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HONG KONG'S CONSUMPTION FUNCTION REVISITED

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Abstract

This paper revisits the relationship among consumption, income and wealth using Hong Kong data. We find that the permanent income hypothesis is weakly supported by Hong Kong's consumption data prior to 1997, but it is not supported for the sample period after 1997 and the whole sample period spanning from 1984 to 2006. Furthermore, we find that both anticipated and unanticipated income and wealth effects have influences on Hong Kong's consumption. While temporary tax changes may have some impact on consumption of durable goods, the evidence that they also affect overall consumption remains limited.

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Keywords: Permanent income hypothesis, consumption smoothness, anticipated and unanticipated effects

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Executive Summary:

- *This paper revisits the relationship among Hong Kong's consumption, income and wealth. Specifically, we investigate four related issues that have not been examined adequately before: 1) Does the consumption behavior in Hong Kong satisfy the permanent income hypothesis? That is, whether consumers in Hong Kong base their consumption decisions on their expected, long-term income or on their current income. 2) If consumers in Hong Kong make their consumption choices based on their permanent income, then we would expect a relatively smooth consumption pattern, as permanent income is generally smooth relative to current income. But empirically, is Hong Kong's consumption smooth? 3) How do consumers in Hong Kong react to anticipated and unanticipated changes (or surprises) in income and wealth? If consumers are forward looking, they should not react much to anticipated changes in income and wealth. 4) Under the permanent income hypothesis, consumers should react less to temporary tax changes than permanent ones. Given there have been many incidences of temporary tax changes in recent years, what do the data reveal about the reaction of Hong Kong consumers to such changes?*

- *Using the well-established Campbell-Mankiw specification, we first test the permanent income hypothesis. We find that the permanent income hypothesis is only weakly satisfied by Hong Kong's consumption data prior to the 1997 period, but it is not for the sample period after 1997 and the whole sample period spanning from 1984 to 2006. This suggests that current income rather than permanent income in the period of the post 1997-98 financial crisis plays an important role in determining consumption in Hong Kong.*

- *We next investigate whether Hong Kong's consumption is volatile, that is, whether Hong Kong's consumption growth is varying excessively relative to the shocks of unexpected labour income in Hong Kong. The overall results seem to indicate that Hong Kong's consumption is not smooth, especially compared with the findings of the US economy. It appears that the volatility measure for the period before 1997 is much smaller than that for the post-1997 period, possibly reflecting large external shocks to the labour income and the overall economy in the latter period.*

- *Thirdly, we explore how consumers respond to anticipated and unanticipated changes in labour income, financial wealth, and housing wealth. We follow two specifications, one following the Blinder and Deaton (1988) framework and one the cointegration approach. Our findings from both specifications appear to suggest that both anticipated and unanticipated income and wealth tend to affect Hong Kong's consumption.*

- *Finally, we find that Hong Kong's consumption does not seem to respond much to temporary changes in taxes. However, temporary tax cuts seem to have a moderate and positive impact on consumption of durables, suggesting that the extra income from temporary tax cuts is mostly used for expenditures of durable goods.*

- *Our empirical findings suggest that Hong Kong's consumption pattern may have experienced a significant change after 1997, possibly affected by the severe financial crisis afterwards. Therefore, the standard consumption theory may not be useful in explaining Hong Kong's consumption pattern. However, given the economy has experienced sustained and above-trend growth after 2003 Q2, what remains to be answered is whether Hong Kong's consumption will be able to return to its pre-1997 pattern.*

I. INTRODUCTION

The relationship between consumption and income is perhaps one of the oldest and enduring statistical regularities in macroeconomics. The most important consumption theory, among others, includes Milton Friedman's permanent income hypothesis (PIH) and Franco Modigliani's life-cycle hypothesis (LCH). Both theories state that consumption is determined by consumers' expected life-time or permanent income, rather than their current income. While these theoretical constructs have remained basically intact, the empirical tests of theories of consumption behaviour have gone through changes and modifications. For example, recent tests of the PIH have not been based on a structural relationship between consumption and income, but rather on the statistical time series properties of consumption data. In a seminal paper, Hall (1978) concludes the marginal utility of consumption evolves according to a random walk with a trend. The random walk hypothesis implies that only surprises in permanent income affect current consumption, once lagged consumption is controlled for.

Previous studies on Hong Kong's consumption have focused on the link of Hong Kong's consumption with the changing structure of the economy (Dodsworth and Mihaljek, 1997), property market (Peng et al., 2001), consumer credit (Lai and Lam, 2001), and household sector income and wealth (Cutler, 2004). While these studies have enhanced our understanding on Hong Kong's consumption behaviour, the forward looking aspects of Hong Kong consumers towards both anticipated and unanticipated changes in income, wealth, and taxes have not been explored adequately. As consumption expenditures account for more than 60% of GDP in Hong Kong, a better understanding of these issues will help improve our ongoing macroeconomic forecasting work and also help contribute positively to policy analyses.

With these objectives in mind, we investigate four specific issues related to Hong Kong's consumption pattern. First, does the consumption behavior in Hong Kong satisfy the permanent income hypothesis? That is, do consumers in Hong Kong base their consumption decisions on their expected, long-term income or on their current income. Secondly, if consumers in Hong Kong make their consumption choices based on their permanent income, then we would expect a relatively smooth consumption pattern, as permanent income is generally smooth relative to current income. But empirically, is Hong Kong's consumption smooth? The answer to this question will also help shed light on whether the PIH is satisfied for Hong Kong's consumption. Thirdly, how do consumers in Hong Kong react to anticipated and unanticipated changes (or surprises) in income and wealth? If consumers are forward looking, they should not react much to anticipated changes in income and wealth. Finally, under the permanent income hypothesis, consumers should react less to temporary tax changes than permanent ones. Given there have been many incidences of temporary tax changes in recent years, what do the data reveal about the reaction of Hong Kong consumers to such changes?

The rest of the paper proceeds as follows: Section 2 tests for the importance of permanent income and the volatility of consumption in Hong Kong. Section 3 estimates the effect of anticipated and unanticipated income and wealth changes on Hong Kong's consumption. Using the same modelling framework, the section also analyses the effect of changes in taxes on consumption. Section 4 concludes.

II. PERMANENT INCOME HYPOTHESIS AND VOLATILITY OF HONG KONG'S CONSUMPTION

In empirical applications, consumption functions can be specified in several ways. In its earliest specification, Friedman (1957) uses distributed lags of current income to approximate the permanent income. Under the rational expectation postulate, however, lagged income variables should not have explanatory power on current consumption. As argued in the Lucas (1976) critique, the PIH does not lead to implementing a "structural" relationship between consumption and current income, as the estimated coefficient may no longer be reliable with changes in underlying economic structure. Hall (1978), in a seminal paper, postulates that the marginal utility of consumption under the rational expectations hypothesis should be a random walk process with a trend. In practical terms, this means that current consumption is sufficient in predicting future consumption. Hall also finds that wealth has predictive power for consumption. Hall (1988) and Campbell and Mankiw (1989) further test the hypothesis by including real interest rate, which could be interpreted as an inter-temporal relative price, and find that the expected changes in consumption have little or no correlation with the ex ante real interest rates.

Following Hall (1978), the objective function of a representative consumption is specified as follows:

$$Max\, E_t\left[\sum_{t=0}^{\infty}(1+\rho)^{-t}U(c_t)\right] \tag{1}$$

$U(C_t)$ is the utility function the consumer derives from consumption C_t and ρ is the subjective discount rate. The present value of lifetime utility is maximised subjected to an intertemporal budget constraint:

$$w_{t+1} = (1+r)[w_t + y_t - c_t] \tag{2}$$

w_{t+1} is next period's wealth, y_t is labour income and c_t is consumption. Maximising the objective function subject to the budget constraint yields the following Euler equation

$$\frac{E_t[U_c(c_{t+1})]}{U_c(c_t)} = \frac{(1+r)}{(1+\rho)} \tag{3}$$

where U_c indicates the first order derivative or the marginal propensity to consume. If the subjective discount rate is equal to the rate of return, e.g. $r = \rho$, we have

$$U_c^{'}(c_{t+1}) = U_c^{'}(c_t) + \varepsilon_t . \tag{4}$$

This implies that next period's marginal utility of consumption can be estimated by today's marginal utility of consumption with a zero mean error term, ε_t. By assuming that preferences are quadratic, this relationship implies that consumption follow a random walk process and is therefore unpredictable, that is, $\Delta c_t = \varepsilon_t$.[1] The economic interpretation is that any expected changes in consumption has already been incorporated in today's consumption, as individuals smooth or update their consumption in the current period t.

Permanent or current income?

Following the theoretical construct, a simple way to test for the permanent income hypothesis is to see whether the current income has any predictive power for current consumption. Consider first the following basic model that measures the impact of current income and current consumption

$$\Delta c_t = \alpha + \lambda \Delta y_t + \varepsilon_t \tag{5}$$

with Δc_t is log difference of real consumption, Δy_t is log difference of current real labour income. If $\lambda = 0$, the PIH is satisfied. The regression results are presented in columns (2) to (3) of Table 1. To check for the robustness of the sample selection, we also report results split into four sub-sample periods. The full sample results show a marginally significant relationship between changes in consumption and changes in income, suggesting the PIH is not satisfied. However, for the sample period prior to 1997, we find that there is not a statistically significant relationship between changes in consumption and changes in labour income, consistent with the PIH. The post-1997 estimates switch again, indicating that there is a strong statistical relationship between changes in labour income and changes in consumption. In this period, it appears that Hong Kong consumers relied on their current income, rather than their expected longer-run income, for consumption. This may be due to the financial constraints that consumers faced in post-1997 because of the burst of the property bubble and severe economic downturns.

[1] See Hall (1978) for a detailed derivation.

The above specification assumes that all agents are forward looking. However, this may not be so in practice. Campbell and Mankiw (1989) thus augment the above model to allow a portion, $(1-\lambda)$, of consumers to be forward looking and a proportion (λ) of consumers to be backward looking. The Campbell-Mankiw framework also allows for some intertemporal substitution for the permanent income consumers, with σ as an elasticity parameter. Therefore, the augmented model is specified as follows:

$$\Delta c_t = \alpha + \lambda \Delta y_t + (1-\lambda)\sigma r_t + \varepsilon_t \tag{6}$$

where r_t is the Hong Kong real best lending rate.[2] The empirical results of equation (6) are presented in columns (4) to (7) in Table 1 and these results are very much in line with the basic PIH model. For the full sample period (1984 Q1-2006 Q4), the portion of backward looking individuals who consume their current income corresponds to 1/3 in the OLS regression and 1/2 in the regression with instrumental variables (IV). However, whether the PIH holds is uncertain depending on the instruments used.[3] Real interest rate appears to be significant statistically in both OLS and IV regressions, implying a negative and very small σ, the intertemporal substitution parameter, which has a wrong sign. This suggests consumers may not follow a specific rule to allocate their consumption intertemporally. For the period prior to 1997, it appears that the PIH holds, as up to 90% of consumers are forward looking and their contemporaneous income does not have much influence on their consumption. Similarly to the full sample period, real interest rate does not appear to affect consumption much. For the period of 1997 to 2006, both OLS and IV estimates suggest that current income matters a great deal and consumption function does not follow a random walk process. These rather contrasting results may suggest the existence of a structural break occurring at the Asian financial crisis.

Following our intuitions, we conduct a Bai and Perron (1998) stability test to see whether these regression specifications are stable over the sample period covered. The Bai and Perron test allows for multiple break dates and also for the break dates to be determined endogenously within a specific model. The test results indicate that we can find two breakpoints in the simple regression model, both corresponding to the Asian financial crisis, 1997 Q3 and 1998 Q4. For the Campbell and Mankiw specification, the structural break test also points two breakpoints, one corresponding to the Asian financial crisis and one to the SARS epidemic. The breakpoints found in these two models thus provide justifications for splitting sample when modelling and testing the permanent income hypothesis.

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[2] It appears that using Hong Kong's HIBOR does not appear to change the result much.

[3] We have also experimented with instruments using various combinations of these instruments in Table 1. The results appear to be similar to the ones reported in Table 1.

Tests for consumption volatility

Our simple test suggests that the Hong Kong's consumption does not necessarily follow a random walk process, implying that PIH does not necessarily hold in Hong Kong, either. Indeed, the test is sensitive to the sample period used. The severe shocks experienced by the economy after 1997 appear to have affected Hong Kong's consumption behaviour profoundly. These findings may also imply that Hong Kong consumption may not be smooth. Consumption volatility in Hong Kong would further cast doubt on the permanent income hypothesis. This section provides a formal test on consumption volatility in Hong Kong.

A simple way to test the permanent income hypothesis is to follow Flavin (1981), Deaton (1987), and Campbell and Deaton (1989), who typically focus on the variance ratio

$$\psi = \sqrt{\left(\frac{Var(\Delta c_t)}{Var(\xi_t)} \right)} \tag{7}$$

ξ_t is the innovation parameter in permanent income, which in turn can be defined as

$$\xi_t \equiv y_t^p - E_{t-1} y_t^p \tag{8}$$

Permanent income y_t^p can be derived as

$$y_t^p \equiv \left(r/(1+r) \right) \left[w_t + \sum_{i=0}^{\infty} (1+r)^{-i} E_t y_{t+i} \right] \tag{9}$$

After some algebraic manipulation, ξ_t can be rewritten as

$$\xi_t \equiv r(1+r)^{-1} \sum_{i=0}^{\infty} (1+r)^{-i} \left(E_t y_{t+i} - E_{t-1} y_{t+i} \right) \tag{10}$$

From the permanent income hypothesis, Flavin (1981) and Deaton (1987) show that $\Delta c_t = \Delta y_t^p = \xi_t$ and hence $\psi = 1$. Most empirical studies for the US consumption data have found that $\psi < 1$, which has been interpreted as evidence that consumption is "excessively smooth." On the other hand, if $\psi > 1$, it would be evidence that consumption is volatile.

A large body of the literature attempting to test the permanent income hypothesis has concentrated on finding ways to estimate ξ_t consistently, since this task is far from being trivial. Various approaches have been proposed to estimate consistent $Var(\xi_t)$. One stream of the literature has focused on the simple ARMA format such as Flavin (1981), Deaton (1987), Blinder and Deaton (1985) and Diebold and Rudebusch (1991). This simple univariate ARMA approach specifies that the true innovation in labour income is measured by ε_t^y in the following ARMA model

$$\phi(L)\Delta y_t = \theta(L)\varepsilon_t^y \tag{11}$$

with $\varepsilon_t^y = \Delta y_t - E_{t-1}\Delta y_t$

The difference among these authors appears to be as how to generate ε_t^y, which in turn lies in the way as how y_t is transformed, that is, by detrending it as in Flavin (1981), or by taking a the first difference as in Deaton (1987), log difference as in Campbell and Deaton (1989), or using fractional integration as in Diebold and Rudebusch (1991).

This paper adopts the Campbell and Deaton (1989) approach for consumption, namely log-differencing, as in the previous models and ε_t^y is calculated using a simple AR(4) model as an estimator of ξ_t.[4] Moreover, the log-differencing takes care of concerns of nonstationarity frequently encountered in macroeconomic data, which are present in the Hong Kong data.[5] Also for simplicity, it is assumed that the discount factor is equal to 1. The values for ψ are estimated in Table 3 for four subsample periods based on empirical findings of Table 2.

The result generated from the sample period as a whole seems to indicate that there is excessive variability in consumption in Hong Kong, contrary to the US results. For the period before 1997, the value of ψ is estimated at 1.15, which is close to 1. The post-1997 (whether including or excluding the SARS period) results show that consumption was varying excessively in a range of 1.27 to 1.51. The variations in current private consumption expenditure are larger than those coming from the unexpected changes in labour income. In other words, a small unexpected change in income will foretell a relatively large change in current consumption. The volatility has increased

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[4] Other approaches looked at different ways to measure $Var(\xi_t)$, such as Gali (1991) who uses spectral density analysis. Flavin (1993) extended the framework by Deaton and Campbell (1989) using a VAR approach for both income and savings in order to explain the potential excess smoothness in US consumption.

[5] See Liu, Pauwels and Tsang (2007) for an updated test of stationarity in the Hong Kong data

significantly after 1997, possibly reflecting large swings in asset prices and greater insecurity about the employment conditions.

III. DOES WEALTH MATTER FOR HONG KONG CONSUMPTION?

Anticipated and unanticipated changes in income and wealth

If Hong Kong's consumption is less smooth than what has been found in other economies such as the United States, it is worthwhile to explore further how consumption responds to both anticipated and unanticipated changes in both income and wealth. To investigate this issue, we first follow a specification by Blinder and Deaton (1985) and then use an error correction approach. Consider the specification of Blinder and Deaton (1985):

$$\begin{aligned}\Delta c_t = {} & \alpha + \gamma c_{t-1} + \beta E_{t-1}[y_t] + \lambda^h E_{t-1}[w_t^h] + \lambda^f E_{t-1}[w_t^f] + \theta(y_t - E_{t-1}[y_t]) + \\ & \delta^f (w_t^f - E_{t-1}[w_t^f]) + \delta^h (w_t^h - E_{t-1}[w_t^h]) + \varepsilon_t\end{aligned} \tag{12}$$

where $(y_t - E_{t-1}[y_t])$ is unanticipated labour income, $(w_t^f - E_{t-1}[w_t^f])$ is the unanticipated financial wealth, and $(w_t^h - E_{t-1}[w_t^h])$ is the unanticipated housing wealth. As in Blinder and Deaton (1985), this equation represents the relationship between change in consumption and the unanticipated components of both labour income and wealth, as well as the anticipated components of income and wealth. Specifically, $E_{t-1}[y_t]$, $E_{t-1}[w_t^h]$, and $E_{t-1}[w_t^f]$ represent, respectively, anticipated income, anticipated housing wealth and anticipated financial wealth. This model, however, can also be written in the form of an error correction model:

$$\Delta c_t = \alpha + \gamma(c_{t-1} - \phi - \beta E_{t-1}[y_t] - \lambda E_{t-1}[w_t]) + \theta(y_t - E_{t-1}[y_t]) + \delta(w_t - E_{t-1}[w_t]) + \varepsilon_t \tag{13}$$

The error correction term is the long-run relationship between consumption and both expected future labour income $E_{t-1}[y_t]$ and expected future wealth ($E_{t-1}[w_t^h]$ and $E_{t-1}[w_t^f]$).[6] Expectations are formed based on all present and past information and represent the agent's view on the future path of her income and wealth. Following Blinder and Deaton (1985), we use a vector autoregression (VAR) to generate the expected income and wealth variables.

[6] Note that our wealth measure consists of both capital wealth, derived from stock prices and market capitalisation, and housing wealth, derived from housing prices and the stock of housing available.

$$
\begin{aligned}
y_t &= \alpha^y + \sum_{j=1}^{4} a_j^y L^j y_t + a_j^f L^j w_t^f + a_j^h L^j w_t^h + e_t^y \\
w_t^f &= \alpha^f + \sum_{j=1}^{4} b_j^y L^j y_t + b_j^f L^j w_t^f + b_j^h L^j w_t^h + e_t^f \\
w_t^h &= \alpha^h + \sum_{j=1}^{4} c_j^y L^j y_t + c_j^f L^j w_t^f + c_j^h L^j w_t^h + e_t^h
\end{aligned} \tag{14}
$$

All variables in the two-equation VAR system have 4 lags.[7] The fitted values generated from the above VAR system are treated as anticipated income, $\hat{y}_t$, and anticipated financial and housing wealth, $\hat{w}_t^f$ and $\hat{w}_t^h$, respectively. Furthermore, following the definitions by Blinder and Deaton (1985), e_t^y, e_t^f and e_t^h, defined as, $\left(y_t - E_{t-1}[y_t]\right)$, $\left(w_t^f - E_{t-1}[w_t^f]\right)$, and $\left(w_t^h - E_{t-1}[w_t^h]\right)$, are treated as unanticipated components of income, financial wealth, and housing wealth. The VAR results are not reported as they are not the main focus of the analysis and do not bring relevant information.

Once we have obtained the fitted values of income, the wealth components and the residual terms from the VAR system, Equation (12) is estimated using OLS. As the errors may be serially correlated, we report the Newey-West Heteroskedasticity and Autocorrelation Consistent (HAC) adjusted standard errors.[8]

Empirical Findings

Firstly, the analysis starts by testing for cointegration using the test proposed by Phillips and Ouliaris (1990) and Hansen (1990) on the generated error (Table 4) from the following equation.[9]

$$c_t = \phi_1 + \phi_2 \hat{y}_t + \phi_2 \hat{w}_t^f + \phi_3 \hat{w}_t^h + \nu_t \tag{15}$$

where the " ^" indicates anticipated variables. The cointegrating vector is estimated by regressing (15) using Stock and Watson (1993) DOLS as specified in equation (16). The cointegration tests are also conducted with the cointegration vector obtained by OLS. The cointegration test results featuring OLS and DOLS are rather consistent to each other: a rejection of the null indicates that there is a cointegrating relationship. As shown in table 4, there is no evidence in favour of cointegration over all sub-samples considered

[7] The number of lags is chosen on parsimonious ground covering 1 year. Changing the lag structure does not affect significantly the results presented here.

[8] This estimation strategy may suffer from the problem of generated regressors, as mentioned by Blinder and Deaton (1985) and Pagan (1984). Although Blinder and Deaton (1985) admits to this potential problem and recommend the use of TSLS, their treatment of the issue is not really explicit. Moreover, they do not talk about making error when approximating expectations.

[9] The critical values are also available from Hamilton (1994), table B.9..

except the post-1997 sample period at the 5% level of significance. The reader is invited to consult Liu, Pauwels and Tsang (2007) for further discussion on cointegration issues in modelling consumption in Hong Kong. As a result, the results from the cointegration approach should be read with caution.

Next, we turn to the regression results following the Blinder and Deaton specification, which are presented in Table 5(a). For the sample period as a whole (1984 Q1-2006 Q4), the anticipated labour income does not affect consumption growth much, while anticipated financial and housing wealth do affect consumption growth. On the other hand, all unanticipated changes in income and wealth affect consumption growth significantly. In addition, the unanticipated income changes account for a large variation in changes of consumption. On the unanticipated wealth effect, we find that the quantitative importance of housing wealth on consumption is larger than that of financial wealth. However, the reverse is true when looking at the anticipated components of these two variables.

The regression results obtained above seem to be sensitive to the choice of sample periods. For the sample period leading to the 1997-98 Asian financial crisis (1984 Q1 – 1997 Q2), we find that only anticipated income effect tends to affect change in consumption sizably and significantly, whereas anticipated financial and housing wealth do not appear to matter. With respect to unanticipated effects, only the unanticipated housing wealth has large positive effect on consumption growth.

On the other hand, the post-1997 results (1997 Q3 – 2003 Q1 and 1997 Q3 – 2006 Q4) show that both effects of anticipated and unanticipated labour income and wealth affect consumption strongly and significantly. In particular, the labour income effect seems to be quantitatively more important than its counterparts of financial and housing wealth. Different from the pre-1997 crisis period, the unanticipated housing wealth has no impact on consumption growth.

These rather different findings may be largely owing to severe external shocks the Hong Kong economy experienced after 1997. Prior to the 1997-98 Asian financial crisis, the Hong Kong economy grew rapidly and the unemployment rate was extremely low. Economic agents saw their income increase regularly and therefore could anticipate their future income path and plan their consumption accordingly. This is confirmed by a significant and large coefficient on anticipated labour income. When the Asian financial crisis struck, uncertainty suddenly increased as the unemployment rate shot up sharply. Surprises to labour income and wealth also become statistically significant while the anticipated labour income continues to be important in affecting consumption growth. Both anticipated housing and financial wealth effects become statistically significant and quantitatively large, perhaps reflecting severe swings of asset prices in Hong Kong.

To summarise, it appears that both anticipated income and unanticipated housing wealth effects have quantitatively significant impact on Hong Kong's consumption growth leading to the 1997 financial crisis. After that, it appears that both anticipated and unanticipated income and wealth effects, with the exception of unanticipated housing wealth effect, influence consumption growth significantly in Hong Kong. These findings offer some evidence from a difference perspective that the permanent income hypothesis may not hold for Hong Kong's consumption data especially for the sample period after 1997, as consumers tend to rely on current income (anticipated and unanticipated income) for their consumption choices.

In the second approach, the cointegration equation (15) is estimated first and then the error correction model is used to estimate changes in income and wealth on consumption. Following the Stock and Watson (1993) dynamic OLS (DOLS) approach to estimating the long-run cointegration equation, the error correction model can be re-written as follows:

$$c_t = \phi_0 + \phi_1 \hat{y}_t + \phi_2 \hat{w}_t^f + \phi_3 \hat{w}_t^h + \sum_{i=-1}^{1} \lambda_i^y \Delta \hat{y}_{t-i} + \sum_{i=-1}^{1} \lambda_i^f \Delta \hat{w}_{t-i}^f + \sum_{i=-1}^{1} \lambda_i^h \Delta \hat{w}_{t-i}^h + v_t \qquad (16)$$

The DOLS specification corrects for both endogeneity problems and serial correlation with the additions of lags and the leads term of the exogenous variables (see Hayashi, 2000, for a discussion). For the current case, the equation features the log-difference of the exogenous variables and one lead and one lag. The reason for the limited leads and lags is to minimise the small sample biases. The data span used for these models are relatively short and in addition, the sample period also needs to be subdivided into the pre- and post-financial crisis periods. The current specification with variables in log-difference and the lead and lag appears to be sufficient enough to tackle the potential endogeneity issue and potential moderate serial correlation.

From the DOLS cointegration equation results, the error correction term ($\hat{ect}_t$) is generated as

$$\hat{ect}_t = c_t - \hat{\phi}_0 - \hat{\phi}_1 \hat{y}_t - \hat{\phi}_2 \hat{w}_t^f - \hat{\phi}_3 \hat{w}_t^h \qquad (17)$$

Next $\hat{ect}_t$ is introduced in the following error correction model[10]

$$\Delta c_t = \alpha + \gamma \hat{ect}_{t-1} + \theta \hat{e}_t^y + \delta \hat{e}_t^f + \psi \hat{e}_t^h + \varepsilon_t \qquad (18)$$

[10] Typically, the short run dynamics in equation (18) should be changes of labour income and wealth in lags rather than the residuals obtained from the VAR system in equation (14).

Equation (18) specifies the relationship between growth rate of consumption and the unanticipated changes in labour income and wealth, as well as the long-run adjustment factor. The estimation results in Table 5(b) are somewhat different from those presented in Table 5(a). For the sample period as a whole (1984 Q1-2006 Q4), anticipated financial wealth and unanticipated income do not appear to affect consumption growth, whereas other variables in the specification do. For the post crisis period (1997 Q3 to 2006 Q4), it appears that both anticipated and unanticipated variables except for anticipated financial wealth and unanticipated housing wealth have positive impact on changes in consumption. For the sample period before 1997 Q3, consumption growth seems to be driven mostly by the unexpected housing wealth variable and anticipated income and housing wealth effect. Note also that the error correction term for the period extending from 1997 – 2006 is positive, which is contrary to the econometric properties of the model. As shown in Table 4, there is no overwhelming evidence to indicate that there exists a cointegration relationship among income, housing, and financial wealth. Therefore, the results obtained from the cointegration specification should be viewed with caution.

Reactions to temporary tax changes

Under the permanent income hypothesis, it is implied that consumers should not react to temporary income tax changes but they should react to permanent ones (Blinder and Deaton, 1985). As it is well documented, the Hong Kong government initiated many temporary tax cuts, especially in the period after the 1997-98 financial crisis period. It would be interesting to assess as to how Hong Kong's consumption would react to temporary tax changes. This section investigates this issue in depth.

The data on temporary tax changes are presented in Table 7 and these data are estimates from the annual Budget Speech from 1984 to 2006 and the details as to how these estimates are constructed are in Appendix. Following Blinder and Deaton (1985), "temporary" tax changes (S_t) are deflated into real numbers and are then divided by labour income (Y_t), also in real term. This ratio specification removes the volume effect generated by the underlying growing economy. The variable of temporary tax ratio is then introduced directly in Equation (13) for the Blinder and Deaton specification and Equation (18) for the error correction specification in order to see whether they have any influence on changes in consumption. What is different from equations (13) and (18) is that we also investigate temporary tax changes on disaggregate consumption series such as private consumption expenditure on food, services, durables, and non-durables, in addition to total private consumption expenditure.

The results are shown in Table 6(a) and 6(b). Overall, temporary tax cuts are statistically insignificant, but can be either positively or negatively related to consumption changes depending on the consumption series and on the model specifications. One exception is that it appears temporary tax cuts have a weakly significant, positive and quantitatively large effect on consumption of durables in the ECM framework. In addition, to account for the potential structural break occurred after 1997, we use a dummy variable for the post-1997 period in order to capture the negative effect of the Asian financial crisis to consumption. The dummy variable turns out to be mostly significant and negative as expected. The results of this exercise suggest that temporary tax cuts do not help stimulate consumption in a significant way. The lack of evidence supporting the PIH could imply that temporary tax changes would possibly alter consumption. However, the tax changes in Hong Kong's case may be too small in magnitude and too little in frequency to show any significant impact in the empirical study. Furthermore, it is possible that such changes may affect the consumption of low income groups. However, this effect may be lost when using aggregated consumption data across different income groups.

IV. CONCLUDING REMARKS

The major findings of the paper can be summarised as follows: First, while Hong Kong's consumption data before 1997 appear to provide empirical support for permanent income consumption, our tests for the overall sample period and the post 1997 period suggest that consumers base their consumption decisions on current income rather than permanent one. The severe shocks in the ensuing years of 1997 may have affected the consumption pattern. Secondly, we find that Hong Kong's consumption is volatile, relative to what has been found in the US, for example. The volatility of consumption increases for the post 1997 period. In fact, this result is consistent to the previous one, consistent with observations that current income is generally more volatile than permanent income. Thirdly, our investigation of anticipated and unanticipated income and wealth effect shows that both anticipated income and wealth effects tend to affect consumption. This is especially so for the period after 1997.[11] Finally, we find that temporary tax cuts have little impact on consumption. However, when adding the tax cut variable in the error correction model for consumption of durables, we find that it has a positive and quantitatively large effect on consumption of durables.

[11] It should be pointed out that our wealth measure could also have contributed to the effect as it is based on a simply aggregate that does not include household holding of foreign wealth. Therefore, there is a stronger home bias effect as the portfolio diversification effect is not allowed.

How does this study help us better specify the consumption function in our macroeconomic forecasting model? Two observations are in order: First, structural breaks occurred after 1997 appeared to have had important influences on Hong Kong's consumption behaviour. Before 1997, Hong Kong's consumption behaviour can be mostly explained by permanent income. The PIH, however, no longer holds after 1997. This finding implies that using the whole sample to conduct forecasts for private consumption expenditure may not lead to reliable forecasts. Maybe a shorter sample covering the post 1997 period may generate better consumption forecasts. Secondly, given the rapid recovery of Hong Kong's economy since 2003 Q2, it is also natural to ask whether Hong Kong's consumption behaviour has returned to the pattern of the pre-1997 era. This judgment will be important to help us predict consumption pattern and inflation dynamics in periods ahead.

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Appendix: Constructing the series of temporary tax changes

Two data series are used in the analysis of reactions of consumption changes to personal income tax changes, temporary tax changes (S_t) and implicit public housing rental subsidy (SUB_t).

The temporary tax changes refer mainly to those measures of temporary tax cuts or other tax relief measures. Before the outbreak of Asian financial crisis in 1997, there was no such kind of temporary tax cuts. These estimates are presented in Table 7. Note that waivers in public housing rent are also included in this temporary tax changes series. As all data are in nominal figures. We use the implied labour income deflator to deflate these nominal estimates.

Specifically, for the series of implicit public housing rental subsidies (SUB_t), it is estimated as follows: The total amount of the subsidy are multiplied by the difference between the market rent and the public housing rent ($RentMkt_t - RentPub_t$) by the average size of the public housing unit (assuming at 20 squared meters) ($Size$) and the number of household lived in public rental housing ($Household_t$).

$$SUB_t = (RentMkt_t - RentPub_t) * Size * Household_t \quad \text{(A.1)}$$

In addition, some estimates of tax changes and implicit public housing rental subsidies are annual figures. To obtain a quarterly series, each annual figure is divided by four and the resulting values are assigned to the corresponding quarters.

Table 1: PIH basic model and Campbell-Mankiw model

	PIH basic model		Campbell and Mankiw (1989)			
	α	λ	α	λ	(1-λ)σ	σ
			1984 Q1 - 2006 Q4			
1. OLS	0.007 **	0.31 *	0.01 ***	0.30 *	-0.001 **	-0.0014
	(1.96)	(1.68)	(2.91)	(1.70)	(-2.06)	
2. IV			0.01	0.50	-0.001 **	-0.0020
			(1.30)	(1.31)	(-2.10)	
			1984 Q1 - 1997 Q2			
1. OLS	0.015 ***	0.03	0.02 ***	0.04	-3E-04	-0.0003
	(5.30)	(0.22)	(5.27)	(0.31)	(-0.71)	
2. IV			0.01 ***	0.11	-0.001	-0.0011
			(2.75)	(0.35)	(-0.72)	
			1997 Q3 - 2003 Q1			
1. OLS	-0.007 **	0.88 ***	0.002	0.71 ***	0.001	0.003
	(-2.09)	(7.31)	(-1.43)	(2.61)	(0.88)	
2. IV			-0.02 *	0.32	0.002	0.003
			(-1.75)	(0.61)	(1.36)	
			1997 Q3 - 2006 Q4			
1. OLS	-0.001	0.72 ***	-0.002	0.70 ***	0.0002	0.001
	(-0.26)	(3.02)	(1.62)	(2.84)	(0.23)	
2. IV			-0.001	1.57 ***	-0.001	0.002
			(-0.16)	(2.98)	(-0.72)	

Notes: 1) All variables are in log. {*,**,***}=Statistical significance at {10,5,1} percent.
2) T-stats are in brackets. We use Newey-West robust standard errors (4 lags).
3) Instruments are 1 lag of each variable including the dependent variable and financial and housing wealth lagged one period.

Table 2: Bai and Perron (1998) results

	Number of breaks	Break dates
PIH basic model	2	1997 Q3 1998 Q4
Campbell and Mankiw (1989)	2	1997 Q3 2003 Q3

Table 3: Consumption smoothness

	ψ
1984 Q1 - 2006 Q4	1.27
1984 Q1 - 1997 Q2	1.15
1997 Q3 - 2003 Q1	1.52
1997 Q3 - 2006 Q4	1.51

Notes: If $\psi < 1$ implies consumption is "excessively smooth,"
if $\psi > 1$ consumption is rather volatile.

Table 4: Phillips-Ouliaris-Hansen test for cointegration

	ADF			ADF				ADF			
Variables	ρ	*k*	Stat	ρ	*k*	Stat		ρ	*k*	Stat	
	1984 Q1 - 2006 Q4			*1984 Q1 - 1997 Q2*				*1997 Q3 - 2006 Q4*			
OLS	0.72	2	-2.86	0.47	0	-3.88	*	0.08	0	-6.09	***
DOLS	0.73	2	-2.77	0.76	2	-1.9199		0.13	0	-6.32	***

Notes: 1) {*,**,***}=Statistical significance at {10,5,1} percent.
2) The standard errors are based on the asymptotic critical values, which are available in Hamilton (1994), table B.9.
3) No constant, no trend. The optimal lag is chosen using the Akaike Criterion.
4) The ADF model is: $\hat{u}_t = \rho \hat{u}_{t-1} + \sum_{p=1}^{k} \phi_i \Delta \hat{u}_{t-p} + \varepsilon_t$

Table 5 (a): Anticipated vs Unanticipated income (The Blinder and Deaton specification)

					Unanticipated						Anticipated					
	Const.		Lag Cons		Income		Financial W		Housing W		Income		Financial W		Housing W	
1984 Q1 - 2006 Q4	1.742	***	-0.284	***	0.200	*	0.039	***	0.096	***	0.061		0.040	***	0.026	***
t-stat	(6.612)		-(5.170)		(1.673)		(2.182)		(3.342)		(1.012)		(2.515)		(2.093)	
1984 Q1 - 1997 Q2	0.811		-0.330	***	-0.030		0.025		0.162	***	0.223	***	0.004		0.036	
t-stat	(1.218)		-(2.887)		-(0.246)		(1.312)		(3.980)		(2.698)		(0.235)		(1.529)	
1997 Q3 - 2003 Q1	-0.262		-1.079	***	0.986	***	0.101	***	0.072	***	0.897	***	0.033	***	0.152	***
t-stat	-(0.605)		-(7.152)		(7.019)		(4.086)		(2.773)		(5.827)		(2.537)		(5.899)	
1997 Q3 - 2006 Q4	3.200	***	-0.623	***	0.446	***	0.047	*	0.039		0.243	***	0.066	***	0.033	*
t-stat	(5.493)		-(5.075)		(2.309)		(1.679)		(1.170)		(2.465)		(4.266)		(1.675)	

Notes: 1) All variables are in log. {*,**,***}=Statistical significance at {10,5,1} percent.
2) T-stats are in brackets use the Newey-West Heteroskedasticity and Autocorrelation Consistent standard errors with 4 lags.

Table 5 (b): Anticipated vs Unanticipated income (The error correction specification)

	Error Correction Model										Cointegration Equation								
			Unanticipated										Anticipated						
	Const.		Income		Financial W		Housing W		ECT		Const.		Income		Financial W		Housing W		
1984 Q1 - 2006 Q4	0.120	***	0.182		0.046	**	0.064	**	-0.005	***	4.145	**	0.451	*	0.057		0.122		***
t-stat	(3.694)		(1.418)		(2.414)		(2.239)		-(3.323)		(2.379)		(1.914)		(0.633)		(4.605)		
1984 Q1 - 1997 Q2	0.158		0.038		0.021		0.146	***	-0.012		4.953	***	0.344	***	0.084		0.126		***
t-stat	(0.500)		(0.288)		(0.959)		(3.111)		-(0.449)		(4.226)		(2.259)		(1.437)		(3.765)		
1997 Q3 - 2003 Q1	-0.007		0.793	*	0.122	*	0.039		-0.003		2.968	**	0.761	***	-0.078	**	0.093		***
t-stat	-(0.319)		(1.687)		(1.833)		(0.608)		-(0.360)		(2.694)		(9.113)		-(2.260)		(4.601)		
1997 Q3 - 2006 Q4	-0.046		0.502	*	0.083	**	0.037		0.001		3.963	***	0.535	***	0.056		0.066		***
t-stat	-(0.334)		(1.709)		(2.043)		(0.548)		(0.367)		(3.305)		(3.935)		(1.224)		(3.201)		

Notes: 1) All variables are in log. {*,**,***}=Statistical significance at {10,5,1} percent.
2) In the cointegration equation, t-stats based on Stock and Watson (1993) adjusted standard errors for the long-run covariances.
3) In the ECM, t-stats in brackets use the Newey-West Heteroskedasticity and Autocorrelation Consistent standard errors with 4 lags.

Table 6 (a): Tax effect using the government estimates of additional tax revenue (The Blinder and Deaton specification)

			Unanticipated			Anticipated				
	Const.	Lag Cons	Income	Financial W	Housing W	Income	Financial W	Housing W	Tax cut	Dum97
Total PCE	1.915 ***	-0.411 ***	0.166	0.040 **	0.074 **	0.160 **	0.049 ***	0.030 ***	0.093	-0.022 **
	(6.739)	-(5.104)	(1.302)	(2.576)	(2.471)	(2.278)	(3.554)	(2.728)	(0.602)	-(2.083)
PCE - Food	1.539 ***	-0.331 ***	-0.135	0.005	0.027	0.098	0.063 ***	-0.023 ***	0.365	-0.043 ***
	(3.666)	-(4.614)	-(0.870)	(0.226)	(0.694)	(1.401)	(3.709)	-(3.249)	(1.012)	-(4.226)
PCE - Service	0.795 **	-0.202 ***	0.013	0.065 ***	0.027	0.101 *	0.030 **	-0.008 **	-0.063	-0.003
	(2.386)	-(2.919)	(0.087)	(5.540)	(0.982)	(1.846)	(2.320)	-(1.993)	-(0.358)	-(0.541)
PCE - Durables	0.195	-0.309 ***	0.257	0.067	0.133	0.091	0.128 **	-0.005	0.876	-0.099 **
	(0.182)	-(3.750)	(0.526)	(1.633)	(1.608)	(0.583)	(2.443)	-(0.168)	(1.400)	-(2.554)
PCE - Non durables	3.935 ***	-0.528 ***	0.474	0.021	0.194 ***	-0.084	0.106 ***	0.071 **	0.223	-0.103 ***
	(3.264)	-(3.189)	(1.376)	(0.675)	(2.964)	-(1.168)	(3.312)	(2.107)	(0.509)	-(3.093)

Notes: 1) All variables are in log. {*,**,***}=Statistical significance at {10,5,1} percent.
2) T-stats are in brackets use the Newey-West Heteroskedasticity and Autocorrelation Consistent standard errors with 4 lags.
3) Tax is a dummy variable recording the temporary tax cut as well as one increase in public housing subsidy.
4) Dum97 is a dummy that records the Asian financial crisis.

Table 6 (b): Tax effect using the government estimates of additional tax revenue (The error correction specification)

	Const.	Unanticipated Income	Financial W	Housing W	ECT	Tax cut	Dum97
Total PCE	0.016 ***	0.175	0.044 **	0.065 **	-0.150	-0.056	-0.010 ***
	(6.228)	(1.155)	(2.096)	(2.089)	-(1.370)	-(0.226)	-(2.871)
PCE - Food	0.013 ***	-0.051	0.005	0.064 *	-0.259 ***	0.117	-0.009
	(3.236)	-(0.270)	(0.179)	(1.677)	-(3.750)	(0.294)	-(1.624)
PCE - Service	0.012 ***	0.017	0.059 ***	0.033	-0.118 *	-0.045	-0.004
	(6.996)	(0.117)	(5.694)	(1.140)	-(1.848)	-(0.226)	-(1.339)
PCE - Durables	0.027 ***	0.277	0.070	0.172 **	-0.118	1.194 *	-0.027 **
	(2.933)	(0.469)	(1.262)	(2.370)	-(1.195)	(1.827)	-(2.046)
PCE - Non durables	0.023 ***	0.498	0.037	0.221 ***	-0.213 *	-0.127	-0.021 ***
	(3.082)	(1.309)	(0.955)	(2.804)	-(1.849)	-(0.206)	-(3.092)

Notes: 1) All variables are in log. {*,**,***}=Statistical significance at {10,5,1} percent.
2) In the ECM the t-stats in brackets use the Newey-West Heteroskedasticity and Autocorrelation Consistent standard errors with 4 lags.
3) Tax is a dummy variable recording the temporary tax cut as well as one increase in public housing subsidy.
4) Dum97 is a dummy that records the Asian financial crisis.

Table 7: Income shocks due to tax changes

Fiscal Year	Temporary tax changes Items	Income shock[1] (HK$ mn)
1998/1999	1) One year reduction in overall property rates from 5% to 4.5%. 2) Rebate the first quarter rates paid in 1998-99 (Handed out in 1998Q4).	5600
1999/2000	1) Rebate final individual assessments for profits tax, salaries tax and property tax by 10% the 1997-98 (by end of 1999Q1). 2) One-off concession of 50% of the property rates payable for the July to Sept quarter.	10300
2000/2001		
2001/2002	1) Waive rent for public rental housing in December 2001.	963
2002/2003	1) Reduce water and sewage charges. 2) Reduce the amount of property rates payable in 2002.	8900
2003/2004		
2004/2005		
2005/2006		
2006/2007		
2007/2008	1) Waive 50% of salaries tax and tax under personal assessment assessed for 2006-07, subject to a ceiling of $15,000. 2) Waive rates for first two quarters of 2007-08 fiscal year subject to a ceiling of $5000 per quarter for each rateable tenement. 3) Provide one additional month of standard rate CSSA payments and one additional month of allowance for SSA recipients. 4) Waive rent for public rental housing in February 2007.	15837

Note[1]: This is additional cost to government.