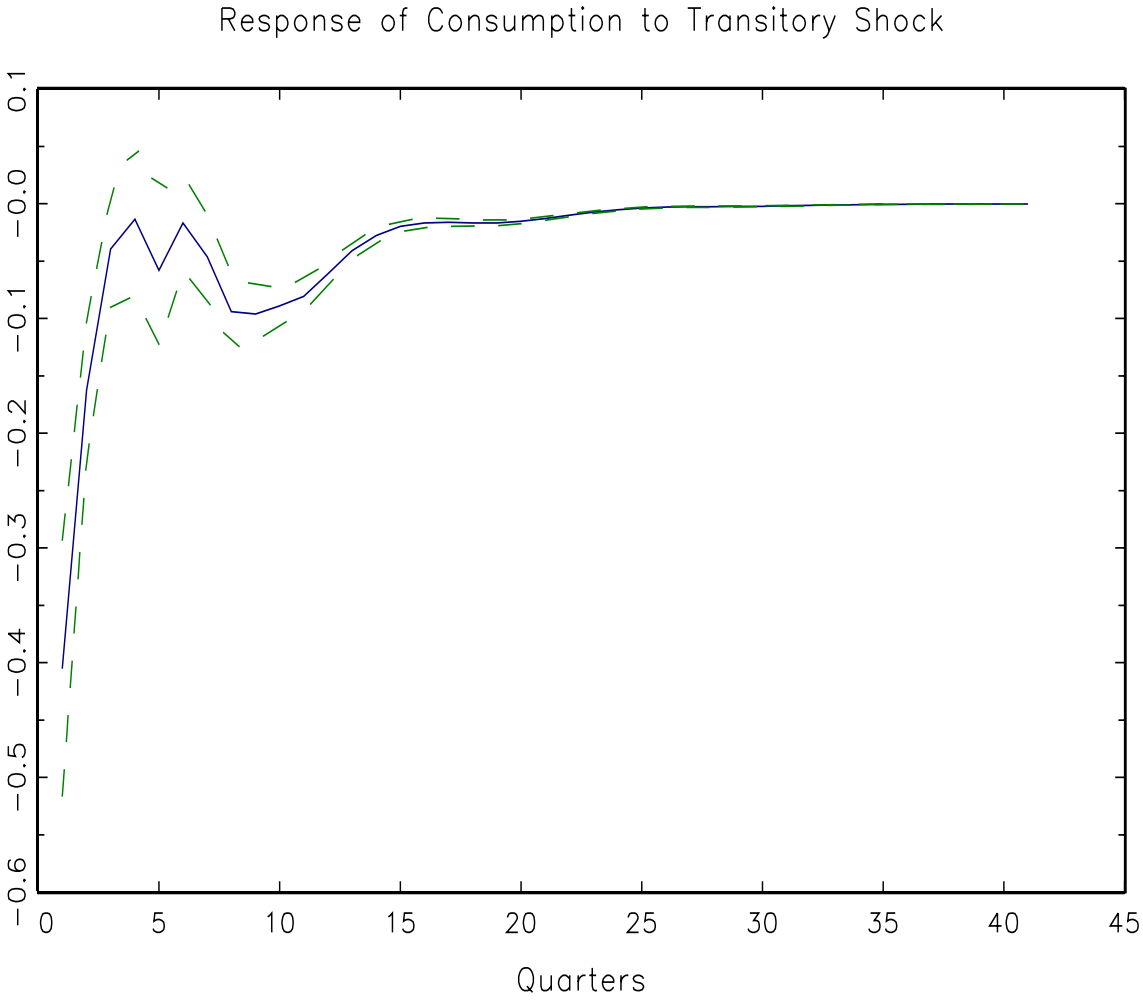
by Alain Guay and Lise Pichette
March 7, 2007

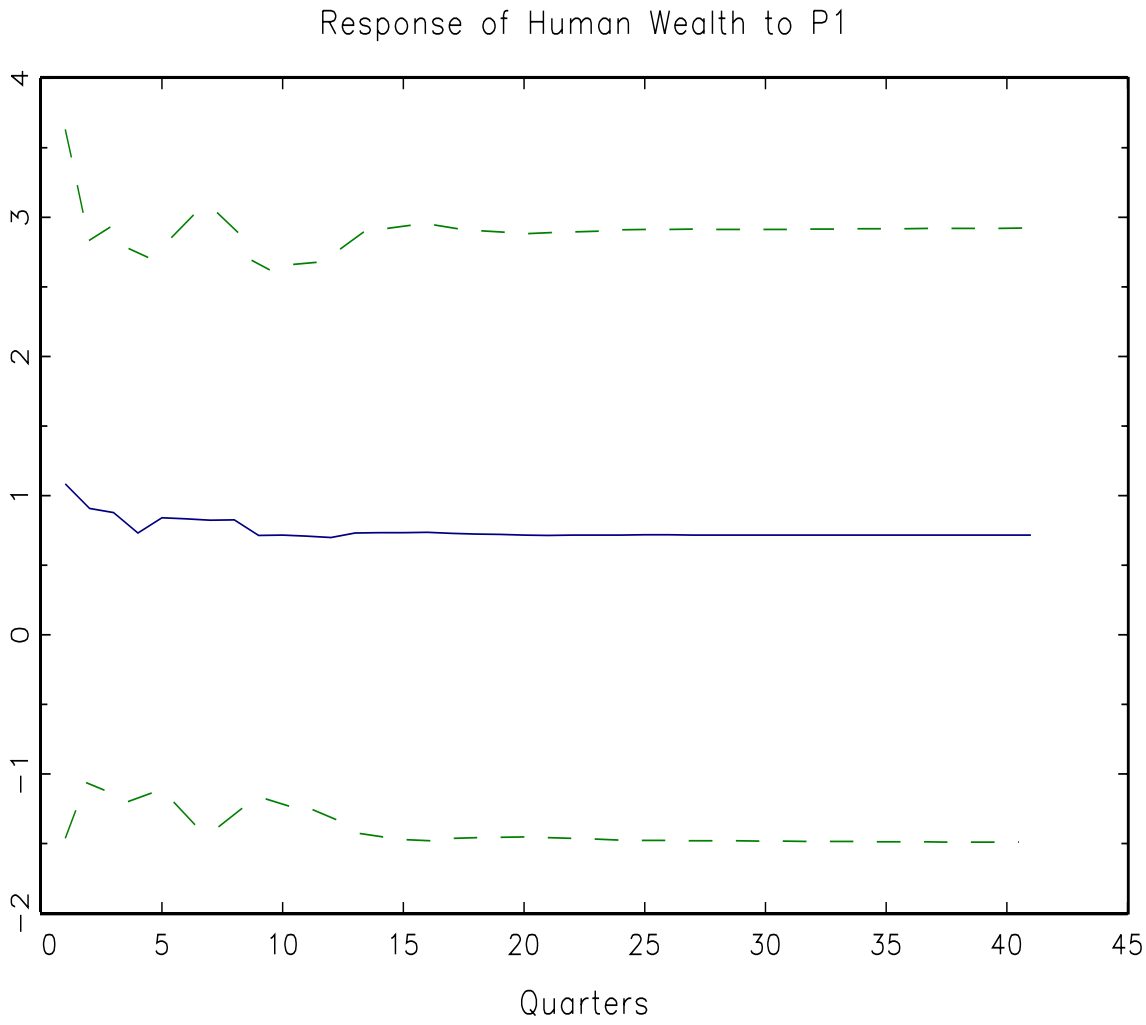
Impulse Response Functions




Response of Consumption to P2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Consumption to P3
0.22
0.18
0.14
0.10
0.06
0.02
−0.02
−0.10
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Consumption to Transitory Shock
0.1
−0.0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Human Wealth to P1
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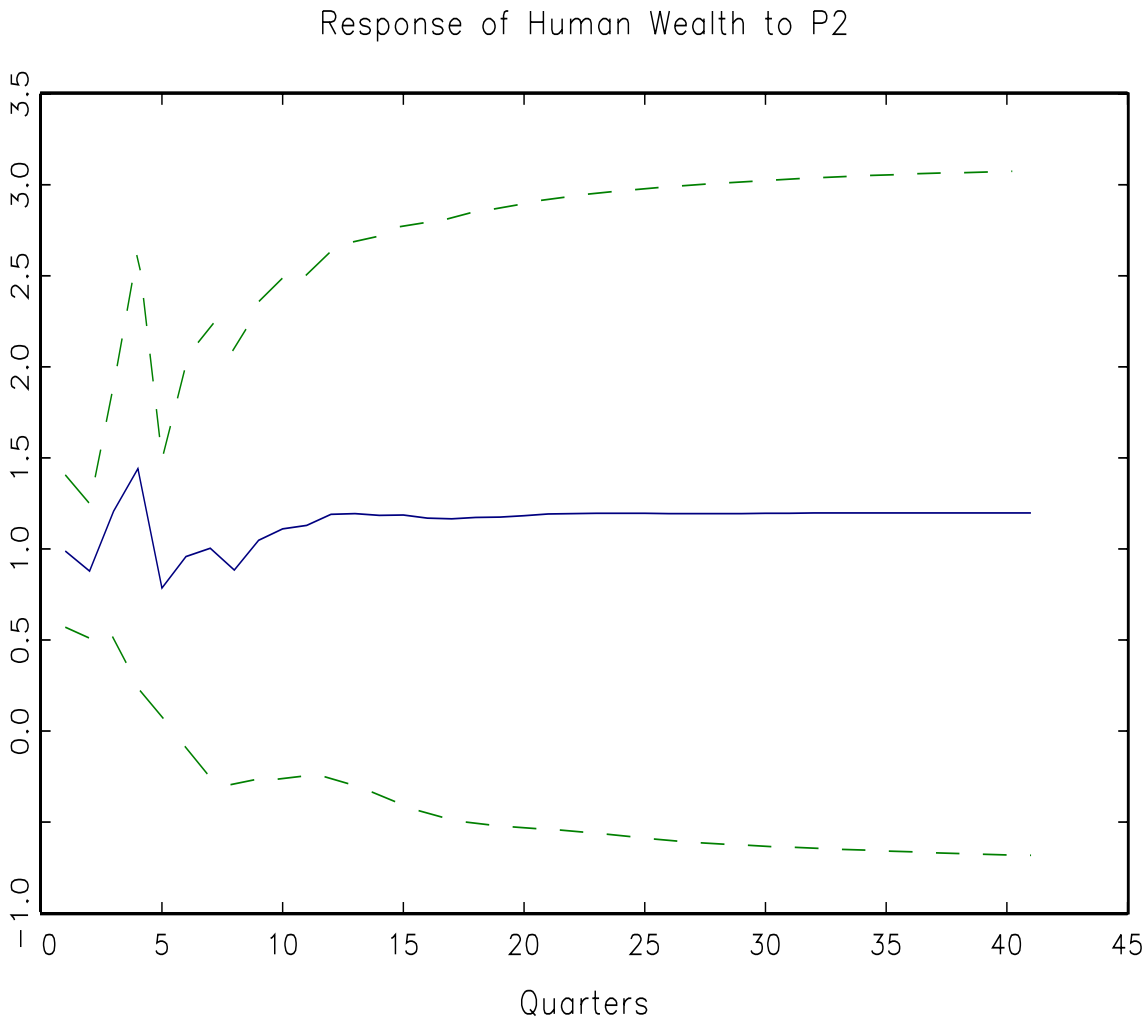
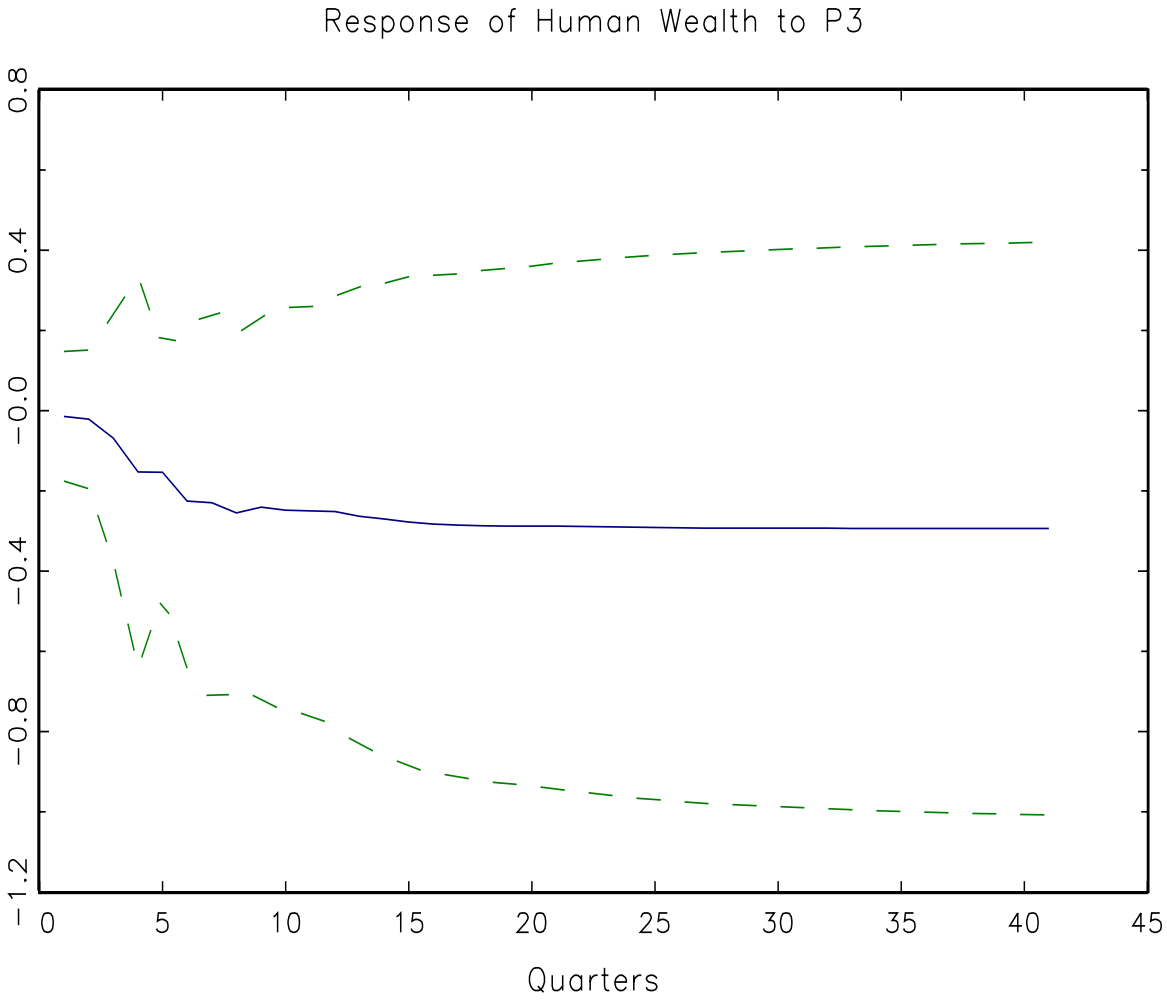
2
1
0
−1
−2
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Human Wealth to P2
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.0
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Human Wealth to P3
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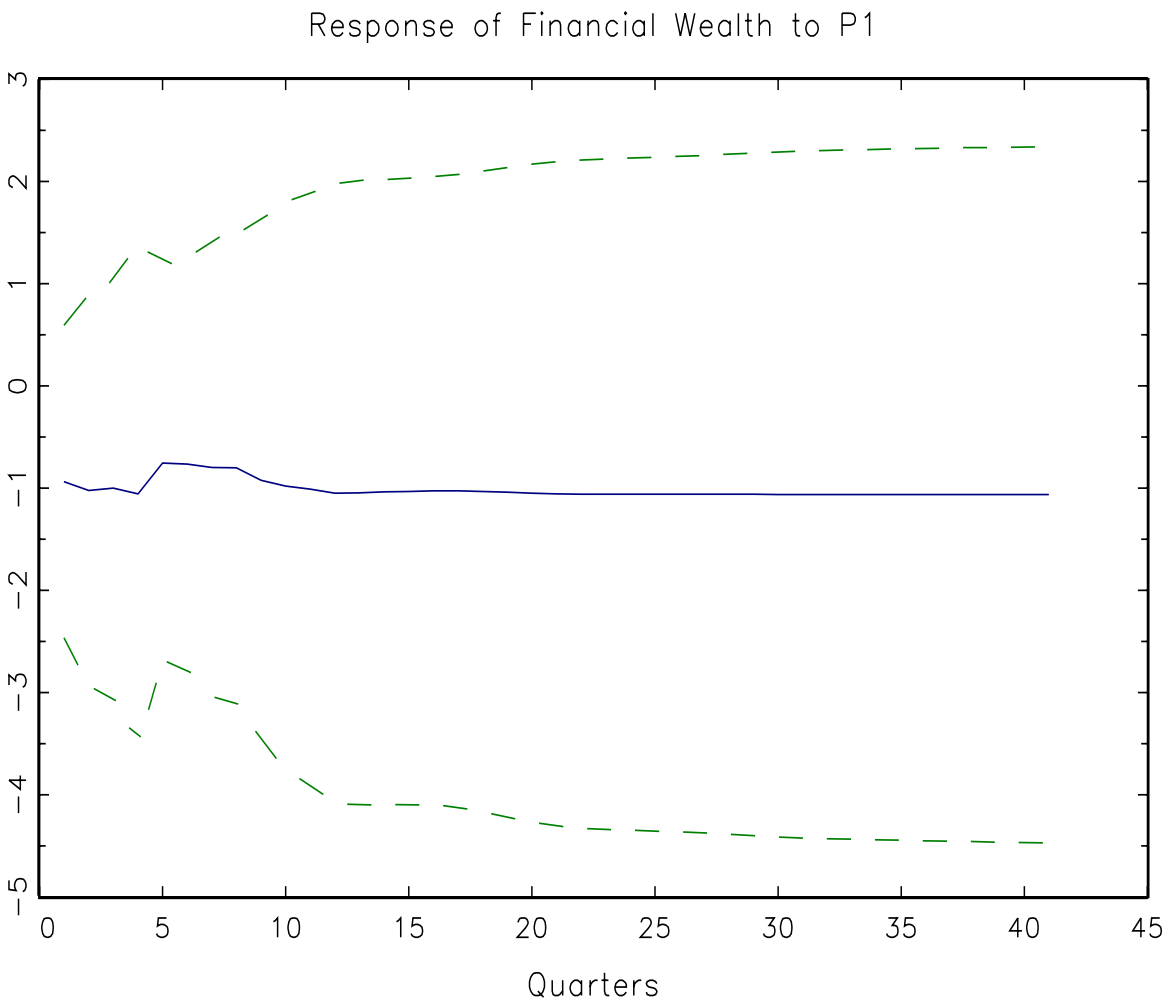
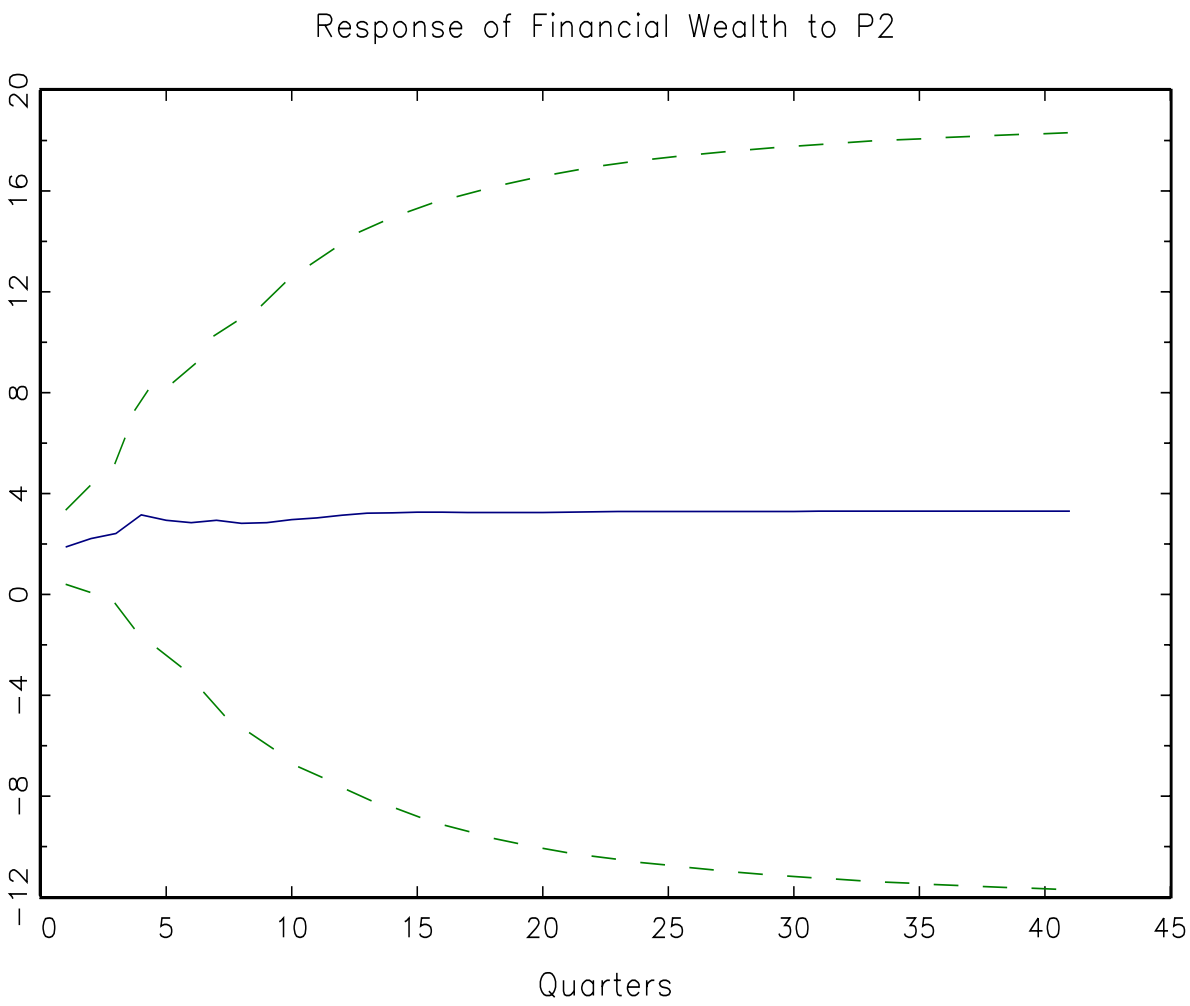
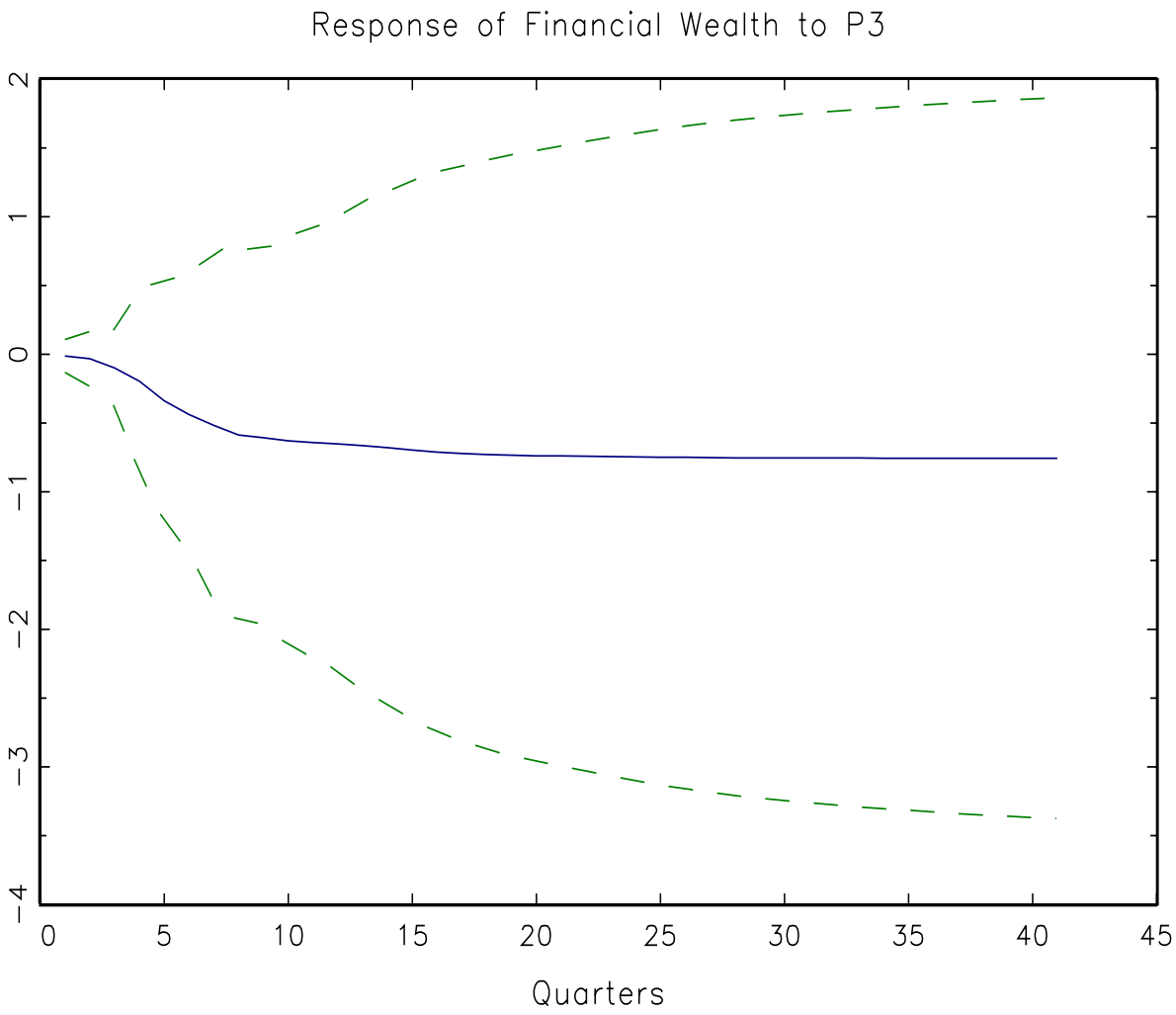
0.4
−0.0
−0.4
−0.8
−1.2
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Human Wealth to Transitory Shock
7
6
5
4
3
2
1
0
−1
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Financial Wealth to P1
3
2
1
0
−1
−2
−3
−4
−5
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Financial Wealth to P2
20
16
12
8
4
0
−4
−8
−12
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Financial Wealth to P3
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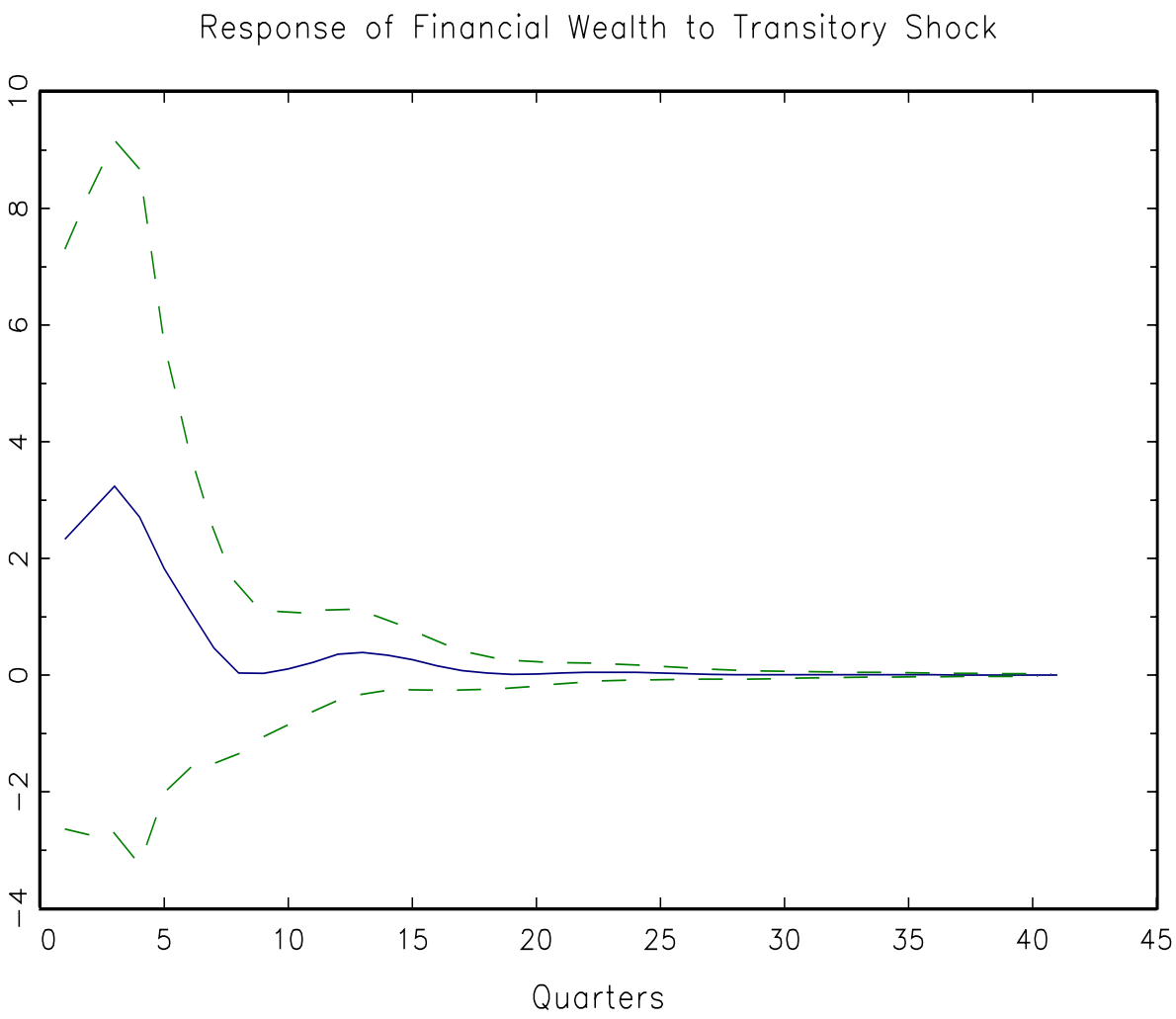
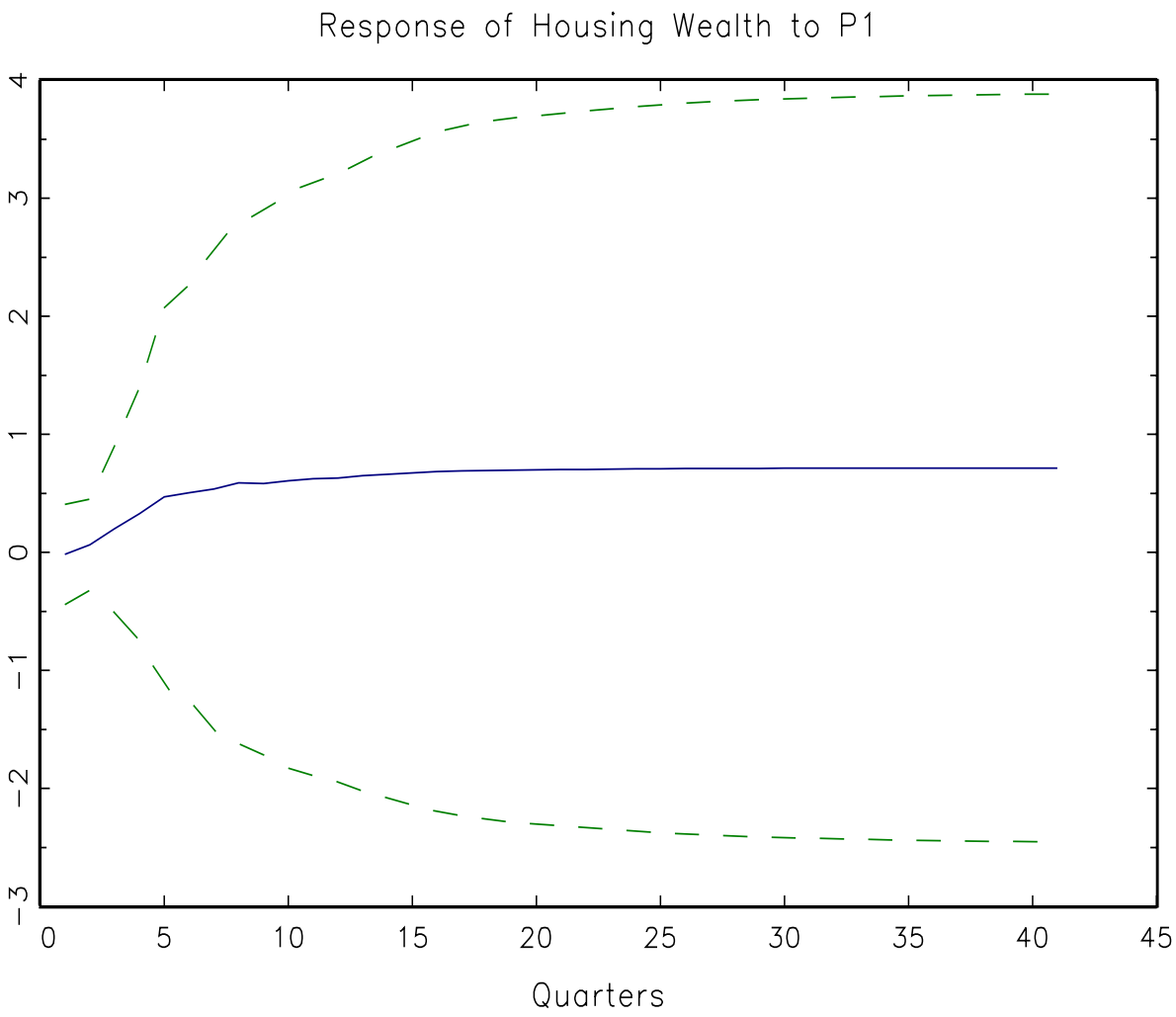
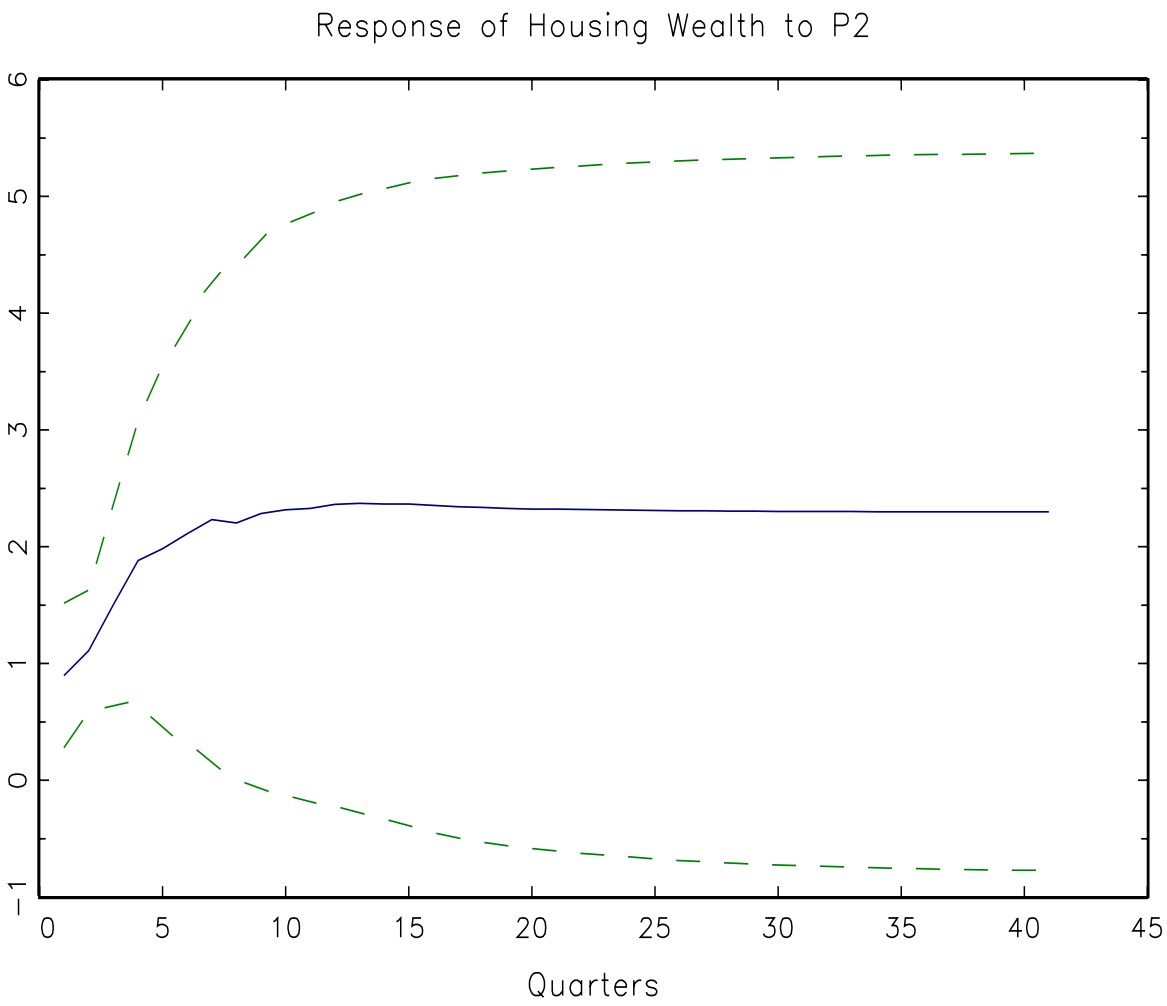
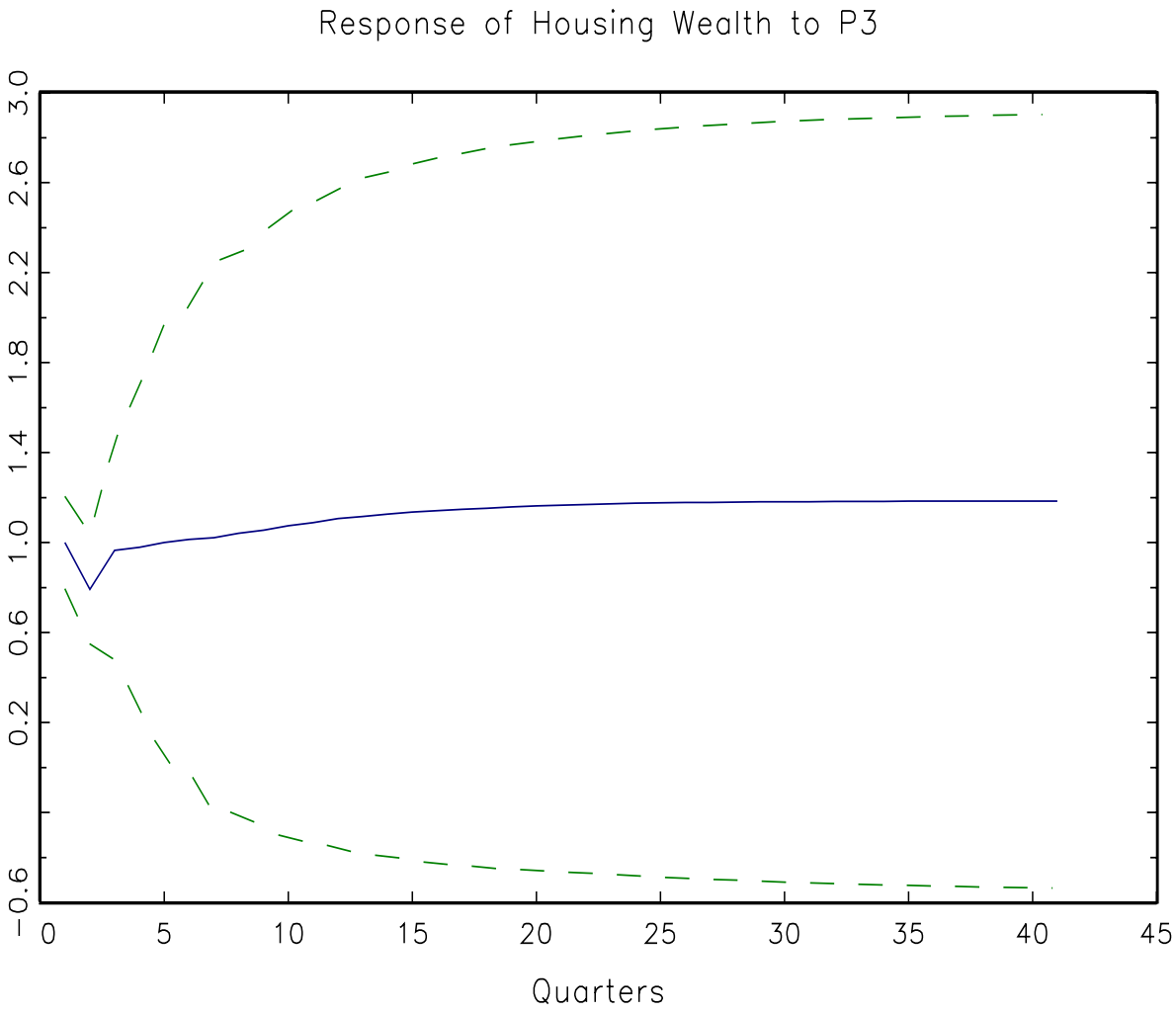
−2
−3
−4
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Financial Wealth to Transitory Shock
10
8
6
4
2
0
−2
−4
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Housing Wealth to P1
4
3
2
1
0
−1
−2
−3
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Housing Wealth to P2
6
5
4
3
2
1
0
−1
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Housing Wealth to P3
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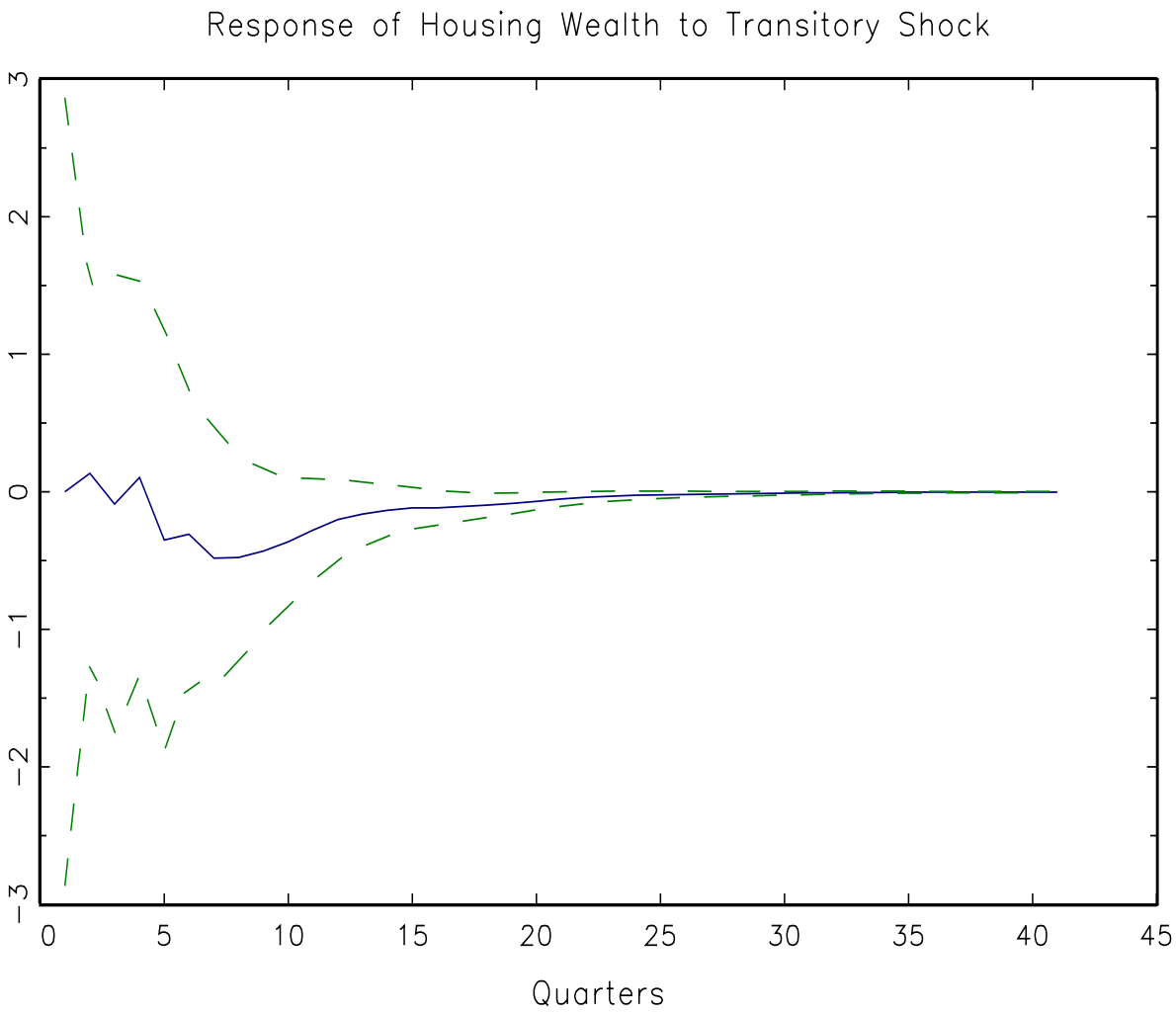
2.6
2.2
1.8
1.4
1.0
0.6
0.2
−0.6
0
5
10
15
20
25
30
35
40
45
Quarters


Response of Housing Wealth to Transitory Shock
3
2
1
0
−1
−2
−3
0
5
10
15
20
25
30
35
40
45
Quarters