The aggregate consumption puzzle in Singapore

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Abstract

We draw attention to an apparent puzzle in the aggregate consumption behavior of Singaporeans. In stark contrast to the rest of the world, the average propensity to consume (APC) has plummeted to just two-fifths of national income by the year 2003, leaving the Singapore economy without a dependable built-in stabilizer. This phenomenon represents a notable departure from the stable long-run equilibrium relationship between consumption, disposable income, and wealth observed elsewhere. The explanation of this puzzle is the main focus of the paper but we also suggest some policy measures that may reverse the process.

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1. Introduction

The aggregate consumption function is one of the most well established and widely estimated relationships in macroeconomics; yet, there is no rigorous study of the consumption function for Singapore.1 In the literature on other countries, the empirical consumption functions estimated have mostly employed a log-linear functional form. In this formulation, a constant long-run average propensity to consume (APC) requires the income elasticity of consumption expenditures to be unity in the absence of other explanatory variables such as wealth. But the handful of researchers who estimated simple

1 Hadjimatheou (1987) provides a comprehensive survey of the major developments pertaining to the consumption function.
consumption functions for Singapore have obtained elasticities that are well below one, thus implicitly allowing the APC to fall as income increases\(^2\) (Lim & Associates, 1988, Chapter 16; Toh & Ramstetter, 1994; Wong, 1974).

When the APC is measured as the ratio of real private consumption expenditures to real GDP in Singapore, it has indeed fallen steadily over time from 0.80 in 1960 to 0.42 in 2003 (Fig. 1). This has produced the lowest share of private consumption in output in the free world. Even amongst the former centrally planned economies, Ermisch and Huff (1999) noted that the lowest share of private consumption reached in the Soviet Union was 55%.

The dramatic decline in the APC seems to have left the Singapore economy without a dependable built-in stabilizer, which together with the higher volatility of external demand could have contributed to the increased amplitudes of Singapore’s business cycles in recent years.

The long-term decline in the APC is puzzling and anomalous because since Kuznets’ (1946) pioneering work, it was observed that the APC is relatively stable in the long run. The post-war evidence on selected economies bear out this remarkable fact: Table 1 shows that the shares of private consumption in GDP of the United States and United Kingdom have hovered around two-thirds to three-quarters from 1960 to 2000. In Asia, Japan saw its APC fall during the 1960s and 1970s—probably a reflection of the demographic transition—but the ratio has stabilized since 1980; this trend was mimicked by Taiwan and Hong Kong. Switzerland, a mature industrialized economy, is perhaps the best comparison for Singapore in view of its smallness and openness. As Singapore reaches a stage of development that is comparable to Switzerland’s, one would expect its APC to stabilize. This, however, has not happened thus far.

Historically, the life-cycle and permanent income hypotheses were formulated precisely to explain the stylized fact of a constant APC, as the simple Keynesian consumption

\(^2\) Given the simple consumption function \(C =AY^a\), the APC is \(C/Y = A/(1/Y^{1-a})\). If \(0 < a < 1\), the APC will fall as income rises.
function had implied that the APC should decrease over time with increases in income. Essentially, these explanations pointed out the key role played by wealth and other human assets in maintaining a stable ratio of consumption to GDP in the long run. The classic study on the US by Ando and Modigliani (1963), for example, showed that the stock of assets played the role of an intercept term in their estimated consumption function, which progressively shifts the function upward as income levels rise so as to trace out an APC that remains roughly unchanged in the long run.

Previous Singapore studies have excluded an appropriate wealth variable, casting doubt on the veracity of the estimated income elasticities. However, it is the contention of this paper that textbook macroeconomic theories of consumption do not provide satisfactory explanations for the anomalous consumption behavior of Singaporeans even when wealth is taken into account. Our efforts to build an aggregate consumption function that incorporates a constant consumption-income ratio in the long run led us to a search for the causes of the APC’s secular decline in Singapore. We begin this quest in Section 2 by estimating a traditional consumption function that depends on disposable income and wealth and show that it leads to an unstable APC. After reviewing in Section 3 some rather implausible explanations put forward by studies on savings behavior, we provide in Section 4 a consumption equation which is capable of resolving the puzzle of Singapore’s falling APC. In Section 5, we draw implications for policymakers and make some recommendations.

2. The consumption puzzle

As the first step in modeling the consumption function, we shall examine the traditional relationship between aggregate private consumption, disposable income, and wealth. Singapore’s statistical data on private consumption expenditures are not broken down into spending on consumer durables and non-durable goods and services; hence, we are forced to model aggregate expenditures without differentiating between these two important categories. Another drawback of using total consumption is that it includes expenditures on housing services in the form of imputed rents on owner-occupied dwellings, so
that an increase in house prices will cause consumption to rise independently of any wealth effect.

Official series for disposable income and wealth are not available in Singapore and therefore had to be constructed. We first calculate real disposable income as:

\[ Y_d = \frac{GDP}{1 - \text{taxes}} - \text{government fees and charges} - \text{net CPF contributions} \]

where taxes include both direct and indirect taxes, and Central Provident Fund (CPF) contributions are net of withdrawals. The variables that enter into the construction of the real disposable income series are all expressed in real terms and where necessary, they are deflated by the Consumer Price Index \( (P_t) \). Fig. 2 plots real private consumption expenditures, real GDP, and disposable income using seasonally adjusted data beginning from the first-quarter of 1978 and ending at the last-quarter of 2003. The graph shows that the paths of consumption and income tend to diverge in the long run, reflecting the phenomenon of a falling APC in Singapore.

In contrast to disposable income, household wealth can be constructed in a number of ways. If households diversify their wealth into \( n \) assets, and \( A_{it} \) is the stock of the \( ith \) asset in

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3 The quarterly data used in this study are sourced from the Singapore Department of Statistics’ online TREND database. Data on taxes and government fees and charges are only available on a quarterly basis starting from 1988, so observations going back to 1978 had to be interpolated from annual data using the Chow-Lin Technique (Abeyesinghe & Gulasekaran, 2003). The CPF is a mandatory saving scheme with contributions by both employers and employees. We add back to disposable income all withdrawals from the CPF including those used for financing investment in residential construction.
nominal terms, $S_{it}$ is the savings that are channeled to the $i$th asset and $\pi_{it}$ is the rate of change of the price of the $i$th asset, then:

$$A_{it} = S_{it} + A_{i t-1} (1 + \pi_{it}).$$

(1)

Upon computing (1) for each asset, aggregate assets can be obtained by summing over the $A_{i}$ terms. Alternatively, the total stock of assets can be written as:

$$A_{t} = S_{t} + A_{t-1} \left[ \sum_{i=1}^{n} \frac{A_{it-1}}{A_{t-1}} (1 + \pi_{it}) \right],$$

(2)

where $A_{t} = A_{1t} + A_{2t} + \ldots + A_{nt}$, $S_{t} = S_{1t} + S_{2t} + \ldots + S_{nt}$, and $A_{it-1}/A_{t-1}$ is the share of the $i$th asset in total wealth. If these shares remain roughly constant over time, the term within square brackets, which represents the aggregate revaluation term, can be worked out without much difficulty. Note that in the case of interest bearing assets, $\pi_{it}$ is the nominal interest rate.

The wealth variable that we construct for Singapore ($W_{t}$) has two major components, gross housing wealth ($HW_{t}$) and financial wealth ($FW_{t}$). We derived the stock of housing assets in each period by revaluing the previous period’s stock in line with changes in house prices as follows:

$$HW_{t} = I_{t} + HW_{t-1} \left( \frac{P_{t}}{P_{t-1}} \right),$$

(3)

where $HW_{t}$ is nominal housing wealth, $I_{t}$ is nominal investment expenditures on residential construction (obtained by multiplying real expenditures by the housing investment deflator) and $P_{t}$ is the private residential property price index in Singapore. The initial value of the housing stock was taken to be S$10,344.7 million in 1975 (computed from Rao & Lee, 1995).

Due to the paucity of data on the savings and investment patterns of households in Singapore, we consider only three types of financial assets: CPF savings, bank deposits ($D$) and equities ($E$). Hence, the aggregate nominal stock of financial wealth can be written as:

$$FW_{t} = A_{t}^{CPF} + A_{t}^{D} + A_{t}^{E}.$$

(4)

Accumulated CPF savings are directly measured by net CPF balances while data on the amount of bank savings held by Singapore residents are also available (both series include interest payments). Assuming that the residual savings are largely invested in local shares, we computed the equity stock using the following two equations:

$$S_{t}^{E} = P_{t} (Y_{dt} - C_{t}) - I_{t}^{n} - S_{t}^{D},$$

(5)

$$A_{t}^{E} = S_{t}^{E} + A_{t-1}^{E} \left( \frac{p_{t}^{E}}{p_{t-1}^{E}} \right),$$

(6)

where $S_{t}^{D} = \Delta A_{t}^{D}$ and $P_{t}^{E}$ is the Stock Exchange of Singapore (SES) share price index. On account of the lower popularity of stock investment by households in the early years of the

\footnote{4 The quarterly housing investment deflator was interpolated from the annual series using the SAS spline method.}
sample, the starting value of equities is taken to be two-fifths of the amount of bank deposits at the end of 1976.

Nominal housing and financial wealth were deflated by the CPI to arrive at their real counterparts, HW_t and FW_t. Fig. 3 plots each of these series and their sum, W_t. The figure shows that household wealth grew relatively slowly in the 1980s, picked up sharply in the 1990s as asset and house prices rose, and then fell during the Asian financial crisis of 1997–1998. Aggregate wealth rebounded strongly after the crisis, only to decline again with the onset of economic recession in 2001. Using the data series graphed in Figs. 2 and 3, OLS regressions of aggregate consumption expenditure on disposable income and the different wealth variables for the period 1978Q1 to 2003Q4 are reported below:

\[ \ln C_t = 1.06 + 0.64 \ln Y_{dt} + 0.14 \ln W_t, \]  
(11.9) (13.7) (3.86) \[ R^2 = 0.988, \quad SE = 0.049, \quad CRDW = 0.28, \quad ADF = -2.21; \]  

\[ \ln C_t = 1.22 + 0.78 \ln Y_{dt} + 0.03 \ln HW_t, \]  
(12.6) (26.8) (1.63) \[ R^2 = 0.987, \quad SE = 0.052, \quad CRDW = 0.29, \quad ADF = -1.96; \]  

\[ \ln C_t = 0.88 + 0.49 \ln Y_{dt} + 0.28 \ln FW_t, \]  
(9.54) (8.44) (5.85) \[ R^2 = 0.990, \quad SE = 0.046, \quad CRDW = 0.34, \quad ADF = -2.93. \]
The numbers in parentheses are the $t$-statistics, CRDW is the cointegrating regression Durbin–Watson statistic and ADF is the residual-based augmented Dickey–Fuller test statistic for cointegration computed from an AR(2) regression.\footnote{ADF tests for unit roots support the hypothesis that all the variables used in this exercise are $I(1)$ but these results are not reported for brevity.} The 5% critical value for the ADF test is $-3.84$ (MacKinnon, 1991).

The estimated income elasticities seem to be rather low and vary substantially depending on the wealth variable employed. If regression (7) with aggregate wealth is used, the income elasticity of 0.64 translates into a marginal propensity to consume (MPC) of about 35 cents out of an additional dollar of disposable income. The implied marginal propensity to consume with respect to wealth is even smaller, at merely 3 cents per $100 of wealth. The reason for this low estimate is found in (8): the indivisibility of the housing stock and limited avenues for realizing capital gains in the local property market mean that consumption expenditure is largely unaffected by housing wealth. Financial wealth, on the other hand, exerts a greater influence on consumption, though the results in (9) are far from satisfactory.

None of the above regressions represent cointegrating relations, implying that the OLS estimates are inconsistent. When we impose the homogeneity restriction that the sum of the income and wealth elasticities equals unity, the resulting logarithmic regression of the consumption–income ratio on the wealth–income ratio not only fails to cointegrate, but also produces a negative wealth coefficient in every case. This finding is yet another manifestation of the non-stationary APC ratio. The absence of cointegration between consumption and income even after allowing for wealth effects constitutes the consumption puzzle in Singapore.

### 3. Savings and consumption

At this juncture, it might be useful to briefly review work that has been done on Singapore’s aggregate savings behavior in order to shed some light on the consumption puzzle.\footnote{Chapter 4 of Peebles and Wilson (2002) contains a thorough review of the literature on savings in Singapore.} Since consumption is the flip side of savings, the dramatic increase in the private saving rate witnessed during the last three decades will pari passu depress the APC. Husain (1995) attributes at least part of the rise in saving to growth in per capita income, but there are two caveats to this explanation. First, as mentioned earlier, theories of consumption behavior do not predict a declining APC in spite of income growth, at least not over long spans of time. Indeed, Kuznets provided evidence to show that the savings ratio in the economically developed countries had not changed much since the middle of the nineteenth century despite the large recorded increase in per capita income. The argument that the APC fell in Singapore due to a rise in real income per capita holds only if we restrict the time period to the ‘short run.’ However one defines that, we think that the 40 years over which the APC has been halved is too long an interval to satisfy the requirement.

Second, it bears repeating the stylized fact that many fast growing economies—including the high saving newly industrialized economies of Taiwan and Hong
Kong—have not witnessed persistent declines in their APCs (Table 1). As we noted earlier, the initial declines experienced by these countries in the 1960s and 1970s are likely to have been caused by demographic shifts affecting their working populations—an explanation emphasized by the proponents of life-cycle theory themselves (Ando & Modigliani, 1963). Demographic change has in fact been cited as another important factor explaining the upward trend in Singapore’s private saving rate (Husain, 1995; Monetary Authority of Singapore, 1993). It was argued that the sustained period of growth experienced by Singapore coincided with a significant fall in both young and old dependents in the population. However, the statistics suggest that if this had any role to play at all in explaining the APC, it cannot be beyond the mid-1980s, when the ratio of the working age population to the total population stabilized at 70%. Yet the APC has continued its precipitous decline in the 1990s.

In a provocative article, Ermisch and Huff (1999) claimed that forced saving in Singapore, extracted through compulsory CPF contributions and the manipulation of the internal terms of trade by the major statutory boards providing utilities and telecommunication services, have been responsible for the high savings rate and hence for “spectacular drops in consumption as a share of GDP” (p. 30). But it will do well to remember that private consumption as a share of disposable income, and not just GDP, has also exhibited a pronounced downward trend. Given the way we have measured disposable income, this suggests that rising CPF contributions and increases in government fees and charges could not have been the reasons behind the APC’s decline. By the same token, high personal income taxes are not a feasible explanation; as a matter of fact, tax rates have been progressively reduced over the years. However, increases in the CPF contribution rate, by reducing disposable income, might have induced people to save more for precautionary purposes or to meet unexpected contingencies. We tested this hypothesis of ‘forced saving’ through the CPF by introducing the overall CPF contribution rate into the standard consumption function. As expected, its impact was insignificant.

A potentially important determinant of savings behavior which has not been considered by existing studies is the rate of interest (Blinder & Deaton, 1985). In theory, the after-tax real interest rate is the relative price that influences intertemporal substitution between present and future consumption. Hence, consumption is expected to be negatively related to movements in the real interest rate. Moreover, Deaton (1977) has hypothesized that unexpected inflation could lead to decreases in consumer spending because households mistake nominal price increases for real price increases. In particular, an absolute rise in the price of all goods and services is confused with a relative price rise for the good that the consumer is considering buying.

Since it is difficult to calculate the effective tax rate on interest income in Singapore, we investigated the sensitivity of consumption to changes in the pre-tax real interest rate. The latter is computed as the difference between the prime lending rate and the annual rate of change of the CPI—a crude, albeit convenient, proxy for expected inflation. We simultaneously perform a simple test of the “Deaton effect” by adding both the real interest rate and the actual inflation rate as arguments to the consumption function. Although the real interest rate appears to be significant, inflation clearly is not, thus rejecting Deaton’s hypothesis. This result is perhaps not surprising given Singapore’s low inflation record (except for the spikes in prices caused by the oil shocks in the 1970s). Still, no evidence of
cointegration could be found. The answer to the Singapore consumption puzzle has to be sought elsewhere.

4. Explaining the puzzle

The analyses in the previous sections suggest that the search for an explanation of the APC’s long-term decline in Singapore must extend beyond the traditional variables. It requires an examination of the peculiar circumstances in which Singaporean households find themselves, in particular, the dramatic increases in house and car prices seen in the 1980s and the first half of the 1990s. Even the most affordable public apartments in Singapore could cost 5–10 times the average annual household income while car prices stand as the highest in the world. House and car price inflation in Singapore can in turn be traced to the limited land space, the rising aspirations of the population to upgrade to better housing, and the demand for cars outstripping the supply of quotas for car ownership.

Since house prices appear to be the key to unlocking the APC puzzle in Singapore, it is worth looking into their links with consumption expenditures on non-housing goods and services in detail. Fig. 4 shows this nexus. A young couple in Singapore typically starts a family by initially buying a Housing Development Board (HDB) three-room flat and then upgrading later to a larger HDB apartment or to private housing as their income and financial assets grow. Although housing wealth grows in line with increases in house prices, the savings locked up in a house cannot be easily converted into the consumption of non-housing goods and services. Coupled with a lack of financial instruments like reverse mortgages in Singapore, this means that housing assets are effectively illiquid (as

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Fig. 4. The nexus between house prices, financial assets and consumption.

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7 The HDB is the statutory board responsible for the provision of subsidized public housing in Singapore. About four-fifths of Singapore residents live in HDB flats and the rest in private housing (condominiums, semi-detached, and detached houses). Singapore citizens are eligible to buy new HDB flats at subsidized rates from the government though in the past, this usually entails a long waiting period.
confirmed by our regression results). For this reason, we have crossed the link from these assets to consumption in Fig. 4.

Unlike in bigger countries, there are no cheap suburbs in Singapore where one could buy a similar or better house and enjoy the capital gains from the sale of the existing one. The sole option available to Singaporeans, apart from emigration to other countries, is to downgrade to a smaller unit. Direct downgrading from private housing to HDB apartments appears to be uncommon because of psychological resistance and a segmented housing market, especially in terms of the amenities provided by private estates. However, downgrading takes place in a more subtle way. The fact that about 85% of elderly parents live with their children suggests that parents might move into a smaller flat with their children in their old age. In this case, the parental house or the proceeds from its sale are passed on to their descendants in the form of bequests.

As house prices go up, the increase in the value of housing assets is accompanied by a concurrent rise in the financial liabilities of households, in the form of higher down payments for the purchase of residential properties and burgeoning housing loans. Due to the limited avenues for liquidating house assets, households have to build up sufficient financial assets to smooth the profiles of their lifetime consumption of non-housing goods and services. In Fig. 4, the dotted arrow from housing loans to financial assets shows this indirect link. While an increase in household financial wealth is likely to have a positive impact on consumption, part of the build-up in financial assets occurs because of the illiquid nature of house assets. The implication is that, as house prices rise over time in Singapore, the consumption profiles chosen by later generations of households do not increase as fast as their income. Therefore, one has to control for this effect in a regression to avoid the problem of omitted variable bias.

The negative effect on consumption of an increase in house prices working through the loans channel is also indicated in Fig. 4. There is some empirical evidence for this direct link: Phang (2004) found that anticipated house price increases have a dampening effect on aggregate consumption in Singapore, although the impact is statistically insignificant. She attributes the finding to what she called the “negative wealth effect” of price increases on those seeking to enter the housing market or to upgrade to better housing (Ludwig & Sløk, 2002 refer to this as a “substitution effect”). Since both wealth and substitution effects have to be non-negative for a normal good and for lack of a better name, we call the negative impact of a rise in house prices the “price effect.”

The price effect is likely to be well captured by a loans variable. Unfortunately, a time series on housing loans is not available in Singapore. A composite variable made up of loans for buildings, construction, and housing was found to be less appropriate. The best proxy for housing loans we can find is withdrawals from the CPF to finance the purchases of houses and mortgages. To capture other loans, including car loans, we used data on bank lending to professional and private individuals. These two loan variables, after deflating by the CPI, are found in preliminary investigations to have negative effects on

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8 Withdrawals from the CPF to pay for publicly built flats have been allowed since 1968; in 1981, the rules were liberalized to cover private residential properties. The increase in such withdrawals have been particularly rapid since the early 1980s, having grown from 2.8% of disposable income in 1977 to 6.4% by 2000; as a proportion of CPF contributions, they have averaged about 40% during the 1990s.
consumption which are roughly equal in magnitude. We therefore combined them to form a total loans variable ($L_t$).

Apart from disposable income, financial wealth and loans, we needed another variable to fully explain the fall in the APC. This variable, again peculiar to Singapore, is total visitor expenditures in real terms ($V_t$).9 In principle, visitor expenditures should be irrelevant as private consumption is defined as expenditures by the resident population on the purchases of final goods and services. It is obtained by netting out the expenditures of tourists from the estimates of total consumption in the domestic market. However, the fact that the number of visitors who visit Singapore each year is nearly twice the size of the resident population means that any errors-in-variables problem created by visitor spending would be amplified. That visitor expenditures turned out to be critical in our regressions points to a residual element of tourist spending in the aggregate consumption data.

The regression that we estimate using the variables discussed above is as follows:

$$\ln \frac{C_t}{Y_{dt}} = \beta_0 + \beta_2 \ln \frac{FW_t}{Y_{dt}} + \beta_3 \ln \frac{L_t}{Y_{dt}} + \beta_4 \ln \frac{V_t}{Y_{dt}} + u_t, \quad (10)$$

with an implied income elasticity of $\beta_1 = 1 - \beta_2 - \beta_3 - \beta_4$. This regression has a nice interpretation—the dependent variable is the logarithm of the APC while the independent variables are the respective ratios of financial wealth, loans, and visitor expenditures to disposable income, also expressed in logarithms. If the specification leads to a cointegrating regression, we would have obtained a constant APC in the long run or put

Table 2
APC regression results

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>DOLS</th>
<th>Johansen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Financial wealth</td>
<td>0.09 (1.99)</td>
<td>0.13 (2.38)</td>
<td>0.11 (2.81)</td>
</tr>
<tr>
<td>Housing wealth</td>
<td>0.02 (0.88)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Loans</td>
<td>-0.18 (-7.74)</td>
<td>-0.26 (-13.7)</td>
<td>-0.17 (-9.94)</td>
</tr>
<tr>
<td>Visitor expenditures</td>
<td>0.18 (7.91)</td>
<td>-</td>
<td>0.19 (9.72)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.868</td>
<td>0.741</td>
<td>0.867</td>
</tr>
<tr>
<td>SE</td>
<td>0.041</td>
<td>0.057</td>
<td>0.041</td>
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<tr>
<td>CRDW</td>
<td>0.74</td>
<td>0.42</td>
<td>0.73</td>
</tr>
<tr>
<td>ADF</td>
<td>-3.44</td>
<td>-2.51</td>
<td>-4.68*</td>
</tr>
</tbody>
</table>

Notes: Figures in parentheses are t-statistics; the corrected statistics for the DOLS estimates are computed from an AR(1) regression on the residuals. The ADF statistics in (1) and (2) are based on AR(2) regressions of residuals and the one in (3) is based on an AR(1) regression.

9 Significant at the 1% level.

9 Total visitor expenditures are obtained by multiplying the number of visitor days by the average expenditure per visitor per day over the period 1985–1998 ($230). We use the period average because expenditure data are only available on an annual basis from 1985 and interpolation of these annual statistics to obtain quarterly figures may introduce further measurement errors. Over the period concerned, average visitor expenditure per day has gone up from $190 in 1985 to $314 in 1990 and then fallen steadily to $206 in 1998. Somewhat reluctantly, we have to ignore these fluctuations.
differently, a unitary income elasticity conditional on constant wealth–income, loan–income, and visitor expenditure–income ratios.

The regression results for (10) are shown in column (3) of Table 2 (the estimate of the constant term is not reported). The residual-based ADF $t$-statistic of $-4.68$ is significant at the 1% level according to the MacKinnon (1991) critical value; hence, this test renders strong support for cointegration. For comparison, we show in columns (1) and (2) regressions that either include the housing wealth variable or omit the visitor expenditures variable. The insignificance of the housing wealth coefficient reinforces the earlier regression findings and vindicates our belief that housing assets in Singapore are perceived to be illiquid. Furthermore, the ADF $t$-statistics associated with these regressions indicate that they do not represent cointegrating relationships.

In order to correct for possible endogeneity and measurement-error biases of the OLS estimates and their standard errors, we employed the ‘dynamic OLS’ (DOLS) procedure popularized by Stock and Watson (1993) to re-estimate (10) (see Hayashi, 2000, pp. 654–657). We set the lead and lag lengths in the dynamic regression to four-quarters, corresponding roughly to the $T^{1/3}$ rule, and ran an AR(1) regression on the residuals to compute the long-run variance. Table 2 shows that the DOLS coefficient estimates on financial wealth and loans are larger than in the OLS case and reassuringly, they come with significant corrected $t$-statistics.

Finally, we used the Johansen (1988) maximum likelihood procedure for further testing and estimation. The trace test, based on a VAR(2) specification for the four variables, supports the existence of a single cointegrating vector. Further testing shows that the
wealth, loan, and visitor expenditure ratios are weakly exogenous for the parameters of interest. This offers a justification for estimating a single equation dynamic consumption function, which we present later. The last column of Table 2 shows that the estimated long-run coefficients in the cointegrating vector are similar to those from the DOLS regression.

We use the DOLS estimates in the rest of our analysis. The income elasticity of consumption implied by these estimates is 0.87, somewhat lower than the usual elasticities reported in the literature but higher than the estimates from regressions (7)–(9) and those found by previous Singapore researchers. Using these results, we are able to derive an ex-post explanation of the APC’s decline. The estimated long-run elasticities suggest that a 1% increase in the financial wealth ratio raises the APC by 0.16%, a similar increase in the loan ratio reduces it by 0.22%, while a 1% decrease in the visitor expenditure ratio reduces it by 0.19%. Perhaps not surprisingly, the price effect dominates the wealth effect, thereby explaining the secular fall in the APC. Even if the wealth and loan coefficients are taken to be of the same magnitude as in the Johansen estimates in Table 2, the observed steeper trend in the loan ratio has more than offset the wealth effect and thereby exerted a downward pressure on the APC.

Fig. 5 charts the historical evolution of the three key ratios and their impact on the APC. The superimposed regression trend lines show that the ratio of household financial wealth to disposable income has an upward trend, but this increase in the wealth ratio has not been sufficient to stem the decline in Singapore’s APC, which has been driven by a sharply rising loan ratio and a declining visitor expenditure ratio. Since the number of visitors hosted by Singapore has risen steadily over time, the falling visitor expenditure ratio is a direct reflection of the drop in average visitor expenditures. This structural trend has inadvertently found its way into the official estimates of private consumption, as we explained earlier. However, it is evident from Fig. 5 that the declining visitor expenditure ratio is not the sole, or even the most critical, reason for the secular decline in the APC.

We have thus far concentrated on modeling the long-term behavior of private consumption expenditures in Singapore. But do short-run fluctuations in consumption also respond to the long-run factors that are found to be important? To answer this question and close our analysis, we present below the error-correction model estimated for aggregate consumption, in which the ECM term is simply the residuals computed from the DOLS estimates in Table 2:

\[
\Delta \ln C_t = -0.14 \Delta \ln C_{t-1} + 0.26 \Delta \ln C_{t-1} + 0.25 \Delta \ln Y_{dt} + 0.08 \Delta \ln FW_t - 0.03 \Delta \ln H_{t-1}^{CPF} \\
- 0.24 \Delta \ln Y_t - 0.03 \Delta \ln H_{t-1}^{CPF} + 0.03 \Delta \ln H_{t-1}^{CPF} + \text{ECM}_{t-1},
\]

\(R^2 = 0.376, \quad SE = 0.018, \quad DW = 1.96.\)

LM(5) = 0.41 (0.84) \quad ARCH(4) = 1.25 (0.30) \quad Normality = 0.69 (0.71)
Heteroscedasticity = 1.01 (0.44) \quad RESET = 0.30 (0.59)

In this regression, we tried the total loans variable and its components (CPF housing withdrawals and loans to individuals) separately, but only CPF housing withdrawals \(H_{t-1}^{CPF}\) turned out to be statistically significant. The diagnostic test statistics (\(P\)-values in
parentheses) indicate that the ECM formulation is satisfactory while the recursive parameter estimates of the model are remarkably stable.

The error-correction model speaks for itself but we would like to highlight some observations. First, the short-run elasticity estimates are smaller than the long-run estimates given in Table 2. Second, it seems to be the case that the price effect is more of a long-run effect than a short-run one. Third, unlike the consumption functions estimated for the UK and the USA, Singapore’s consumption expenditure is subject to more short-term variation as reflected by the negative coefficient on $\Delta \ln C_{t-1}$. Fourth, the estimated ECM coefficient implies a moderate pace of adjustment to the long run, with about 24% of the short-term disequilibrium in last period’s consumption expenditures being eliminated in the current quarter.

5. Policy implications

We conclude this paper by drawing out the policy implications of the foregoing analysis. Before that, it should be pointed out that due to ‘measurement error’ caused by tourist spending, the APC in Singapore is underestimated. Although we do not want to engage in second guessing the published data, we could not resist performing the following counterfactual experiment: how much higher would it have been if the remaining effect of visitor expenditures was purged from the data? The easiest way to answer the question is to divide $C/Y_{dt}$ by $(V/Y_{dt})^{0.19}$ to obtain an adjusted APC. However, the series adjusted in this way needs to be re-scaled and we did this by setting the adjusted APC to be the same as the unadjusted one in the first-quarter of 1978. Fig. 6 plots both the unadjusted and adjusted APCs (four-quarter moving averages are used to smooth out the fluctuations). The
discrepancy between the two average propensities to consume is small in the early years but it widened in the last decade. Interestingly, the adjusted APC, apart from large cyclical fluctuations, shows only a mild downward trend since 1985. Nonetheless, it appears that the decline in the visitor expenditures to income ratio has only been partially responsible for the fall in the APC.

Why should the falling APC be a cause for concern? It is a fact in most countries, Singapore not excluded, that private consumption expenditures constitute the most stable component of final aggregate demand. With a declining APC, the more variable components in aggregate demand such as investment and exports become dominant in cyclical fluctuations. This results in more volatile GDP growth, ceteris paribus. In particular, as a small open economy, Singapore is highly vulnerable to external shocks affecting her domestic exports. During such times, measures to stimulate consumer spending will not be very potent given that private consumption expenditures currently account for less than half of GDP. In other words, consumption spending cannot serve as a built-in stabilizer for the economy unless the government takes measures to raise the share of such expenditures in output.

The main result of our study is that rising loans and withdrawals from the CPF to finance house and car purchases have played a crucial role in the evolution of Singapore’s APC. It is observable that a fall in house prices is accompanied by a rise in APC with a lag of 4–5 years. This leads us to another important policy implication: to prevent further declines in the APC, the government should ensure that residential property and other household assets remain affordable to Singaporeans. At the least, it should do its best to prevent a recurrence of the bubble-like increases in residential property prices experienced in the early 1980s and 1990s. As our analysis demonstrates, these were the periods during which the APC lost much ground. More specifically, we recommend that any increase in property prices that exceeds the trend growth rate of disposable income should be mitigated by policy interventions. If the wealth–income ratio grows faster than the loan–income ratio, the adjusted APC should eventually recover to levels that could support a more stable GDP growth rate.

References


