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AN EMPIRICAL ANALYSIS OF FINANCIAL AND HOUSING WEALTH EFFECTS ON CONSUMPTION IN TURKEY

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ABSTRACT

This paper investigates the financial and housing wealth effects on aggregate private consumption in Turkey for the period 1987-2007. Given the lack of data, the study proposes an innovative method to construct a proxy for the housing wealth series. A long-run equilibrium relationship between consumption, disposable income, financial and housing wealth is estimated using the cointegration method, and a sensitivity analysis is undertaken following Leamer & Leonard's (1983) extreme bound analysis approach. The results show that income elasticity of consumption is much higher in Turkey than in industrialized countries. While financial and housing wealth effects on consumption are found to be positive, there is no evidence that one effect is stronger than the other.

Keywords: Consumption function, wealth effect, housing wealth, Turkey.

JEL Classification: E21, C22

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1. Introduction

The objective of this paper is to construct a consumption function for Turkey to analyse the effects of financial and housing wealth on the economy's private consumption expenditure. The lack of housing wealth data presents the biggest challenge to this line of research for emerging economies and, thereby, an opportunity for innovation in the methodology – as attempted in this paper.

Determinants of private consumption have been widely examined in the literature for many decades, motivated by the fact that private consumption expenditure accounts for the largest share of aggregate demand. From the policy perspective, understanding consumption behaviour also has important implications for maintaining stable output and employment levels, as well as for controlling inflationary pressures in the economy.

Besides income, the extent to which financial and housing wealth affect consumption has been sought to be understood by researchers since the seminal works of Friedman (1957) and Ando & Modigliani (1963), who introduced household wealth as another important determinant of consumption. Moreover, along with the episodes of housing booms and subsequent slumps in a number of industrialized countries like the United States, the United Kingdom and Spain, attention on the importance of housing wealth in determining macroeconomic stability has never been bigger.

The vast majority of empirical studies on the effects of financial and housing wealth on consumption in the past decade have focused on industrialized countries (see Tan & Voss, 2000; Dvornak & Kohler, 2007; Fisher & Voss, 2004 for Australia; Carroll, 2004; Bostic *et al.*, 2005; Case *et al.*, 2005 for the United States; Slacalek, 2006; Sierminska & Takhtamanova, 2007 for country comparisons of industrialized countries). More recently, attempts to differentiate between transitory and permanent components of income and disaggregated wealth effects were also made by Lettau & Ludwingson (2004) and Fisher *et*

al. (2007) for the United States and Australia. There are also a small number of studies on newly industrialized economies, the findings of which seem to be generally in line with those from the industrialized countries (see Kim, 2004 for South Korea; Edelstein & Lum, 2004 for Singapore; Tse *et al.*, 2007 for Hong Kong). The evidence suggests that both financial (or stock market) and housing wealth have significant positive effects on consumption, with marginal propensities to consume (MPC) varying between 0.01 and 0.15 amongst countries, as compared to MPC out of income ranging between 0.40 and 0.60.

Between the financial and housing wealth effects on consumption, there has not been consensus on whether one effect is stronger than the other (Slacalek, 2006). Potential differences between these effects arise from the different natures of financial and housing assets, such as liquidity, trackability, permanence of shocks, and perceived appropriateness to finance consumption (Sierminska & Takhtamanova, 2007). Since these features are mainly institutional dependent, it is not surprising that MPC figures vary across countries. For the same reasons, the empirical findings for industrialized and newly industrialized countries may not hold for emerging countries – as evident in this paper.

As developing and emerging countries have gradually been deregulating their financial markets and introducing financial products similar to those in industrialized countries in the recent past, housing wealth is expected to become more pronounced as a determinant of consumption and thus aggregate demand. Thereby, it becomes essential for policymakers to be more informed about this growing wealth effect. However, the main obstacle in understanding the impact of housing wealth on consumption in emerging economies is the lack of housing wealth data. Turkey is a case in point.

Little empirical work has been done to examine the determinants of Turkey's private consumption; yet housing wealth effect has been especially left out in the relevant literature mainly due to the lack of data on both the housing stock and the housing prices, and thus the

housing asset value. However, as the country is on the path of developing a mortgage market since 2007, having a better understanding of the housing wealth effect on private consumption has become increasingly important. Hence, the main aim of this paper is to quantify the financial and housing wealth effects on Turkey's private consumption expenditure, using a new method to measure housing wealth in the country.

The first two attempts to incorporate housing wealth in a consumption function for Turkey are attributed to Akkoyunlu (2002) and Aydede (2008). The method proposed in the current paper improves on the techniques used by both studies. Assuming that housing prices lag housing investment costs but lead rental prices, we construct a quarterly housing price index as a weighted average of the leading housing investment deflator and lagging rental price index. On the other hand, using population, household size and occupancy permits data, we obtain an estimate of the housing stock in every quarter. The product of the housing price index and the housing stock series is then used as a proxy for housing wealth.

In the empirical analysis, a long-run equilibrium relationship between aggregate private consumption, disposable income, financial wealth and housing wealth for Turkey is estimated with quarterly data for the period 1987-2007 using a cointregration framework. The fact that numerous housing wealth series can be constructed depending on the choice of the weighting scheme and the leads and lags in the construction process of the housing price index is not overlooked. Since there is no prior knowledge of the "true" value of the housing wealth series, a sensitivity analysis is undertaken to examine the robustness of the long-run coefficient estimates, using a variant of the Leamer & Leonard (1983) extreme bound analysis approach.

The results indicate that disposable income is the major driving force of consumption in Turkey. While the financial and housing wealth effects are also found to be positive, the difference between the impacts of these two wealth components is not found to be

statistically significant. The long-run coefficient estimates of the disposable income and the financial wealth elasticities remain robust with respect to the construction of the housing wealth series, according to the sensitivity analysis.

The remainder of the paper is structured as follows: Section 2 provides the background of the Turkish economy. Section 3 discusses potential determinants of consumption and presents the data construction methods. Section 4 summarizes the methodology used in the analysis and Section 5 presents the empirical results. Finally, Section 6 concludes with a discussion on the policy implications of the findings.

2. Background of the Turkish Economy

Prior to the analysis of private consumption in Turkey, it is important to have an understanding of the macroeconomic environment in which households make their consumption and saving decisions.

Historically, inflation has been very high and volatile in Turkey, and often linked to the public sector deficit. In order to keep inflation under control and maintain sustainable economic growth, numerous disinflationary programs were introduced by the government over the past two decades, most of which were either short-lived or unable to deliver the intended outcomes.

The period under investigation in this study – from 1987 to 2007 – is also an era in which the country has undergone a transition towards economic liberalization. Structural reforms, deregulations and new laws that aimed at correcting fiscal imbalances and strengthening the fragile banking system, have been a crucial part of the reform programs that primarily focused on lowering inflation and stabilizing the economy.

The financial crises in 1994 and 2001, the Russian crisis in 1998, and the two earthquakes in 1999 were the major turmoils of the past two decades, causing economic slowdown and

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large swings in interest rates and exchange rates. It can be argued that this volatile nature of the economy has made both household and business saving and investment decisions difficult, as well as hindering the development and deepening of the financial system at a strong pace. Fuelled by uncertainty and growing concerns for the value of the Lira due to high inflation, the 1990s witnessed the maturity of domestic currency deposits shifting towards shorter terms, and currency substitution became a pronounced feature of the economy.

The introduction of the economic program titled "Strengthening the Turkish Economy" subsequent to the 2001 crisis, marked the start of a new era. This program aimed at reducing uncertainties in the financial market by taking urgent measures in the banking sector, enhancing stabilization of interest rates and exchange rates, completing structural reforms to promote economic efficiency, and focusing macro policies on the disinflation effort so that a sustainable growth path would be assured (CBRT, 2002). As the Central Bank of the Republic of Turkey (CBRT) adopted an implicit inflation targeting monetary policy framework, the government committed itself to fiscal disciples in terms of stabilizing the public debt and delivering a budget surplus. The exchange rate was let free-float and CBRT gained better control over the short-term interest rates. From that time onwards, the inflation rate dropped continuously from 30 percent to single digit levels (see Figure 1), and the economy grew at a rate of 7.5 percent on average for the next four years.

The structural shifts in the economy after the 2001 crisis were not limited to lower inflation rates and improved economic performance. A considerable decrease in the consumption-to-income ratio, which previously remained relatively stable around 68 - 70 percent, was observed after 2001 (see Figure 2). As progress towards economic stability was made and confidence in the program was established, a reverse-dollarization process also started to take shape. The proportion of financial assets held by the private sector in foreign

currencies, which stood at 40 percent before the crisis, fell below 30 percent over the course of stabilization (Akıncı *et al.*, 2005). In 2005, a currency reform was made and six zeros were dropped from the Lira. The introduction of the "New Turkish Lira" (TRY) was seen to signify the government's commitment to the new policy and to assure the public that the gains achieved over this period would be permanent. The implicit inflation targeting framework became explicit in 2006.

This macroeconomic background is essential to the modelling and understanding of the effects of housing and financial wealth on private consumption in Turkey. In the past, Turkish households held their financial wealth mainly in deposits simply because other financial products are unavailable. With the liberalization efforts, the financial system deepened and alternative financial instruments became more widely available. Today, households have a diverse portfolio that comprises shares, government bonds, money market funds, repos, in addition to deposits. Although empirical studies that investigate consumption and saving behaviour in Turkey have commonly used the monetary aggregate M2 as a proxy for financial wealth (such as Akkoyunlu, 2002; Metin Özcan *et al.*, 2003; Aydede, 2008), the financial deepening of the economy following the liberalization process necessitates a broader definition of financial wealth in order to account for the full effect of this variable on consumption. This paper addresses the issue by introducing a net financial wealth measure that not only includes all available financial instruments, but also nets out household debts.

The second issue concerns housing wealth. Housing was one of the most popular investment options for households due to the shallow financial markets and high inflation (Aydede, 2008). The house ownership ratio has always been stable and quite high in Turkey. According to the latest population census of the Turkish Statistical Institute (TurkStat) in 2000, it stood at 68.3 percent. Although people have used housing as their main investment vehicle, due to financial volatility and uncertainty, there were no affordable and long-term

housing finance opportunities in the country until recent years. The maturity of the consumer credits was mostly limited to five years only and some housing credits were offered in foreign currencies in order to hedge against devaluation risks. Hence, housing acquisitions were mainly through inheritance. However, as the economy recovered from the 2001 crisis and the stability in the financial markets was maintained, banks started to offer longer term housing credits and a mortgage system was established in early 2007. Housing credits, which accounted for roughly 12 percent of the total consumer credits in 2000, formed nearly half of the total household debt by the end of 2007. This recent credit expansion in Turkey has attracted much interest in the housing market, and also provided the motivation for this study to test whether housing wealth has a sizeable effect on consumption.

3. Potential Determinants of Consumption and Data Issues

The modern consumption theory, which is a blend of the permanent income and the life cycle hypotheses, suggests that a consumption function should include income, financial wealth, housing wealth and demographic variables. The theory asserts that, assuming diminishing returns to consumption, households would allocate resources in a way to maintain a stable standard of living in the face of changes in income and wealth. Spending out of wealth is suggested to be relatively small compared to income, implying a considerably lower MPC; also, the MPC out of permanent income and wealth is expected to be much higher than that out of transitory components. Furthermore, the theory predicts that an individual would save and accumulate assets during the working years, and spend out of these assets after retirement, signifying the role of age distribution of the population in determining MPC.

Amongst these determinants, measuring housing wealth represents a major challenge because of the unavailability of data, which necessitates the construction of a housing wealth proxy from other available data series. This section discusses the compilation of the dataset.

Housing Wealth

In two previous studies on Turkey, Akkoyunlu (2002) and Aydede (2008) attempt to construct a housing wealth proxy, using completely different approaches. Akkoyunlu's procedure to formulate the housing stock is adherent to the capital stock accumulation framework, accounting for new investment as well as depreciation, while she approximates housing prices with a cost-based measure, i.e. housing investment deflator. Although housing investment costs might be useful in tracking the trend in housing prices, there is doubt on the ability of these measures alone to reflect actual retail prices in the housing market. Moreover, housing investment costs are likely to lead changes in housing prices rather than mirroring them contemporaneously. On the other hand, Aydede derives the housing stock from data on new dwelling constructions, but argues that property incomes might be a better proxy for housing wealth than the total value of the dwelling units in countries without mortgage markets and with high bequest motives, as consumption of housing wealth could be weak relative to that of more developed economies; and accordingly uses direct and imputed incomes (such as rent) from ownership of dwellings. This measure, however, is a measure of the "dividend" of housing wealth, rather than a stock measure of housing wealth itself. Nevertheless, the methods proposed in these two studies represent a good starting point.

The construction of a housing wealth proxy for Turkey in this study involves three steps: (i) constructing the housing stock series, (ii) constructing the housing price series and (iii) defining the housing wealth proxy in terms of the product of the two series.

Household Consumption Expenditures Survey conducted by TurkStat comprises an official number of households. Since 'household' is defined as the number of individuals living in the same dwelling, the number of households is also an official estimate of the size of the housing stock. However, because the survey is not conducted on a regular basis, the

available time-series data on the housing stock is limited[1]. As a remedy to this problem, the method Akkoyunlu (2002) proposed for the calculation of the initial housing stock is adopted. The annual housing stock is defined as:

$$HS_t = N_t/F_t \tag{1}$$

where HS is the housing stock, N is the total population and F is the average household size. The average household size is interpolated for the missing years, assuming that it follows a linear downward trend[2]; then the number of households is calculated from the corresponding figures, using population data. The procedure does not require information on the depreciation rate of the housing stock, because the figures are already the estimates of the number of households and thus the existing number of residential units.

For the interpolation of the quarterly housing series from the annual data, linearity assumption is not appropriate since seasonal effects are important in the construction sector. Addressing this issue requires the interpolation to be based on a reference series that reflects construction activity in each quarter. To this end, TurkStat's monthly occupancy permits given to newly built apartment dwelling units and houses, sourced from the Construction Statistics According to Occupancy Permits table, are used. The annual increase in the housing stock is distributed to each quarter in proportion to the number of occupancy permits given in the corresponding quarter[3].

The housing price series is constructed as a combination of the rental prices and the housing investment deflator. The rationale behind this approach is that, although both of these series might serve as a proxy for the prices in the housing market, investment costs are

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[1] During the analysis period, Household Consumption Expenditures Surveys were conducted in 1987, 1994 and on an annual basis since 2002.

[2] The magnitude of the annual decrease that is consistent with the official data is 0.035 points, that is, the average household size is down by 1 member in about 30 years.

[3] Illegal constructions are ignored in this framework. But since the reference series is only used as an approximation of the construction activity, this does not constitute a problem. Besides, due to its inability to be used as collateral, illegal housing is unlikely to contribute to housing wealth.

more likely to lead the changes in housing prices, while rental prices are more likely to reflect these changes with a lag[4]. Therefore, in order to mirror housing prices contemporaneously, one should consider a combination of these two price series, taking into account their lead-lag relationship.

The rental price index is sourced from TurkStat's Consumer Price Index (CPI) dataset. The housing investment deflator, on the other hand, is calculated using the private sector expenditure on construction of buildings and houses, sourced from TurskStat's GNP table. The base year for both series is 1987. Both of these potential housing price indicators follow a similar trend, and more importantly, the private housing investment deflator inflation tends to lead rental price inflation, supporting the abovementioned argument (see Figures 3 & 4).

The Granger Causality test confirms the observation that the direction of the causality is from annual inflation of housing investment deflator to annual rental price inflation[5]. A simple single-equation framework shows that the third lag of housing investment deflator inflation is significant in explaining rental price inflation[6]. Therefore, the housing price index should lie somewhere between these two indices within three lags. The housing price index is hereby defined as:

$$HPI_t = \lambda RPI_{t+1} + (1-\lambda) HID_{t-2} \qquad\qquad (2)$$

where HPI is the housing price index, RPI is the rental price index and HID is the housing investment deflator. The λ parameter determines the relative weight of each series in the housing price index and is set to be 0.5 as a starter. The sensitivity of the empirical results

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[4] Theoretically, it is also possible that an increase in demand for housing would first push up housing and rental prices, which would lead to a higher demand in housing investment (Tobin's q effect), eventually increasing construction costs. However, Granger Causality test results reject the scenario of rental prices leading construction costs.

[5] The F-statistic for the null hypothesis that rental price inflation does not Granger cause housing investment deflator inflation is 0.923, while the F-statistic for the null hypothesis that housing investment deflator inflation does not Granger cause rental price inflation is 4.466 (The number of lags included in the test is 4.).

[6] The t-statistic for the coefficient is 4.039.

with respect to alternative number of leads and lags and weighting parameters is examined later. Finally, the housing wealth is calculated as:

$$HW_t = \theta \, HS_t \, HPI_t \qquad (3)$$

where θ is the initial housing price in 1987[7].

Since the breakdown of consumer credits data series into housing, automobile and other credits only starts from year 2000, households' housing debts cannot be net out from the housing wealth. Therefore, in strict sense the constructed series is a measure of housing asset rather than housing wealth (i.e. net worth). Nevertheless, considering the facts that housing credits has accounted for less than 10 percent of the total household credits before 2005, and that most household credits have been largely associated with non-housing assets due to the underdevelopment of the mortgage loan markets, this does not seem to constitute a major drawback. Therefore, we continue to use the term housing wealth rather than housing asset.

Financial Wealth

The total financial assets are defined as M2[8] plus stocks, government bonds, money market funds and repos held by the private sector. Data on M2, money market funds and repos are sourced from CBRT; while data on stocks and government bonds are retrieved from the Istanbul Stock Exchange and the Treasury respectively. To calculate the net financial wealth, total household credits, sourced from CBRT, are subtracted from total financial assets and the final series is deflated by the CPI.

Consumption and Disposable Income

The real consumption variable is measured by private consumption expenditure in constant 1987 prices sourced from TurskStat's GNP table. The real disposable income

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[7] Since the housing wealth elasticity is not related to the initial housing price at the base-year when the consumption function is defined in a logarithmic form, the value of θ needs not to be known.
[8] M2 is composed of currency in circulation, sight and time deposits in both Lira and other foreign currencies.

variable is defined as GDP at current prices less taxes, deflated by the GDP deflator. Tax revenues are retrieved from Treasury's Budget Balance and Finance Statistics. Both the real consumption and the real disposable income series are seasonally adjusted[9].

Other Variables

The real interest rate (RIR) is calculated by deflating the quarterly weighted average of the nominal interest rate on government bonds[10] by the annual consumer price inflation. The meta data for Treasury auctions are retrieved from the Treasury. This definition of the real interest rate is ex-post, as realized inflation rates rather than expectations are used in the calculation.

The demographic variable, age dependency ratio, is defined as the ratio of the population aged below 15 and over 64 to that between 15 and 64, and is generated using annual data from the World Bank's World Development Indicators Database. The quarterly figures are interpolated from annual data assuming intra-year linearity. Figure 10 shows that the age dependency of the population in Turkey, in contrast to many industrialized countries, has been declining over the sample period.

Finally, two dummy variables are introduced to control for the financial crises that took place during the sample period. These impulse dummies take the value of one during 1994 and 2001, and zero otherwise. Another dummy variable, that takes the value of one after 2001 and zero elsewhere, is also introduced to capture the structural change in the consumption behaviour after 2001, since a sizeable drop in the average propensity to consume is observed after this period (see Figure 2). This structural change can be attributed to the change in the monetary policy framework after the 2001 crisis. As the inflation rate averaged around 75

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[9] X-12 ARIMA is used as the seasonal adjustment method.
[10] The maturity of government bonds auctioned in the primary market each month range from 3 months to 2 years. The weighted average is calculated according to the respective amounts sold in the Treasury auctions, which provides a robust measure of the prevailing rate in the financial market, since bonds with longer maturities are sold in larger amounts.

percent per annum before 2001 but financial products were not fully hedged against inflation, households were given the incentives to consume. However, with the switch to inflation targeting, inflation rates constantly declined and stabilized at single digit levels, encouraging households to save more.

Figures 5 to 10 presents the generated series that are used in the empirical analysis.

4. Methodology

The most common feature of empirical studies on consumption is the focus on establishing a long-run relationship between consumption, income and wealth variables. Although the econometric techniques used in the studies differ, almost all attempt to test the steady-state relationship among these variables, expressed in the form of a cointegrating model.

First introduced by Granger (1981), cointegration among a set of variables implies that the series share similar stochastic trends. Since the variables tend to move together and never diverge far from each other, the relationship among the variables stays stable over time, and hence, the economic interpretation of cointegration is the existence of a long-run equilibrium relationship.

In the methodology developed by Johansen (1988, 1991), the number of cointegrating vectors within a system of variables is determined using certain tests. The main advantage of this system approach over the Engle & Granger (1987) single equation approach is that it considers the possibility of having multiple cointegrating relationships when more than two variables are involved. While the Engle-Granger cointegration test only verifies whether the variables are cointegrated or not, the Johansen cointegration tests reveal how many cointegration vectors exist among the variables. In fact, in the presence of more than one cointegrating relationship, the long-run parameters estimated from a single-equation analysis

would be a non-linear combination of the true long-run parameters of the system (Johansen 1992).

In order to account for the change in consumption behaviour after 2001, the structural change dummy is also included as an exogenous variable in the estimation of the long-run consumption function for Turkey. The incentive for the inclusion of the structural change dummy comes from the proposed residual-based tests for cointegration in the presence of structural breaks. A commonly used test for cointegration with structural breaks is the one suggested by Gregory & Hansen (1996). In this method, a breakpoint is identified such that the cointegrating relationship is suspected to be of one form before that point and another after. The structural break dummy incorporated in the model reflects a level shift in the cointegration relationship, i.e. a change in the intercept[11]. The test for cointegration is the same for the Engle-Granger single equation test; the residuals from the model estimated by ordinary least squares are checked for stationarity.

The sensitivity of the long-run estimation results with respect to the construction of the housing wealth series is examined adopting a variant of Leamer & Leonard's (1983) extreme bound analysis (EBA) approach. EBA is originally designed to examine how a model's coefficients change when "doubtful" explanatory variables are added to a model that already comprises some "certain" variables that are known to be theoretically important and statistically significant. The method suggests computing the upper and lower bounds of these certain variables' coefficients that could be produced with respect to different model specifications. If the coefficients of the certain variables remain significant and retain their signs within the widest range of estimates, then the results are regarded as "robust", otherwise they are regarded as "fragile" (Levine & Renelt, 1992). Thus, EBA can be regarded as a sensitivity analysis for specification bias. In the current content, the housing wealth series is

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[11] Other types of structural breaks such as changes in trend and slope coefficients are also considered by the authors, but there is no evidence to suggest those types of structural changes in the current study.

considered as the doubtful variable, since we do not have exact prior information about how this series should be defined. More precisely, it is the weighing parameter and the number of leads and lags that are doubtful. Depending on the choice of the weighting parameter and the leads and lags of the rental price index and the housing investment deflator used in the construction process of the housing price index, it is possible to construct alternative housing wealth measures. To this end, 30 potential housing wealth series are constructed and the long-run cointegrating equation is re-estimated using each of these series to see how the coefficient estimates are affected.

Finally, an error correction model (ECM) is estimated to track the short-run dynamics of the consumption function. The ECM reveals how the adjustment mechanism works to restore the long-run equilibrium when deviations from it occur. It relates the change in consumption to the change in its potential determinants and the previous period's deviation from the equilibrium. The coefficient for the error correction term is referred to as the speed of adjustment and indicates how much of the deviation from the equilibrium is corrected in one period. It is expected to lie between minus one and zero; the larger the coefficient in absolute terms, the faster the adjustment towards the equilibrium.

5. Empirical Results

Unit Root Tests

The Augmented Dickey-Fuller (ADF) tests are applied to determine the order of integration for each series in the dataset. The results reported in Table 1 indicate that the logarithms of real aggregate private consumption expenditure (C), real disposable income (Y^d), real financial wealth (FW) and real housing wealth (HW) series are I(1), while the real interest rate (RIR) is I(0), and the age-dependency ratio (ADR) is trend stationary.

The Long-run Model

The long-run consumption function comprises the series that are I(1) according to the ADF tests, and has the form:

$$\text{Log } C_t = \beta_0 + \beta_1 \text{Log } Y^d_t + \beta_2 \text{ Log } FW_t + \beta_3 \text{ Log } HW_t + \varepsilon_t \qquad (4)$$

where β_i (i=0,1,2,3) denote the long-run equilibrium coefficients and ε_t is the error term.

Since more than two variables exist in the model, Johansen's system approach is adopted for the estimation. First, a vector auto-regressive model is specified and the number of lags is chosen as four based on minimum AIC. Then, the existence of a cointegrating relationship among the variables is tested based on the trace and the maximum eigenvalue tests. The 2001 structural change dummy is included as an exogenous variable.

The Johansen cointegration test results are presented in Table 2. According to both the trace and the maximum eigenvalue tests, the null hypothesis that "no cointegrating vector exists" is rejected in favour of the alternative that "at least one cointegrating vector exists" at the 5 percent significance level. Based on the estimated cointegrating vector, the model representing the long-run consumption function is:

$$\text{Log } \hat{C}_t = 0.935 \text{ Log } Y^d_t + 0.077 \text{ Log } FW_t + 0.046 \text{ Log } HW_t \qquad (5)$$
$$(0.073) \qquad\qquad (0.020) \qquad\qquad (0.063)$$

where the values in parentheses are standard errors. Under this specification, all estimated coefficients have the expected signs.

According to the long-run model, the income elasticity of the Turkish consumption function is 0.935 and is statistically significant. That is, a one percent permanent increase in real disposable income causes real consumption to rise by almost the same proportion, ceteris paribus. This translates into a MPC of around 0.65[12], which is higher than a typical estimate for industrialized countries that ranges between 0.40 and 0.60. One particular reason for the

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[12] The elasticities are converted to marginal propensities by multiplying the relevant figures with sample mean values.

relationship between consumption and income to be stronger in Turkey could be the underdevelopment of its credit markets. Thereby, households are relatively more liquidity-constrained and have to rely more heavily on their disposable income for spending.

Financial wealth also has a significant, positive effect on consumption. Other things equal, a one percent permanent increase in real financial wealth is estimated to increase real consumption by 0.077 percent, which is in line with the empirical evidence from industrialized countries. This corresponds to a MPC of around 0.04, meaning that a one TRY increase in financial wealth is estimated to increase private consumption by 4 Kuruş[13], ceteris paribus.

Housing wealth, on the other hand, has an elasticity of 0.046, implying a MPC of around 0.01. This figure is smaller than the Akkoyunlu's (2002) finding of 0.05. Although the coefficient has the expected positive sign, it is statistically insignificant at the 10 percent level. This statistical insignificance can be attributed to the illiquid nature of housing assets in Turkey compared to industrialized countries. Firstly, both the owner-occupied and the investment housing markets are relatively underdeveloped in Turkey because of the lack of affordable and long-term finance options for housing. Secondly, the relatively shallow personal credit market does not enable households to withdraw equity out of their housing assets as easily. Lastly, housing is usually inherited and passed from one generation to another, thus seldom liquidized; accordingly fluctuations in housing prices are not likely to affect households' disposable wealth as much as fluctuations in financial asset values.

Although the point estimates seem to suggest that the financial wealth effect is larger than the housing wealth effect in accordance to the above discussion, a formal test indicates otherwise. Taking H_0: $\beta_2 = \beta_3$ as the null, the alternative hypothesis that the financial wealth

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[13] 1 TRY=100 Kuruş.

effect is stronger than the housing wealth effect (H_1: $\beta_2 > \beta_3$) is rejected in favour of the null at any standard significance level[14].

The weak exogeneity tests for each variable are also performed and the hypothesis of weak exogeneity with respect to the cointegrating coefficients is formulated as a parametric restriction on adjustment coefficients as given in Table 2. According to the chi-square test statistics, only consumption is endogenously determined within the system, while disposable income, financial wealth and housing wealth variables are all weakly exogenous.

Given the fact that cointegration test results indicate existence of only one cointegrating relationship among consumption, disposable income and wealth variables, it is also possible to estimate a long-run consumption function using the single equation framework. Adopting Engle-Granger methodology also enables to test the significance of the structural dummy more easily using the Gregory-Hansen approach, rather than going into more complicated procedures developed for the system approach, such as Johansen *et al.* (2000), Andrade & Bruneau (2000) and Westerlund & Edgerton (2006).

The long-run consumption function estimated according to the Engle-Granger methodology is:

$$\text{Log } \hat{C}_t = -0.273 + 0.813 \text{ Log } Y^d_t + 0.104 \text{ Log } FW_t + 0.083 \text{ Log } HW_t - 0.028 \text{ D}^S \qquad (6)$$
$$\phantom{\text{Log } \hat{C}_t = } (0.469) \quad (0.046) \qquad\quad (0.013) \qquad\qquad (0.039) \qquad\qquad (0.013)$$

where D^S denotes the structural break dummy which takes the value of zero before 2001 and one afterwards. In this model, all coefficients except the intercept are statistically significant and the error term is stationary[15]. While income elasticity is lower than that of the previous model, the financial wealth and housing wealth coefficients are comparatively higher. The significance of the structural break dummy implies that the hypothesis of a structural break cannot be rejected. The cointegrating relation indicates that autonomous consumption is -

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[14] The corresponding chi-square test statistic is 0.255 with a probability 0.614.
[15] The ADF test statistic is -4.078 with lag length 3.

0.273 before 2001, and -0.301 afterwards. The result is in line with a prior expectation that households have reduced their consumption and increased their saving (in absolute terms) since the introduction of the inflation targeting regime, which has lowered inflation rates and thus raised the risk-adjusted real returns of savings. A policy implication that can be drawn from this finding is that the regime has been successful in lowering inflation expectations, consistent with theoretical rationale underlying inflation targeting. The finding of higher saving rates can also be attributed to stronger public confidence in the economic reform.

The Sensitivity of the Long-run Estimation Results

The sensitivity of the long-run estimation results with respect to the construction of the housing wealth series is examined by replacing the current housing wealth series with alternative measures in the long-run consumption function. Choosing different weighting parameters, and the leads and lags of the rental price index and the housing investment deflator used in the construction process of the housing price index, 30 alternative housing wealth series have been constructed. The representations of these are given in Table 3, together with their unit root test results in logarithmic real terms, as they appear in the long-run model. HW^0 series corresponds to the current housing wealth series used in the analysis.

Using these alternative housing wealth series, the long-run cointegrating equation is re-estimated using the Johansen procedure with the same specifications as before to see how the coefficient estimates are affected[16]. Since the purpose is to check whether the equilibrium coefficients are sensitive to different housing wealth definitions, we proceed to the model estimations even though some of the alternatively constructed housing wealth series are trend stationary instead of I(1). Table 4 presents the estimated long-run normalized cointegrating coefficients, the number of cointegrating equations indicated by the trace and maximum eigenvalue test, and the log-likelihood statistic corresponding to each model. Model 0 in

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[16] Sensitivity analysis is also undertaken using the single equation framework and the results are available upon request from the authors. The long-run coefficient estimates remain by and large similar.

Table 4 is the previously estimated long-run cointegrating relationship and reported once again for comparison purposes.

The analysis reveals that the long-run coefficient estimate of disposable income remains highly robust both in terms of the sign and the magnitude, with respect to the changes in the housing wealth definition. The income elasticity estimates lie in the range of 0.799 and 0.935 (see Table 5) and are always highly significant.

The elasticity of financial wealth also has a consistent positive sign in all models. The coefficient estimates are always significant and lie between 0.065 and 0.112; thus the financial wealth elasticity is also a robust coefficient. The largest fluctuation is observed in the housing wealth elasticity, which ranges between 0.044 and 0.221. This is not surprising since its definition changes in every model. While the sign of the coefficient estimates remain robust, the significance level of the housing wealth series differs across models, yet always stays above the 20 percent threshold. The log-likelihood statistic, on the other hand, does not differ considerably amongst the models. In conclusion, the earlier findings in Model 0 are robust to alternative ways to construct the housing wealth series.

Consequently, a question arises: out of the 31 long-run models, is there a preferred one for the estimation of the short-run model? In order to choose amongst these models, the following decision rules are adopted. Firstly, models that both the trace and maximum eigenvalue tests do not indicate existence of a cointegrating relation are eliminated. Secondly, for methodology concerns, models incorporating a trend stationary housing wealth series are eliminated. Lastly, based on the previous discussion, models that have the housing wealth effect larger than the financial wealth effect are eliminated.

The elimination procedure leaves only Model 0 and Model 5, which comprise housing wealth series constructed with slightly different weighting parameters (0.5 for HW^0 and 0.4 for HW^5), but with the same number of leads and lags. Although the log-likelihood statistics

of Model 5 is slightly higher than that of Model 0, this criterion alone is not sufficient to discriminate between the two models. Thus, to maintain consistency with the empirical analysis so far conducted, we proceed to the short-run estimation with the initial Model 0, which places equal weight to both RPI and HID in the construction of the housing wealth series.

The Short-run Model

In order to track the short-run dynamics of the consumption function, an ECM is estimated in the form

$$\Delta LogC_t = \delta_0 + \sum_{k=1}^{4}\delta_{1k}\Delta LogC_{t-k} + \sum_{k=0}^{4}\delta_{2k}\Delta LogY_{t-k}^{d} + \sum_{k=0}^{4}\delta_{3k}\Delta LogFW_{t-k} + \sum_{k=0}^{4}\delta_{4k}\Delta LogHW_{t-k}$$
$$+ \sum_{k=0}^{4}\delta_{5k}RIR_{t-k} + \delta_6\Delta ADR_t + \delta_7 D_{94} + \delta_8 D_{01} + \delta_9 D^S + \gamma\varepsilon_{t-1} + \mu_t \qquad (7)$$

where δs are the short-run coefficients, ε_{t-1} is the last period's deviation from long-run equilibrium (i.e. the error correction term) and μ_t is residual of the short-run model. D_{94} and D_{01} are the impulse dummies for the financial crises in 1994 and 2001 respectively. The results for the short-run model are reported in Table 6.

The coefficient of the error correction term is negative and significant. It indicates that when the equilibrium is disturbed by an exogenous shock, slightly over 50 percent of its adjustment is completed in one period, indicating a rather fast adjustment process.

Looking at the other coefficients, the lagged terms of consumption growth has positive effects on current consumption growth, indicating inertia. The contemporaneous effect of disposable income on consumption growth is 0.506, which is lower than the long-run income elasticity. Moreover, the first impact is mitigated by the following negative effects of the lagged terms of income, supporting the view that households react to income changes instantly, but then re-adjust their consumption. The contemporaneous effect of financial

wealth on consumption growth is positive but insignificant. The estimated short-run coefficient is slightly lower than the long-run elasticity of 0.077.

The housing wealth variable is estimated to have a negative contemporaneous effect on current consumption growth. Since long-term housing credits in Turkey were not available until recent years, households needed to first accumulate the funds for house acquisition. Therefore, the negative coefficient may reflect the dominance of the impact of a change in housing prices on the saving of prospective house buyers, over that on the consumption of house owners. Still, this finding does not contradict the finding of a positive long-run effect of housing wealth on consumption, because once the house is acquired, the household would become wealthier and tend to consume more.

In theory, the effect of an increase in the real interest rate can be decomposed into substitution and income effects. The substitution effect is always negative because households substitute towards future consumption through saving as the interest rate rises. The income effect, on the other hand, is ambiguous, since savers gain from a higher interest rate, while borrowers lose. Hence, for the economy as a whole, the total effect can either be positive or negative, depending on which effect dominates. In our short-run model, the real interest rate has a negligible effect on consumption in the short-run.

The age dependency ratio is found to affect consumption positively as the literature suggests, although not significant. Metin Özcan *et al.* (2003) and Aydede (2008) also find demographic variables being insignificant determinants of saving and consumption in Turkey.

The diagnostic tests and the stability test for the short-run model are presented in Table 7. The results confirm that there is no evidence of non-normality, serial correlation and auto-regressive conditional heteroscedasticity (ARCH) concerning the residuals, while the stability

tests indicate no structural change despite the financial crisis in 2001, confirming that the estimated short-run consumption function is stable.

6. Conclusion

The results of the empirical analysis reveal that disposable income is the major determinant of aggregate private consumption in Turkey, with an elasticity over 0.90. The finding of a strong income effect can be explained by the fact that Turkish households are relatively more liquidity-constrained and rely more heavily on their disposable income for spending due to the under development of the credit markets as compared to their industrialized country counterparts. Financial and housing wealth are found to have positive effects on consumption, with elasticities 0.077 and 0.046 respectively, which is consistent with evidence from other countries. Although there are several explanations why the housing wealth effect might be smaller than the financial wealth effect in Turkey, the difference between the two wealth components are not found to be statistically significant. The results of the sensitivity analysis performed shows that the disposable income and the financial wealth elasticities remain robust with respect to the construction of the housing wealth series. Finally, the short-run error correction model indicates that the system converts to equilibrium rather quickly after an exogenous shock.

As for the policy implications, changes in housing prices do not seem to be a major driver of aggregate demand in Turkey at this stage. The underdevelopment of the housing market in Turkey works to prevent speculative behaviours and the formation of housing bubbles in the near future. Therefore, policy makers should continue to pay close attention to factors that impact on disposable income, since it remains the major driving force of consumption and thus the aggregate demand. Large fluctuations in financial asset prices should also concern policy makers for the possibility of causing distress through uncertainty in consumption behaviour. Nevertheless, as Turkey is on the path of developing a housing credit market

similar to those in the industrialized countries since 2007, the development in the housing

market warrant close monitoring, as the experience in industrialized countries have signified

the increasing importance of housing wealth in determining macroeconomic stability. The

findings also suggest that monitoring changes in consumption and saving behaviours can

provide policy makers some early indications of public expectation on future economic

conditions, such as inflation, in addition to direct expectation surveys.

References

Andrade, P. & Bruneau, C. 2000, 'Cointegration with Structural Breaks: from the Single Equation Analysis to the Multivariate Approach with Application to US Money Demand', paper presented at 8th World Congress of the Econometric Society. Available at: http://www.econometricsociety.org/meetings/wc00/pdf/1605.pdf

Akıncı, O., Barlas Özer, Y. & Usta, B. 2005, 'Dollarization Indices: Indicators for the Dollarization Process in Turkey' (in Turkish), Central Bank of the Republic of Turkey Research and Monetary Policy Department Working Paper, no: 05/17.

Akkoyunlu, Ş. 2002, 'Modeling Consumers' Expenditure in Turkey, 1962-1999', 1st OxMetrics User Conference, Faculty of Finance, Cass Business School, London. Available at: http://www.cass.city.ac.uk/conferences/oxmetrics2003/Sakkoyun.pdf

Aydede, Y. 2008, 'Aggregate consumption function and public social security: the first time-series study for a developing country, Turkey', Applied Economics, vol. 40, no. 14, pp. 1807-1826.

Ando, A. & Modigliani, F. 1963, 'The 'Life Cycle' Hypothesis of Saving: Aggregate Implications and Tests', The American Economic Review, vol. 53, pp. 55-84.

Bostic, R., Gabriel, S. & Painter, G. 2005, 'Housing Wealth, Financial Wealth, and Consumption: New Evidence from Micro Data', Lusk Center for Real Estate Working Paper, no: 2004-1005. Available at: http://www.usc.edu/schools/sppd/lusk/research/pdf/wp_2004-1005.pdf

Carroll, C.D. 2004, 'Housing Wealth and Consumption Expenditure', paper presented at the Academic Consultants' meeting of the Board of Governors of the Federal Reserve System (30 January 2004).

Case, K. E., Quigley, J. M. & Shiller, R. J. 2005, 'Comparing Wealth Effects: The Stock Market Versus the Housing Market', Advances in Macroeconomics, vol. 5, pp. 1–32.

Central Bank of the Republic of Turkey 2002, 'Developments in the Turkish Economy', Section 2 in Annual Report 2002. Available at: http://www.tcmb.gov.tr/research/yillik/02ing/sectionII.pdf

Dvornak, N. & Kohler, M. 2007, 'Housing Wealth, Stock Market Wealth and Consumption: A Panel Analysis for Australia', The Economic Record, vol. 83, pp. 117–130.

Edelstein, R.H., & Lum, S.K. 2004, 'House Prices, Wealth Effects, and the Singapore Macroeconomy', Journal of Housing Economics, vol. 13, pp. 342–367.

Engle, R. F. & Granger, W. J. 1987, 'Co-integration and Error Correction: Representation, Estimation, and Testing', Econometrica, vol. 55, no.2, pp. 251-276.

Fisher, L.A. & Voss, G.M. 2004, 'Consumption, Wealth and Expected Stock Returns in Australia', The Economic Record, vol. 80, pp. 359–372.

Fisher, L.A., Otto, G. & Voss, G.M. 2007, 'Housing Booms, Non-financial Wealth and Consumption: Lessons from the Australian experience', paper presented at University of Queensland, Schools of Economics Seminar (19th October 2007).

Friedman, M. 1957, A Theory of the Consumption Function: A Study by the National Bureau of Economic Research, Princeton University Press, Princeton.

Granger, C. W. J. 1981, 'Some Properties of Time Series Data and Their Use in Econometric Model Specification', Journal of Econometrics, vol.16, no.1, pp. 121-130.

Gregory, A. W. & Hansen, B. E. 1996, 'Residuals-based Tests for Cointegration in Models with Regime Shifts', Journal of Econometrics, vol 70, pp. 99-126.

Johansen, S. 1988, 'Statistical Analysis of Cointegration Vectors', Journal of Economic Dynamics and Control, vol. 12, no. 2/3, pp. 231-254.

Johansen, S. 1991, 'Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models', Econometrica, vol.59, no.6, pp. 1551-1580.

Johansen, S. 1992, 'Cointegration in Partial Systems and the Efficiency of Single-equation Analysis', Journal of Econometrics, vol. 52, no. 3, pp. 389-402.

Johansen, S., Mosconi, R. & Nielsen, B. 2000, 'Cointegration Analysis in the Presence of Structural Breaks in the Deterministic Trend', Econometrics Journal, vol. 3, pp. 216-249.

Kim, K. H. 2004, 'Housing and the Korean Economy', Journal of Housing Economics, vol. 13, pp. 321–341.

Leamer, E. & Leonard, H. 1983, 'Reporting the Fragility of Regression Estimates', The Review of Economics and Statistics, vol. 65, no. 2, pp. 306-317.

Lettau, M. & Ludvigson, S.C. 2004, 'Understanding Trend and Cycle in Asset Values: Reevaluating the Wealth Effect on Consumption', The American Economic Review, vol. 94, no. 1, pp. 276-299.

Levine, R. & Renelt, D. 1992, 'A Sensitivity Analysis of Cross-Country Growth Regressions', The American Economic Review, vol. 82, no. 4, pp. 942-963.

MacKinnon, J. G., Haug, A. A. & Michelis, L. 1999, 'Numerical Distribution Functions of Likelihood Ratio Tests for Cointegration', Journal of Applied Econometrics, vol. 14, no. 5, pp. 563-577.

Metin Özcan, K., Günay, A. & Ertaç, S. 2003, 'Determinants of Private Saving Behaviour in Turkey', Applied Econometrics, vol.35, pp.1405-1416.

Sierminska, E. & Takhtamanova Y. 2007, 'Wealth Effects out of Financial and Housing Wealth: Cross Country and Age Group Comparisons', Federal Reserve Bank of San Francisco Working Paper, no: 2007-01.

Slacalek, J. 2006, 'What Drives Personal Consumption? The Role of Housing and Financial Wealth', German Institute for Economic Research. Available at: http://www.slacalek.com/research/sla06whatDrivesC/sla06whatDrivesC.pdf

Tan, A. & Voss, G. 2000, 'Consumption and Wealth', Reserve Bank of Australia Research Discussion Paper, no: 2000-09.

Tse, R.Y.C., Man, K.F. & Choy, L. 2007, 'The Impact of Housing and Financial Wealth on Household Consumption: Evidence from Hong Kong', Journal of Real Estate Literature, vol. 15, no. 3, pp. 429-440.

Westerlund, J. & Edgerton, D. L. 2006, 'New Improved Tests for Cointegration with Structural Breaks', Journal of Time Series Analysis, vol. 28, no. 2, pp. 188-224.

Table 1: Unit Root Test Results						
	Levels (Random walk with drift)		Levels (Random walk with drift and trend)			First differences (Random walk with drift)	
	ADF Test Statistic	Lag Length[†]	ADF Test Statistic	Lag Length[†]		ADF Test Statistic	Lag Length[†]
Log C	-0.061	4	-2.300	0	ΔLog C	-5.796[*]	3
Log Y^d	-0.174	4	-3.221	0	ΔLog Y^d	-6.435[*]	3
Log FW	-0.543	0	-1.886	0	ΔLog FW	-7.768[*]	0
Log HW	-0.083	2	-2.305	2	ΔLog HW	-8.963[*]	1
RIR	-4.399[*]	0	-	-	-	-	-
ADR	-0.853	5	-4.002[*]	5	-	-	-

[†] Automatically determined according to minimum Akaike Information Criterion (AIC).

([*]) and ([**]) denote rejection at the 5 percent and 10 percent significance levels respectively, here and elsewhere in this paper.

Table 2: Cointegration Test Results for the Turkish Consumption Function				
Trace and Maximum Eigenvalue Tests				
Hypothesized number of cointegrating equations (r)	None ($r=0$)	At most 1 ($r \leq 1$)	At most 2 ($r \leq 2$)	At most 3 ($r \leq 3$)
Eigenvalue	0.326	0.202	0.033	0.000
Trace Statistic	49.014[*]	19.403	2.500	0.000
5 % Critical Value	47.856	29.797	15.495	3.841
Prob.[†]	0.039	0.464	0.985	0.999
Maximum Eigenvalue Statistic	29.611[*]	16.903	2.500	0.000
5 % Critical Value	27.584	21.132	14.265	3.841
Prob.[†]	0.027	0.177	0.974	0.999
Cointegrating Equation				
Log-likelihood statistic	635.314			
Normalized Cointegrating Coefficients				
	Log C	Log Y^d	Log FW	Log HW
β_i	1.000	-0.935	-0.077	-0.046
Standard errors		0.073	0.020	0.063
Adjustment Coefficients				
	ΔLog C	ΔLog Y^d	ΔLog FW	ΔLog HW
α_{1i}	-0.633	-0.126	0.425	-0.425
Standard errors	0.190	0.258	0.342	0.260
Weak Exogeneity Test				
	Log C	Log Y^d	Log FW	Log HW
Restriction	$\alpha_{1.}=0$	$\alpha_{2.}=0$	$\alpha_{3.}=0$	$\alpha_{4.}=0$
$\chi^2_{[1]}$ Test Statistic	11.253	0.315	1.797	1.715
Prob.	0.001	0.575	0.180	0.190

[†] MacKinnon *et al.* (1999) probability values.

Table 3: Alternative Housing Wealth Series						
Representation	Unit Root Test Results (in logarithmic real terms)					
	Levels (Random walk with drift)		Levels (Random walk with drift and trend)		First differences (Random walk with drift)	
	ADF Test Statistic	Lag Length†	ADF Test Statistic	Lag Length†	ADF Test Statistic	Lag Length†
$HW^0_t = \theta\, HS_t\,(0.5\,RPI_{t+1} + 0.5\,HID_{t-2})$	-0.083	2	-2.305	2	-8.963*	1
$HW^1_t = \theta\, HS_t\,(HID_{t-2})$	-0.540	3	-0.958	3	-8.048*	2
$HW^2_t = \theta\, HS_t\,(0.1\,RPI_{t+1} + 0.9\,HID_{t-2})$	-1.202	2	-1.968	2	-10.326*	1
$HW^3_t = \theta\, HS_t\,(0.2\,RPI_{t+1} + 0.8\,HID_{t-2})$	-0.657	2	-1.878	2	-10.399*	1
$HW^4_t = \theta\, HS_t\,(0.3\,RPI_{t+1} + 0.7\,HID_{t-2})$	-0.303	2	-1.915	2	-10.202*	1
$HW^5_t = \theta\, HS_t\,(0.4\,RPI_{t+1} + 0.6\,HID_{t-2})$	-0.127	2	-2.076	2	-9.703*	1
$HW^6_t = \theta\, HS_t\,(0.6\,RPI_{t+1} + 0.4\,HID_{t-2})$	-0.124	2	-4.437*	0	-	-
$HW^7_t = \theta\, HS_t\,(0.7\,RPI_{t+1} + 0.3\,HID_{t-2})$	-0.833	0	-4.396*	0	-	-
$HW^8_t = \theta\, HS_t\,(0.8\,RPI_{t+1} + 0.2\,HID_{t-2})$	-0.738	0	-4.365*	0	-	-
$HW^9_t = \theta\, HS_t\,(0.9\,RPI_{t+1} + 0.1\,HID_{t-2})$	-0.686	0	-4.339*	0	-	-
$HW^{10}_t = \theta\, HS_t\,(RPI_{t+1})$	-0.663	0	-4.313*	0	-	-
$HW^{11}_t = \theta\, HS_t\,(HID_{t-1})$	-1.200	6	-1.129	6	-4.296*	5
$HW^{12}_t = \theta\, HS_t\,(0.1\,RPI_{t+1} + 0.9\,HID_{t-1})$	-0.559	6	-1.416	6	-4.325*	5
$HW^{13}_t = \theta\, HS_t\,(0.2\,RPI_{t+1} + 0.8\,HID_{t-1})$	-0.237	6	-2.513	5	-4.222*	5
$HW^{14}_t = \theta\, HS_t\,(0.3\,RPI_{t+1} + 0.7\,HID_{t-1})$	-0.318	3	-2.889	5	-9.032*	2
$HW^{15}_t = \theta\, HS_t\,(0.4\,RPI_{t+1} + 0.6\,HID_{t-1})$	-0.209	3	-4.815*	0	-	-
$HW^{16}_t = \theta\, HS_t\,(0.5\,RPI_{t+1} + 0.5\,HID_{t-1})$	-0.216	3	-4.426*	0	-	-
$HW^{17}_t = \theta\, HS_t\,(0.6\,RPI_{t+1} + 0.4\,HID_{t-1})$	-0.689	1	-4.170*	0	-	-
$HW^{18}_t = \theta\, HS_t\,(0.7\,RPI_{t+1} + 0.3\,HID_{t-1})$	-0.509	1	-4.087*	0	-	-
$HW^{19}_t = \theta\, HS_t\,(0.8\,RPI_{t+1} + 0.2\,HID_{t-1})$	-0.415	1	-4.107*	0	-	-
$HW^{20}_t = \theta\, HS_t\,(0.9\,RPI_{t+1} + 0.1\,HID_{t-1})$	-0.713	0	-4.193*	0	-	-
$HW^{21}_t = \theta\, HS_t\,(0.1\,RPI_{t+2} + 0.9\,HID_{t-1})$	-0.736	6	-1.707	6	-4.596*	5
$HW^{22}_t = \theta\, HS_t\,(0.2\,RPI_{t+2} + 0.8\,HID_{t-1})$	-0.571	6	-2.916	9	-4.511*	5
$HW^{23}_t = \theta\, HS_t\,(0.3\,RPI_{t+2} + 0.7\,HID_{t-1})$	-0.583	6	-3.495*	9	-	-
$HW^{24}_t = \theta\, HS_t\,(0.4\,RPI_{t+2} + 0.6\,HID_{t-1})$	-0.656	6	-3.852*	9	-	-
$HW^{25}_t = \theta\, HS_t\,(0.5\,RPI_{t+2} + 0.5\,HID_{t-1})$	-1.742	0	-3.968*	9	-	-
$HW^{26}_t = \theta\, HS_t\,(0.6\,RPI_{t+2} + 0.4\,HID_{t-1})$	-1.430	0	-3.889*	9	-	-
$HW^{27}_t = \theta\, HS_t\,(0.7\,RPI_{t+2} + 0.3\,HID_{t-1})$	-1.221	0	-3.703*	9	-	-
$HW^{28}_t = \theta\, HS_t\,(0.8\,RPI_{t+2} + 0.2\,HID_{t-1})$	-1.085	0	-3.486*	9	-	-
$HW^{29}_t = \theta\, HS_t\,(0.9\,RPI_{t+2} + 0.1\,HID_{t-1})$	-0.999	0	-3.672*	8	-	-
$HW^{30}_t = \theta\, HS_t\,(RPI_{t+2})$	-0.849	3	-3.623*	8	-	-

† Automatically determined according to minimum AIC.

	Cointegrating Coefficients			Number of Cointegrating Relations Indicated by		Log-Likelihood Statistic
	Log Y^d	Log FW	Log HW^i	Trace Test	Maximum Eigenvalue Test	
Model 0	0.935 (0.073)	0.077 (0.020)	0.046 (0.063)	1	1	635.314
Model 1	0.836 (0.085)	0.110 (0.027)	0.128 (0.073)	1	1	622.676
Model 2	0.860 (0.081)	0.104 (0.024)	0.114 (0.072)	1	1	628.150
Model 3	0.889 (0.078)	0.097 (0.022)	0.096 (0.071)	1	1	632.648
Model 4	0.916 (0.076)	0.089 (0.021)	0.076 (0.069)	1	1	635.507
Model 5	0.934 (0.074)	0.083 (0.020)	0.057 (0.067)	1	1	636.273
Model 6	0.923 (0.072)	0.073 (0.019)	0.044 (0.060)	1	1	633.556
Model 7	0.907 (0.072)	0.071 (0.019)	0.045 (0.056)	1	1	631.632
Model 8	0.892 (0.070)	0.069 (0.019)	0.049 (0.052)	1	1	629.703
Model 9	0.879 (0.068)	0.067 (0.019)	0.052 (0.048)	1	1	627.708
Model 10	0.879 (0.066)	0.067 (0.018)	0.052 (0.044)	1	1	625.548
Model 11	0.799 (0.101)	0.112 (0.031)	0.221 (0.108)	1	1	625.840
Model 12	0.849 (0.094)	0.097 (0.026)	0.166 (0.100)	0	1	627.588
Model 13	0.883 (0.089)	0.087 (0.024)	0.126 (0.093)	0	1	628.539
Model 14	0.900 (0.086)	0.080 (0.022)	0.098 (0.087)	0	1	629.209
Model 15	0.901 (0.084)	0.076 (0.021)	0.080 (0.080)	0	1	629.999
Model 16	0.893 (0.082)	0.073 (0.020)	0.071 (0.074)	0	1	630.875
Model 17	0.885 (0.080)	0.071 (0.020)	0.065 (0.067)	0	1	631.458
Model 18	0.879 (0.076)	0.070 (0.019)	0.061 (0.060)	0	1	631.361
Model 19	0.875 (0.073)	0.069 (0.019)	0.058 (0.054)	0	1	630.359
Model 20	0.871 (0.070)	0.067 (0.018)	0.056 (0.048)	1	1	628.401
Model 21	0.873 (0.095)	0.092 (0.026)	0.152 (0.103)	0	1	633.065
Model 22	0.918 (0.093)	0.080 (0.024)	0.105 (0.099)	0	1	635.716

Table 4: The Sensitivity of the Long-run Coefficients using the Johansen Procedure

Model 23	0.946 (0.094)	0.073 (0.022)	0.069 (0.096)	0	0	637.635
Model 24	0.953 (0.095)	0.070 (0.021)	0.048 (0.092)	0	0	639.204
Model 25	0.942 (0.095)	0.070 (0.021)	0.043 (0.086)	0	0	640.552
Model 26	0.919 (0.093)	0.070 (0.021)	0.049 (0.079)	0	0	641.571
Model 27	0.894 (0.090)	0.070 (0.020)	0.059 (0.071)	0	1	642.111
Model 28	0.871 (0.086)	0.069 (0.020)	0.070 (0.064)	0	1	642.128
Model 29	0.850 (0.082)	0.067 (0.019)	0.080 (0.057)	1	1	641.688
Model 30	0.833 (0.078)	0.065 (0.019)	0.089 (0.051)	1	1	640.875

Table 5: Extreme Bounds for the Long-run Coefficients†			
	Log Y^d	Log FW	Log HW
Minimum	0.799	0.065	0.044
Maximum	0.935	0.112	0.221
Median	0.883	0.076	0.076
Range	0.137	0.047	0.177

† Coefficients from non-cointegrating models, i.e. models 23-26, are excluded, since they cannot be regarded as long-run parameter estimates.

Table 6: The Short-run Consumption Function		
Dependent Variable: ΔLog C Sample (adjusted): 1989Q1 2007Q3		
Variable	Coefficient	Standard Error
Intercept	0.036	0.027
ΔLog C(-1)	0.068	0.154
ΔLog C(-2)	0.291*	0.142
ΔLog C(-3)	0.288*	0.145
ΔLog C(-4)	-0.051	0.129r
ΔLog Y^d	0.506*	0.084
ΔLog Y^d(-1)	-0.035	0.117
ΔLog Y^d(-2)	-0.205**	0.107
ΔLog Y^d(-3)	-0.175	0.120
ΔLog Y^d(-4)	-0.023	0.109
ΔLog FW	0.075	0.056
ΔLog FW(-1)	-0.025	0.049
ΔLog FW(-2)	-0.106*	0.048
ΔLog FW(-3)	-0.010	0.047
ΔLog FW(-4)	-0.023	0.045
ΔLog HW	-0.140**	0.081
ΔLog HW(-1)	-0.155**	0.091
ΔLog HW (-2)	-0.004	0.091
ΔLog HW (-3)	-0.041	0.087
ΔLog HW (-4)	0.071	0.064
RIR	-0.00045**	0.000
RIR(-1)	0.00005	0.000
RIR(-2)	0.00046**	0.000
RIR(-3)	-0.00007	0.000
RIR(-4)	-0.00017	0.000
ΔADR	0.085	0.082
D_{94}	-0.051**	0.030
D_{01}	0.006	0.033
D^S	-0.005	0.007
ε(-1)	-0.511*	0.149
Adjusted R-squared		0.651
F-Statistic		5.749

Table 7: Diagnostic Tests for the Short-run Model					
Normality					
Null Hypothesis: Residuals are normally distributed					
Jarque-Bera Statistic		2.769	Prob.		0.250
Breusch-Godfrey Serial Correlation LM Test					
Null Hypothesis: No serial correlation					
Lag=1	F(1,44)	2.381	Prob.		0.130
Lag=2	F(2,43)	1.379	Prob.		0.263
Lag=3	F(3,42)	1.244	Prob.		0.306
Lag=4	F(4,41)	0.913	Prob.		0.465
ARCH LM Test					
Null Hypothesis: No ARCH effect					
Lag=1	F(1,72)	1.522	Prob.		0.221
Lag=2	F(2,70)	1.219	Prob.		0.302
Lag=3	F(3,68)	0.943	Prob.		0.425
Lag=4	F(4,66)	0.735	Prob.		0.571
Chow Breakpoint Test					
Null Hypothesis: No breaks at specified breakpoint					
Breakpoint: 2001Q1	F(27,21)	0.621	Prob.	0.878	
Chow Forecast Test					
Null Hypothesis: No structural change					
Forecast from 2001Q1 to 2007Q3	F(27,20)	0.639	Prob.	0.862	

Figure 1: Annual Inflation Rate
(CPI, percent)
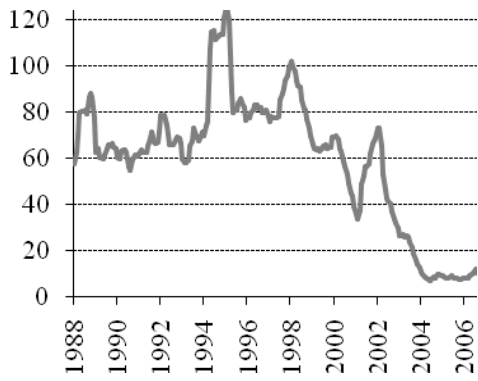
Figure 2: Consumption-to-GDP Ratio
(annual moving average)

Figure 3: Rental Price Index
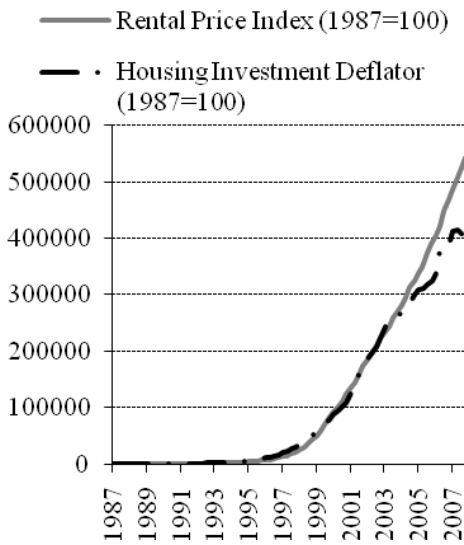and Housing Investment Deflator

— Rental Price Index (1987=100)

— · Housing Investment Deflator
    (1987=100)

Figure 4: Annual Inflation of Rental Prices
and Housing Investment Deflator

— Annual Inflation of the Rental Price
    Index

— · Annual Inflation of the Housing
    Investment Deflator
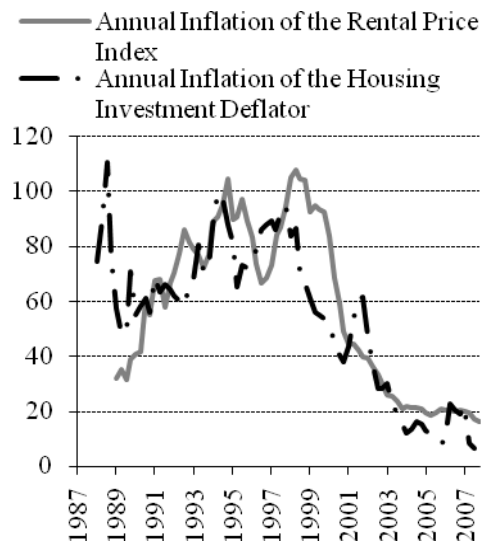
Figure 5: Consumption
(in logarithm, real, seasonally adjusted)
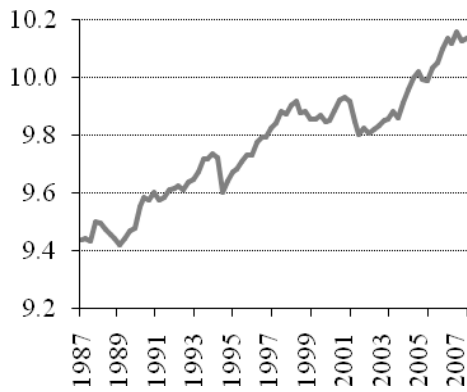
Figure 6: Disposable Income
(in logarithm, real, seasonally adjusted)
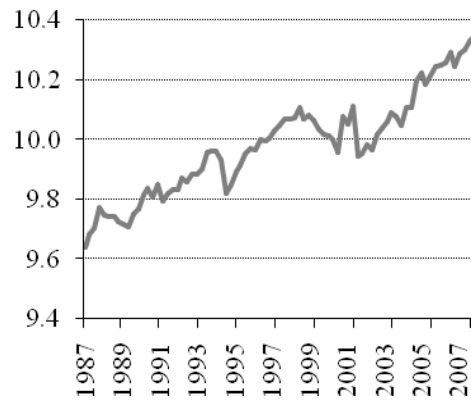
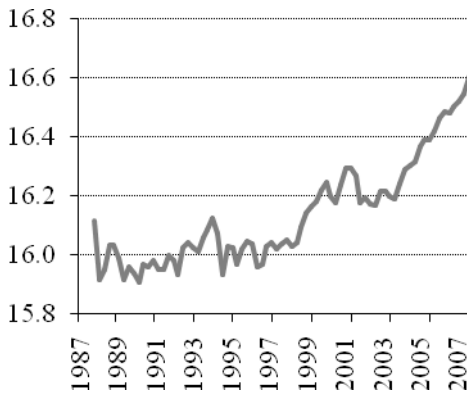Figure 7: Housing Wealth
(in logarithm, deflated by CPI)

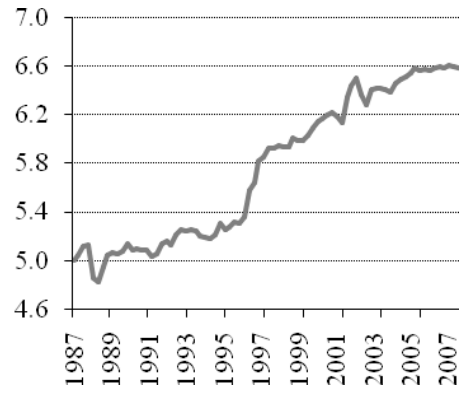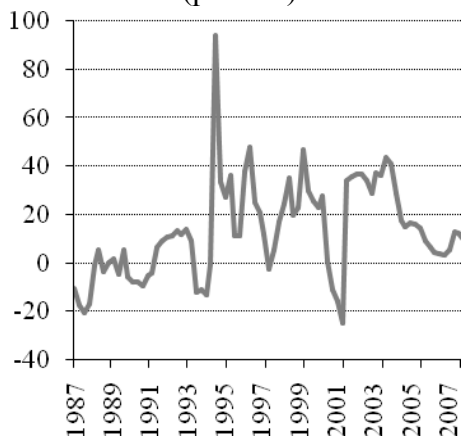Figure 8: Financial Wealth
(in logarithm, deflated by CPI)

Figure 9: Real Interest Rate
(percent)

Figure 10: Age Dependency Ratio
(percent)