House Prices and Aggregate Consumption: Do They Move Together? Evidence from Singapore

Sock-Yong Phang, Singapore Management University

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House prices and aggregate consumption: do they move together? Evidence from Singapore

Sock-Yong Phang*

Singapore Management University, Singapore 259756, Singapore

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Abstract

Using data from Singapore, we find no evidence that house price increases have produced either wealth or collateral enhancement effects on aggregate consumption. We confirm the presence of liquidity constraints from the asymmetric reaction of consumption to income increases vis-a-vis income declines. When we allow for asymmetric response, anticipated house price increases do not have a positive effect on aggregate consumption: we find that they are considerably more likely to have a modest dampening effect, although this negative result is not statistically significant from zero. Declines in expected house price growth have a larger and marginally significant negative effect on consumption. We conclude that the results of recent studies of OECD countries, which find changes in housing wealth to be positively associated with changes in aggregate consumption, cannot be generalized to the Singapore case.

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Keywords: Housing prices; Consumption; Life-cycle/permanent income hypotheses

1. Introduction

The link between house prices and consumption has received a great deal of attention from economic researchers as well as monetary policymakers in recent years. This increase in attention has derived from the large changes in asset prices in the past decade which appear to have had substantial effects on the economy. Recent
empirical studies include Case et al. (2001), Ludwig and Slok (2002), Dvornak and Kohler (2003), and Aoki et al. (2002).

Consumption is one of the most important components of aggregate demand. The life-cycle theory of consumption implies that consumers’ expenditure depends on human capital and the value of tangible and financial assets (Deaton, 1992). Housing wealth in turn is the single most important component of non-financial wealth in households’ portfolios. Theoretically, housing asset price fluctuations, through their impact on household wealth, affect household consumption. Increases in house prices benefit those who aim to trade down and harm those who have yet to enter the market or aim to trade up. In the aggregate, and assuming gainers and losers balance out (net migration and foreign demand for housing are insignificant), one might expect the aggregate wealth effect of house price rises on consumption to be zero. Skinner (1989) refers to this as the Ricardian equivalence result; homeowners do not consume their housing wealth.

However, there exist at least three alternative mechanisms through which house prices may affect consumption (Aoki et al., 2002): (a) consumer optimism resulting in increase in demand for both housing and non-housing goods; (b) increase in consumption of consumer durables as a result of increase in housing transactions which often accompanies house price increases, and (c) the collateral enhancement/credit market/balance sheet effect, that is, assuming that households face binding credit restrictions, and credit instruments exist which allows the withdrawal of housing equity for consumption. Financial market deregulation and innovations in the past two decades in particular have resulted in robust growth of mortgage markets, making it easier for households to withdraw their home equity for reinvestment and consumption through loans and refinancing (Davey, 2001; Greenspan, 1999).

An earlier study for the US by Elliott (1980) found that variations in non-financial wealth had no effect on aggregate consumption.1 More recent studies, however, appear to support the view that changes in housing wealth are unambiguously associated with changes in aggregate consumption. Skinner (1993) suggests that the marginal propensity to consume from housing wealth for the US was roughly 6 cents per dollar of housing wealth. Case et al. (2001) find ‘a statistically significant and rather large effect of housing wealth upon household consumption’ for a panel of 14 countries (12 European, Canada, and US) and a panel of US states. Estimated elasticity ranges from 0.11 to 0.17 for the 14 countries and between 0.05 and 0.09 for US states. Ludwig and Slok (2002) in their study of 14 OECD countries find that ‘while the effect of housing prices on consumption is ambiguous the wealth effect has become more important over time’ and that for the period 1985–2000, ‘the effect of housing prices on consumption is significantly positive.’

Dvornak and Kohler (2003) estimate that a permanent increase in housing wealth of one dollar increases annual consumption by around 3 cents for Australia.

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1 Studies using US data on individual households (Engelhardt, 1996; Hoynes and McFadden, 1997; Levin, 1998; Skinner, 1989, 1993) have found the housing wealth effect on consumption to be ambiguous. Case et al. (2001) have attributed this ambiguity to the reliance of micro studies on owners’ estimates of housing values which typically have high sampling variances.
According to Gramlich (2002), the Federal Reserve Board’s model of the US economy uses a marginal propensity to consume out of real gross housing wealth of 3–5 cents for every additional dollar while the Bank of England’s model also incorporates significant housing wealth effects: a 10% rise in real gross housing wealth boosts consumer spending by 0.5% or 1.5 pence per pound of net worth increase. Based on the preliminary evidence that has become available recently, one might be tempted to generalize that housing prices and aggregate consumption do in fact move together, that is, there is no Ricardian equivalence result.

This paper makes a contribution to the growing literature by providing additional evidence in the context of a Southeast Asian economy. Singapore provides a good case study for a number of reasons. First, homeownership is widespread at more than 90% and household wealth is predominantly in housing (Phang, 2001). Second, Singapore (and other East Asian countries) experienced dramatic rises and falls in housing prices in the past two decades (Mera and Renaud, 2000). This is in contrast to the US where large declines are rare, and the general experience has been that of a modest, but persistent, rise in nominal home values that is perceived to be largely permanent. Third, Singapore’s housing institutions and policies have attracted much attention from policymakers of many developing countries hoping to achieve similar improvements in housing standards and to better understand the links between the housing sector and economic growth.

Section 2 of this paper briefly describes the Singapore housing market and presents the time series trends for relevant housing and macroeconomic variables. In Section 3, we present empirical evidence of the impact of house prices on real consumption for the period 1980–2000. In Section 4 we test for the presence of liquidity constraints and collateral enhancement effect of house price increases. Section 5 concludes with main findings.

2. The Singapore housing market

Singapore is a densely populated city state with 4.2 million people and a land area of only 685 sq km. Figures for 2003 indicate that 0.75 million or 18% of the population are foreigners. Between 1982 and 2002, Singapore’s GDP grew at an average annual rate of 6.6%, while GDP per capita growth averaged 4.2% per annum. In 2002, GNI per capita was US$20,690. Inflation as measured by the consumer price index is low and generally below 1% a year (World Bank, 2003).

There exists a vast literature on various aspects of the housing sector in Singapore (see for example books by Castells et al. (1990) for comparison with Hong Kong;² Chua (1997); Low and Aw (1997); Phang (1992); and Wong and Yeh (1985); and the sample of articles referenced here). This section provides a brief overview of

² There are many similarities in the housing markets of Singapore and Hong Kong. Both cities have sizeable public housing sectors as well as dynamic private sector real estate markets. The Hong Kong government owns virtually all the land in Hong Kong, whereas the Singapore government owns more than 80%. See Phang (2000), Reanud et al. (1997), and Fu (1995).
policies that have shaped the housing sector and trends in housing and macroeconomic variables.

Since the 1960s, housing institutions and policies have been developed systematically and comprehensively to advance social development and economic growth. The housing sector is dominated by public sector provision of dwellings that are sold on 99-year leasehold basis to eligible households. The Housing and Development Board (HDB) as the public housing authority is the largest housing developer. About 84% of the resident population lived in HDB flats. Of the total of 1.1 million housing units in 2003, 80% were HDB apartments. 94% of HDB flats are owner occupied units while the remaining 6% are rental units. The public housing sector resale price index is highly correlated with the private housing price index and the analyses of the interactions between the two sectors have been the focus of a number of recent papers (Bardhan et al., 2003; Ong and Sing, 2002; Phang and Wong, 1997).

There is a clear bias towards financing the housing sector in Singapore. Between 1968 and 1981, substantial forced savings of workers ‘locked up’ in the Central Provident Fund (CPF), a national defined contribution pension scheme, could only be withdrawn to make downpayments, mortgage payments, stamp duties, and interest payments for the purchase of public sector built housing. Required CPF contribution rates have ranged up to 50% of wages (25% employee contribution and 25% employer contribution); the distortions that this and related housing policies created for household housing and commute decisions are analyzed in Phang (1992).

From 1981, CPF savings could be used for private housing mortgage financing and for a variety of other merit good purposes since the scheme was further liberalized from the mid 1980s (Low and Aw, 1997). In the first half of the 1990s, housing market deregulation and asset enhancement policies featured strongly in the government’s socio-economic program (Lum, 2002; Phang and Wong, 1997). The private housing price index increased from its trough at 43 points in mid-1986 to reach a peak of 181 points in mid-1996. Under such conditions, housing assets became an increasingly major component of household as well as the national stock of wealth. Phang (2001) estimates that net housing wealth as a ratio of GDP increased significantly from 0.42 in 1980 to 2.34 by 1997. At the same time, the housing loans to GNP ratio increased from 0.10 in 1980 to 0.49 by 1997. Recent changes were implemented in 2002 to cap the CPF withdrawals for housing loans at 150% of the value of the property, and bringing this cap down to 120% over 5 years for new private housing loans (see Phang (2003) for details of this and other recent housing policy changes).

A distinctive feature of Singapore’s housing market is the dominance of apartments/flats (80% HDB apartments and 14% private apartments/condominiums), with private landed houses comprising only 6% of the housing stock. It is therefore, unlike most other markets where households trade up from apartments to houses or trade down from houses to apartments. Household mobility within the HDB sector is also constrained by various regulations to discourage mobility within the first 5 years of purchasing a subsidized HDB flat (to prevent ‘abuse’ of the housing subsidy). Until 1989, mobility in the HDB resale market was further constrained by regulations on citizenship and household income ceilings that applied to both new
applicant households as well as households buying a resale HDB unit. Following the 1989 deregulation of the HDB resale market, a study using 6 categories of public housing (by apartment size) and private housing as the 7th category revealed that 185,100 households shifted house between 1991 and 1995 (the housing stock was 637,000 units in 1990). Of these mover households, 47.0% upsized their housing, 24.4% downsized, while 28.6% moved to a same-category dwelling (Department of Statistics, Singapore, 1997).

2.1. Trends in housing market and macroeconomic variables

The Singapore housing market experienced two major housing boom-bust cycles between 1975 and 2000 (Fig. 1). The boom of 1980–1984 occurred during a period of rapid GDP growth and followed the liberalization of CPF regulation that allowed CPF savings to be used for private housing mortgages. Housing prices increased by 139% between 1979 and 1983, then dropped by 27% with the bust in 1985 coinciding with Singapore’s first general recession since independence.

The housing market picked up again in 1987, with the housing price index level more than tripling between 1987 and 1996. This was a period of strong economic recovery and growth (Fig. 2), which also witnessed the liberalization of regulations governing the purchase and financing of HDB resale flats (Phang and Wong, 1997). The bust from mid-1996 followed the implementation of anti-speculation measures and was exacerbated by the Asian crisis of 1997, with the index falling 43% from 1996 to 1998.

Table 1 and Fig. 3 show the trends in the average propensity to consume (APC) in Singapore for the past two decades. Two measures of disposable income are used: \( y_d \) which excludes CPF contributions, and \( y_{d+CPF} \), which is disposable income plus CPF contributions. We report APC for for three definitions of consumption: total personal consumption \( c^t \), non-durable consumption \( c^{nd} \) (i.e., total consumption minus consumption expenditure on furniture and household equipment), and consumption defined as expenditure on non-durable goods and services, excluding rent and utilities \( c^{nd-ru} \). Regardless of the definition of consumption expenditure or disposable income used, the downward trend in APC remains pronounced. The ratio of total consumption expenditure to \( y_{d+CPF} \) declined from 0.59 in 1979 to 0.44 by 1999.

From Figs. 3A and B, a deviation from the general downward trend can be observed for the period 1983–1986, when APC dipped sharply and then increased again. In Table 2, we report on the growth rates of real disposable income and of the various consumption definitions. From the data, it is possible to establish the extent to which the movement in ratios is due to movements in the numerator and in

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3 In May 1996, the government announced a package of measures to curb real estate speculation: capital gains arising from the sale of any property within 3 years of purchase would be taxed as income; stamp duty was to be levied on every sale and sub-sale of property; housing loans were limited to 80% of the property value; and foreigners were limited to non-Singapore denominated housing loans (Mera and Renaud, 2000).
the denominator. Fig. 4 clearly indicates that growth rates in income were much higher than growth rates in consumption for 1980–1984, and also for 1994–1996. These were also periods of rapid housing price increases (see Fig. 1).

To what extent did housing price increases dampened consumption demand? To assess the importance of this and other factors, we present a model in the next section that will be used to analyze the empirical evidence of the impact of housing prices on real consumption.
3. Model specification, data, and results

3.1. Model specification

The life-cycle-permanent income framework of consumption developed by Modigliani and Brumberg (1954) and Friedman (1957) has become the standard way that economists think about consumption. There exists an extensive literature with regard to both the specification of the aggregate consumption function as well as the fundamental value of housing. Deaton (1992) and Browning and Crossley (2001) provide an excellent review of the literature and various issues of empirical tests for the life-cycle-permanent income theory. With regard to housing value, there is considerable variation in the housing market literature on how the fundamental value of housing is modeled (Meen, 2002). Some studies use returns (Case et al., 2001; Engelhardt, 1996; Ludwig and Slok, 2002; Skinner, 1993), some place the analysis in an error-correction framework (Abrahams and Hendershott, 1996; Bourassa et al., 2001; Malpezzi, 1999) and some use an inverted demand model based on levels (DiPasquale and Wheaton, 1994; Muellbauer and Murphy, 1997).

Table 1
Consumption to income ratios, 1979–1999

<table>
<thead>
<tr>
<th>Year</th>
<th>$c_t/y_d$</th>
<th>$c^{nd}_t/y_d$</th>
<th>$c^{nd-ru}_t/y_d$</th>
<th>$c^d/(y^d+CPF)$</th>
<th>$c^{nd}/(y^d+CPF)$</th>
<th>$c^{nd-ru}/(y^d+CPF)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>0.6473</td>
<td>0.5832</td>
<td>0.5130</td>
<td>0.5880</td>
<td>0.5297</td>
<td>0.4659</td>
</tr>
<tr>
<td>1980</td>
<td>0.6179</td>
<td>0.5546</td>
<td>0.4880</td>
<td>0.5567</td>
<td>0.4997</td>
<td>0.4397</td>
</tr>
<tr>
<td>1981</td>
<td>0.6047</td>
<td>0.5403</td>
<td>0.4773</td>
<td>0.5366</td>
<td>0.4794</td>
<td>0.4235</td>
</tr>
<tr>
<td>1982</td>
<td>0.5988</td>
<td>0.5361</td>
<td>0.4724</td>
<td>0.5194</td>
<td>0.4650</td>
<td>0.4098</td>
</tr>
<tr>
<td>1983</td>
<td>0.5642</td>
<td>0.5043</td>
<td>0.4435</td>
<td>0.4879</td>
<td>0.4361</td>
<td>0.3835</td>
</tr>
<tr>
<td>1984</td>
<td>0.5650</td>
<td>0.5025</td>
<td>0.4390</td>
<td>0.4816</td>
<td>0.4284</td>
<td>0.3742</td>
</tr>
<tr>
<td>1985</td>
<td>0.5866</td>
<td>0.5193</td>
<td>0.4462</td>
<td>0.4887</td>
<td>0.4326</td>
<td>0.3718</td>
</tr>
<tr>
<td>1986</td>
<td>0.5774</td>
<td>0.5135</td>
<td>0.4320</td>
<td>0.5022</td>
<td>0.4466</td>
<td>0.3757</td>
</tr>
<tr>
<td>1987</td>
<td>0.5722</td>
<td>0.5149</td>
<td>0.4292</td>
<td>0.5096</td>
<td>0.4585</td>
<td>0.3822</td>
</tr>
<tr>
<td>1988</td>
<td>0.5687</td>
<td>0.5133</td>
<td>0.4312</td>
<td>0.5095</td>
<td>0.4599</td>
<td>0.3863</td>
</tr>
<tr>
<td>1989</td>
<td>0.5708</td>
<td>0.5180</td>
<td>0.4383</td>
<td>0.5069</td>
<td>0.4600</td>
<td>0.3893</td>
</tr>
<tr>
<td>1990</td>
<td>0.5619</td>
<td>0.5089</td>
<td>0.4291</td>
<td>0.4970</td>
<td>0.4501</td>
<td>0.3795</td>
</tr>
<tr>
<td>1991</td>
<td>0.5543</td>
<td>0.5029</td>
<td>0.4197</td>
<td>0.4889</td>
<td>0.4435</td>
<td>0.3701</td>
</tr>
<tr>
<td>1992</td>
<td>0.5621</td>
<td>0.5097</td>
<td>0.4243</td>
<td>0.4933</td>
<td>0.4474</td>
<td>0.3724</td>
</tr>
<tr>
<td>1993</td>
<td>0.5562</td>
<td>0.5072</td>
<td>0.4278</td>
<td>0.4891</td>
<td>0.4460</td>
<td>0.3762</td>
</tr>
<tr>
<td>1994</td>
<td>0.5402</td>
<td>0.4944</td>
<td>0.4208</td>
<td>0.4784</td>
<td>0.4379</td>
<td>0.3727</td>
</tr>
<tr>
<td>1995</td>
<td>0.5106</td>
<td>0.4671</td>
<td>0.3961</td>
<td>0.4478</td>
<td>0.4097</td>
<td>0.3474</td>
</tr>
<tr>
<td>1996</td>
<td>0.5013</td>
<td>0.4580</td>
<td>0.3881</td>
<td>0.4401</td>
<td>0.4021</td>
<td>0.3407</td>
</tr>
<tr>
<td>1997</td>
<td>0.4909</td>
<td>0.4491</td>
<td>0.3799</td>
<td>0.4314</td>
<td>0.3947</td>
<td>0.3338</td>
</tr>
<tr>
<td>1998</td>
<td>0.4845</td>
<td>0.4438</td>
<td>0.3687</td>
<td>0.4243</td>
<td>0.3886</td>
<td>0.3229</td>
</tr>
<tr>
<td>1999</td>
<td>0.4844</td>
<td>0.4442</td>
<td>0.3721</td>
<td>0.4377</td>
<td>0.4013</td>
<td>0.3362</td>
</tr>
</tbody>
</table>

Note. $c_t$, total personal consumption expenditure; $c^{nd}$, personal expenditure on non-durable goods and services = $c^d$−personal expenditure on furniture and household equipment; $c^{nd-ru}$ = $c^{nd}$−personal expenditure on rent and utilities; $y^d = GDP - CPF$ contribution−direct tax (personal and corporate tax); $y^d + CPF = GDP - direct tax (personal and corporate tax).
In this section, we generate simple time series models of income and house price changes and estimate the impacts of income and housing price movements on consumption. Following the well-established consumption framework of Campbell and

Fig. 3. Average propensity to consume (A) Income = GDP – direct taxes – CPF. (B) Income = GDP – direct taxes.

In this section, we generate simple time series models of income and house price changes and estimate the impacts of income and housing price movements on consumption. Following the well-established consumption framework of Campbell and
Deaton (1989), we regress the change in log consumption $D \log c$ on anticipated and unanticipated components (equation residuals) of the growth in disposable income and of real house price:4

$$D \log c_t = \lambda_1 + \lambda_2 \text{UDY}_t + \lambda_3 \text{ADPH}_t + \lambda_4 \text{UDP}_t + \beta \hat{r}_t + \epsilon_t,$$  \hspace{1cm} (1) 

where $\text{ADY}_t$ is the expected income growth between $t - 1$ and $t$, $\text{UDY}_t$ is the unexpected income growth between $t - 1$ and $t$, $\text{ADPH}_t$ is the expected real house price growth between $t - 1$ and $t$, $\text{UDP}_t$ is the unexpected real house price growth between $t - 1$ and $t$, and $\hat{r}_t$ is the expected real mortgage interest rate between $t - 1$ and $t$.

Under the life-cycle-permanent income hypothesis (LCH/PIH), predictable income movements should not affect consumption, controlling for the return to saving. Thus, $\lambda_1$ should be zero, provided income, house prices, and the interest rate are measured using information available at $t - 1$. Increases in house prices benefit those who aim to trade down and harm those who have yet to enter the market or aim to trade up. In the aggregate, provided the assumption of no liquidity constraints is true, and further that gainers and losers balance out, we would then expect the aggregate wealth effect of house price rises on consumption to be zero (Miles, 1994). Thus, under the null hypothesis, $\lambda_1$ and $\lambda_2$ should be zero.

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4 This approach utilizing returns for modeling the fundamental value of housing is consistent with the Campbell and Deaton specification for the consumption equation and is also utilized by Miles (1994), Case et al. (2001) and Ludwig and Slok (2002). The unexpected income and real house price variables are modeled as the error terms specified in the forecasting equations for income and house price in Table 4.
3.2. Data

We use quarterly, aggregate data on consumption and income obtained from Singapore’s Ministry of Trade and Industry. The basic data we use are constructed as follows:

Consumption ($c$): We considered all three measures of consumption defined earlier—total consumption $c_t$, non-durable consumption $c_{nd}$, and non-durable consumption less rent and utilities $c_{nd-ru}$. These are quarterly, per capita real, personal expenditure series deflated using the Consumer Price Index (CPI). Econometric studies of consumption generally use $c_{nd}$ rather than $c_t$, excluding durable goods due to the complexities associated with durable goods investment. The series $c_{nd-ru}$ excludes consumption of rental housing services and may therefore be more appropriate; but that series also excludes other components of non-housing consumption which might be expected to have a large wealth elasticity of demand. We use all three measures of consumption, but only report in detail results for non-durable consumption $c_{nd}$.

Disposable income ($y$): This is quarterly, real per capita derived disposable income, where real disposable income is nominal GDP less personal and corporate taxes, deflated using the CPI. It is therefore, inclusive of Central Provident Fund (CPF) contributions, which although not ‘disposable’ in a general sense, is certainly a significant part of permanent income, and may be used for housing purchase and other investments.

Interest rate ($r$): The interest rate series used is the average of the nominal housing loan rate for 15 year loans for each quarter.
Real housing price (PH): This is the Residential Property Price Index series compiled by the Urban Redevelopment Authority each quarter, deflated using the CPI. This series is an index of the market price of transacted private residential properties and is shown in Fig. 1.

3.3. Results

Preceding any analysis of the time series data, we perform the standard augmented Dickey–Fuller unit root test for stationarity. Table 3 shows the results of the test for the log of the real consumption, income, and housing price time series. For the first difference of the log of real consumption $c^t$ and $c^{nd}$, income and house price, we are able to reject the hypothesis of unit root using the MacKinnon critical values at the 5% level. For the first difference of the log of $c^{nd-ru}$, we are able to reject the hypothesis of unit root at the 10% level.

The predicted component of income growth is the fitted value from a regression of income growth on lags of income growth, the savings rate and seasonal dummies. The predicted component of real housing price changes is based on a regression where the explanatory variables include lags of real house-price changes, real income growth, and the mortgage interest rate. The prediction equations are shown in Table 4. The fitted values from these regressions are interpreted as the anticipated component of growth and the equation residuals are the unanticipated components.

Table 5 shows the non-durable consumption growth equations for 1981–2000 for $c^t$, $c^{nd}$, and $c^{nd-ru}$, as well as for the sub-periods 1981–1990 and 1990–2000 for $c^{nd}$ only. We handle expectations of real interest rate by including the lag of the nominal interest rate and four lags of consumer price inflation: if households use a simple time-series model to predict next period inflation, this specification allows for changes in ex ante real interest rate.

Table 3
Augmented Dickey–Fuller test results

<table>
<thead>
<tr>
<th>ADF unit root test on</th>
<th>No. of lags</th>
<th>Durbin–Watson</th>
<th>$\gamma_1$</th>
<th>Standard error</th>
<th>Reject unit root at 95%?</th>
</tr>
</thead>
<tbody>
<tr>
<td>log $c^t$</td>
<td>4</td>
<td>2.1</td>
<td>-0.119</td>
<td>0.053</td>
<td>No</td>
</tr>
<tr>
<td>D log $c^t$</td>
<td>3</td>
<td>2.0</td>
<td>-1.109</td>
<td>0.271</td>
<td>Yes</td>
</tr>
<tr>
<td>log $c^{nd}$</td>
<td>4</td>
<td>2.1</td>
<td>-0.114</td>
<td>0.051</td>
<td>No</td>
</tr>
<tr>
<td>D log $c^{nd}$</td>
<td>3</td>
<td>2.0</td>
<td>-1.095</td>
<td>0.271</td>
<td>Yes</td>
</tr>
<tr>
<td>log $c^{nd-ru}$</td>
<td>4</td>
<td>2.1</td>
<td>-0.152</td>
<td>0.056</td>
<td>No</td>
</tr>
<tr>
<td>D log $c^{nd-ru}$</td>
<td>3</td>
<td>2.0</td>
<td>-0.929</td>
<td>0.273</td>
<td>No*</td>
</tr>
<tr>
<td>log $y$</td>
<td>5</td>
<td>2.0</td>
<td>-0.162</td>
<td>0.067</td>
<td>No</td>
</tr>
<tr>
<td>D log $y$</td>
<td>4</td>
<td>2.0</td>
<td>-1.057</td>
<td>0.297</td>
<td>Yes</td>
</tr>
<tr>
<td>log PH</td>
<td>3</td>
<td>2.0</td>
<td>-0.047</td>
<td>0.018</td>
<td>No</td>
</tr>
<tr>
<td>D log PH</td>
<td>2</td>
<td>2.0</td>
<td>-0.312</td>
<td>0.087</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note. D log $x$ is the first difference of the log of the series $x$.
* Reject unit root at 90%.
Table 5 shows that for the full period (1981–2000), anticipated elements of real income changes had a significant impact on total consumption as well as non-durable consumption (the $t$ statistics are 2.15 and 2.03, respectively), which is inconsistent with the life-cycle/permanent income hypothesis. This result is consistent with other recent studies such as those of Campbell and Mankiw (1990) and Shea (1995) using US aggregate time-series data. Predictable movements in income do affect consumption. As expected, the impact of unanticipated increases in income on consumption was positive and significant for all the equations.

Neither anticipated nor unexpected elements of real house price changes seem to have had a clear impact on consumption for all the regression equations. It would appear that the dramatic and very significant increase in housing wealth over the two decades had no impact on consumption in the aggregate. Moreover, whatever little impact of housing wealth on consumption was not unambiguously positive: for $c_{1}^{nd}$ the signs of the coefficient were negative for expected real house price changes for the 1980s and for unexpected real house price changes for the 1990s.

The above result is not in agreement with recent empirical findings for the studies on OECD countries (see section 1) which support the view that changes in housing wealth are unambiguously associated with changes in aggregate consumption. This may be attributable to institutional factors: it is not as easy for households in Singapore to withdraw housing equity to finance consumption. Mortgage equity withdrawal in Singapore is limited by restrictions imposed by the Housing and Development Board as well as the Central Provident Fund Board that forbid the refinancing of HDB housing which comprises four-fifths of the housing stock

### Table 4

**Real income growth and house price inflation forecasting equations**

<table>
<thead>
<tr>
<th>Dependent variable: $D \log y$</th>
<th>Period: 1980.3–2000.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>Const D log $y_{-1}$ D log $y_{-2}$ syratio $y_{1}$ syratio $y_{2}$</td>
</tr>
<tr>
<td>Coefficient</td>
<td>0.006 0.079 $-0.192^<em>$ $-0.239^</em>$ 0.164</td>
</tr>
<tr>
<td>SE</td>
<td>(0.007) (0.106) (0.062) (0.104) (0.104)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent variable: $D \log PH$</th>
<th>Period: 1981.1–2000.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>Const D log $PH_{-1}$ D log $PH_{-2}$ D log $PH_{-3}$ D log $y_{-1}$ D log $y_{-2}$</td>
</tr>
<tr>
<td>Coefficient</td>
<td>0.034 0.787* $-0.338^<em>$ 0.170 0.057 0.409</em></td>
</tr>
<tr>
<td>SE</td>
<td>(0.021) (0.109) (0.139) (0.111) (0.186) (0.182)</td>
</tr>
</tbody>
</table>

* denotes significance at the 5% level.

Note. Seasonal dummies were included in both specifications but are not reported. syratio $y_{1}$ is the first lag of a simple measure of ratio of aggregate saving to disposable income. $r_{-1}$ is the first lag of the nominal interest rate on mortgages. Standard errors of the estimated coefficients are given in parentheses.

a OLS statistics: $R^2 = 0.79$, SE of regression = 0.025.

b OLS statistics: $R^2 = 0.62$, SE of regression = 0.039.
The only manner in which HDB housing equity might be withdrawn for consumption is for the household to move house and take on a new mortgage loan, an option with substantial transaction costs. Skinner (1989) has also suggested that consumption effects are moderated in the presence of a bequest motive: individuals concerned about their children facing higher housing prices leave larger bequests rather than spend their windfall gains.

Consistent with other studies of non-durable consumption (Campbell and Mankiw, 1990; Shea, 1995) the coefficients on the interest rate and inflation rate variables are insignificant.

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Consistent with other studies of non-durable consumption (Campbell and Mankiw, 1990; Shea, 1995) the coefficients on the interest rate and inflation rate variables are insignificant.

Phang (1992) and McCarthy et al. (2002) have suggested various changes to Singapore housing policy to facilitate access to substantial housing asset values to preserve old-age consumption. These include allowing owners of HDB apartments to rent out their flats or rooms, permitting HDB home equity loans and reverse annuity mortgages. Partial deregulation to allow HDB owners who have owned their flat for more than 10 years to rent out their flat was implemented in 2003 (Phang, 2003).
4. Testing for liquidity constraints and collateral effects

4.1. Use of asymmetric dummy variables

The failure of the life-cycle/permanent income hypothesis in aggregate data as shown in the section above is not surprising as the result is well established (Campbell and Mankiw, 1990). Two alternative hypotheses viz. myopia and liquidity constraints have been put forth. Altonji and Siow (1987) were first to note that myopia and liquidity constraints have testable implications for asymmetry in consumption behavior. Under myopia, consumption tracks income and should respond equally to predictable income increases and decreases. Under liquidity constraints, however, agents cannot borrow when income is temporarily low so that consumption should be more strongly correlated with predictable income increases than declines: liquidity constraints impede borrowing but not saving. Most existing tests of liquidity constraints have been carried out with household data, with mixed results. Shea (1995) was the first to test for asymmetries in the response of aggregate consumption to expected income growth.

Shea (1995) tests for the presence of myopia or liquidity constraints by running the following modified Campbell–Mankiw OLS regression using aggregate non-durable consumption data:

\[
D \log c_t = \mu + \gamma_1(POS)ADY_t + \gamma_2(NEG)ADY_t + \beta\bar{r}_t + \epsilon_t,
\]

where POS is a dummy variable for periods in which ADY, expected income growth, is positive, and NEG is a dummy variable for periods in which expected income growth is negative.

In this paper, we extend Shea’s innovation of using dummy variables to the expected housing price term to test for the collateral effect of housing price increases:

\[
D \log c_t = \mu + \gamma_1(POS1)ADY_t + \gamma_2(NEG1)ADY_t + \gamma_3(POS2)ADPH_t + \gamma_4(NEG2)ADPH_t + \beta\bar{r}_t + \epsilon_t,
\]

(2)

where POS1 is a dummy variable for periods in which anticipated real income growth is positive and NEG1 is a dummy for periods in which ADY is negative. POS2 is a dummy variable for periods in which anticipated real house price growth ADPH is positive and NEG2 is a dummy for periods in which ADPH is negative.

Under LCH/PIH, both \(\gamma_1\) and \(\gamma_2\) should equal zero. Under myopia, consumption tracks income: \(\gamma_1\) should be equal to \(\gamma_2\), both ADY coefficients should be positive, significant, and equal; similarly, \(\gamma_3\) should be equal to \(\gamma_4\) and both ADPH coefficients should be equal. With liquidity constraints, \(\gamma_1\) should be significantly positive, and should be significantly greater than \(\gamma_2\). If households are liquidity constrained, and if anticipated housing price increase enhances the scope to borrow against housing wealth by increasing the value of collateral against which loans are made, \(\gamma_3\) should be significantly positive, and should be significantly greater than \(\gamma_4\).
4.2. Results

Table 6 shows the results of the OLS regression for Eq. (2). Consumption responds significantly to expected income increases but insignificantly to predicted declines. $c_1$ is positive and significant while $c_2$ is positive but not significant for 1980–2000 data. This result indicates the existence of liquidity constraints. Table 6 also shows the results of running the regressions without the asymmetric dummies, which are consistent with the earlier results reported in Table 5. This is unlike the findings of Shea (1995) who found no evidence of liquidity constraints for postwar US aggregate consumption data.\footnote{In fact, Shea found US aggregate consumption to be more sensitive to predictable income declines than to predictable income increases and attributes this ‘perverse asymmetry’ findings to loss aversion: households suffer relatively large psychic losses when forced to cut living standards even a small amount.}

Capital market imperfections
which limit the ability to borrow against future labor income may be more severe in Singapore as compared to the US. Households in Singapore may also be more averse to borrowing against uncertain future labor income. Carroll (2001) has also suggested that the precautionary saving motive can generate behavior that is virtually indistinguishable from that generated by a liquidity constraint as the precautionary motive induces self-imposed reluctance to borrow (or to borrow too much).

The coefficients for expected housing price increase $c_3$ are consistently negative but insignificant. This implies a negative impact of house price increases on aggregate consumption as well as the non-existence of collateral enhancement effects. The positive sign for $c_4$ indicates that consumption tends to decline with anticipated house price declines, although the impact is statistically insignificant.

A plausible explanation is that the negative wealth effect of house price increases (on those seeking to upsize or enter the housing market) is stronger than the positive wealth effect of those seeking to downsize their housing assets. However, when the relative impacts on upizers and downsizers of a housing price decline is the reverse, the negative impact on housing asset owners outweighs the positive impact of housing price declines on upizers and those entering the housing market. A relative lack of downsizing in a market that is dominated by apartment housing might help to explain this asymmetry. Indeed, a 1997 study (Department of Statistics, Singapore (1997)) revealed that 14% of the stock of households in 1990 upized between 1991 and 1995 while only 7% downsized during the 5-year period (that is, an average of less than 1.4% of households downsized each year).

Skinner (1993) and Engelhardt (1996) also find similar asymmetry in the response of consumption to positive and negative housing wealth gains using US household data. Both these micro studies found that households that experience real housing capital gains did not change their consumption behavior, while households that experience real housing capital losses responded by consuming less. A plausible explanation is that housing is viewed as a risky asset with uncertain asset value. Households do not view their housing gains as permanent but suffer relatively large psychic losses when house prices decline. Using time series macro data for Sweden, Lyhagen (2001) finds that increased uncertainty concerning future income does lower consumption by increasing the precautionary demand for saving. A similar argument applies to uncertainty concerning household wealth. Skinner (1993) has suggested that households view housing wealth as a buffer against contingencies during retirement. Retired households do not wish to draw down their housing equity in the good states of the world because it is contingency against the bad state of the world.

5. Conclusion

Our analysis of 1981–2000 quarterly data for Singapore leads us to the following conclusions:

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7 Shea (1995) also find evidence of asymmetries in consumption behavior with respect to changes in expected income which he attributes to loss aversion in preferences.
1. There is evidence against the life-cycle/permanent income hypothesis as an explanation for aggregate consumption behavior for Singapore. This result is consistent with other recent studies using US aggregate time-series data. Predictable movements in income do affect consumption.

2. From the asymmetric reaction of consumption to income increases vis-a-vis income declines, we confirm the reason for the failure of the LCH/PIH to be liquidity constraints rather than myopia. Capital market imperfections which limit the ability to borrow against future labor income may be more severe in Singapore. Households in Singapore may also be more averse to borrowing against uncertain future labor income.

3. We conclude that the dramatic increases in house price and housing wealth over the past two decades had had no significant positive effect on aggregate consumption in Singapore. This is contrary to recent empirical findings for the OECD countries which support the view that changes in housing wealth are unambiguously associated with changes in aggregate consumption. This may be attributable to institutional factors: it is not as easy for households to withdraw housing equity to finance consumption. Households in Singapore may also have stronger bequest motives.

4. When we allow for asymmetric response, anticipated house price increases appear to have a dampening effect on aggregate consumption while declines in expected house price growth also had a negative effect on consumption, although the results are statistically insignificant. The relative lack of downsizing in a market that is dominated by apartment housing might help explain this. A contributory factor might be households’ demand for precautionary savings and their view of housing as a risky asset with uncertain value (gains are not regarded as permanent while losses are).

Finally, we conclude that there are major institutional differences across countries in the nature of housing and credit markets, and in the transaction costs for mortgage equity withdrawal. Other factors such as the strength of precautionary saving and bequest motives and the volatility of income and housing prices also differ. These factors are relevant in determining the response of aggregate consumption to housing wealth changes. The results presented here indicate that the recent empirical findings for OECD countries that changes in housing wealth are unambiguously associated with changes in aggregate consumption, cannot be easily generalized.

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References