Quantitative analysis of wealth effects on private consumption expenditure in Hong Kong

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Abstract

This note, based on data from 1997Q2 to 2018Q4, uses econometric methods to estimate the magnitude of the wealth effects from property and equity markets in Hong Kong. Specifically, a 10% quarter-to-quarter increase in real property wealth at an aggregate level would lead to around a 1.1%-1.2% quarter-to-quarter boost in private consumption expenditure (PCE), whereas a 10% quarter-to-quarter increase in real stock market wealth would boost PCE by a smaller extent, by around 0.5%. These results are generally consistent with the findings from previous empirical studies for Hong Kong.

財富效應對香港私人消費開支的影響的定量分析

摘要

本文以 1997 年第二季至 2018 年第四季的數據,使用計量經濟學方法估算香港物業及股票市場財富效應的大小。具體而言,整體物業財富按季實質增長 10%,將為私人消費開支帶來按季約 1.1%-1.2% 的提振作用。而股票市場財富按季實質增長 10%,相關的提振作用會較小,約為 0.5%。這些結果與先前香港的實證研究所得結論大致吻合。

I.   INTRODUCTION

1.   Private Consumption Expenditure (PCE), which gauges the overall consumption spending of Hong Kong's residents in both domestic and foreign markets, is an integral component of final demand in Hong Kong (PCE averaged almost one-fourth of all final demand from 1997 to 2018). Given that PCE features prominently in Hong Kong's economy, it is important to quantitatively investigate the effect on PCE growth from changes of various macroeconomic factors, such as household wealth. This letter provides an up-to-date assessment of the wealth effects from property and stock markets on private consumption in Hong Kong after a brief literature review and a description of relevant data and methodology. The results in this letter are based on the framework established by prior internal research.

II.   LITERATURE REVIEW

2.   Following the theoretical underpinnings of the life cycle model[1] and related analysis, there have been a number of empirical studies on wealth effects in Hong Kong in the past two decades *(Table 1)*. Peng, Cheung and Leung (2000)[2] estimated wealth effects from changes in property and share prices using an ordinary least squares (OLS) approach and found a larger boosting effect on PCE from increases in property wealth than from equity wealth.   Possible reasons for this include perceptions that changes in equity wealth tend to be more temporary or subject to uncertainty, the additional value of property as a hedge against rent increases, or differences in the psychological "framing" of different types of assets and norms concerning how such assets should be used.[3] Lai and Lam (2002)[4] identified a cointegrating relationship between PCE, real disposable income and real property prices in Hong Kong, and hence adopted an error correction model (ECM). Yet, their

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[1]   The Life Cycle Model formulated by Ando and Modigliani in 1963 proposes a link between consumption and wealth. In this model, individuals determine their levels of consumption at each point in time to maximize their own satisfaction over the life cycle, subject to their lifetime budget constraints. Hence, consumption decisions are essentially influenced by expectations of wealth and income. Ando, A., and Modigliani, F. 1963. "The "life cycle" hypothesis of saving: Aggregate implications and tests." *The American Economic Review*, 53(1), 55-84. https://www.econ.nyu.edu/user/violante/NYUTeaching/MTA/Spring14/Readings/ando_aer.pdf

[2]   Peng, W., Cheung, L., and Leung, C. 2001. "The property market and the macro-economy." *HKMA Quarterly Bulletin*, May, 40-49.   https://www.hkma.gov.hk/media/eng/publication-and-research/quarterly-bulletin/qb200105/fa02.pdf

[3]   Case, K., Quigley, J. and Shiller, R. 2005. "Comparing wealth effects: the stock market versus the housing   market."   *Advances   in   Macroeconomics*   5(1),   article   1. http://www.econ.yale.edu/~shiller/pubs/p1181.pdf

[4]   Lai, K., & Lam, R. 2002.   "The nexus of consumer credit, household debt service and consumption." *HKMA Quarterly Bulletin*, November, 35-48. https://www.hkma.gov.hk/media/eng/publication-and-research/quarterly-bulletin/qb200211/fa2.pdf

paper did not include equity wealth as an explanatory variable. Culter (2005)[5] similarly found a stable cointegrating relationship between consumption, labour income and wealth in Hong Kong, and estimated likewise from an ECM that a 10% increase in housing wealth would raise PCE by 0.7-0.9%, versus 0.5-0.6% for the same increase in financial wealth. While these studies point to wealth effects on private consumption in Hong Kong, their estimates mostly cover the 1980s and 1990s. Given the huge economic transformation of Hong Kong's economy in the past several decades, it is useful to provide updated estimates of these wealth effects.

Table 1: Summary of selected empirical studies on wealth effects for Hong Kong

Authors	Affiliation	Data Type	Span	Estimation Strategy	Short-run estimates (% change in PCE given 10% change in wealth)	
					Property	Equity
Peng, Cheung and Leung (2001)	HKMA	Annual	1984-2000	OLS	1.0	0.24
Lai and Lam (2002)		Quarterly	1982Q1-2001Q4	ECM	1.5-1.7	Not available
Cutler (2005)	HKIMR		1985Q2-2000Q4		0.7-0.9	0.5-0.6

III.   DATA

3.   Having briefly reviewed empirical studies on wealth effects for Hong Kong, it is now time to describe the data. To begin with, because of the lack of data on total property and equity assets owned by domestic households, proxy indicators are compiled for these variables. Specifically, equity wealth is proxied by the Hang Seng Index (HSI) or the total market capitalisation of companies listed on the Hong Kong's main board[6], whilst property wealth is proxied by the price level of private domestic units[7] in Hong Kong or the product of the price level and stock of private domestic units. Wealth indicators aside, labour income as another major determinant of

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[5]   Cutler, J. 2005. "The relationship between consumption, income and wealth in Hong Kong." *Pacific Economic Review*, 10(2), 217-241.
http://www.hkimr.org/uploads/conference_detail/893/con_paper_0_67_joanne_cutler.pdf

[6]   The use of either the HSI or the Hong Kong Main Board's market capitalisation as a proxy of equity wealth produced very similar results. Data are sourced from the Hong Kong Exchanges and Clearing Limited (HKEX).

[7]   The Rating and Valuation Department (RVD) publishes statistics on a quarterly residential price index and the stock of private domestic units as of year-end. Linear interpolation is deployed to derive quarterly stock levels. The use of either the price level or the product of the price and stock levels of private domestic units in Hong Kong as a proxy of property wealth produced very similar results.

household consumption is also considered. In this letter, labour income is proxied by the product of payroll per person engaged and total employment, both of which are readily available from the Census and Statistics Department (C&SD).

4.   After acquiring the data, it is necessary to take a few steps to transform the data before conducting statistical analysis. First, as the 'real' relationship between consumption, income and wealth is of interest, nominal variables (i.e. property and equity assets) are deflated by consumer prices. Second, where appropriate, the Census X-12 package is used to eliminate seasonal effects to facilitate comparison between consecutive time periods.

5.   Next, it is also worthwhile to visualize the variables during the estimation period (1997Q2 to 2018Q4). *Chart 1* shows that PCE growth was particularly robust during economic upturns, usually when asset markets performed well and employment and earnings were favourable. By contrast, PCE usually declined following economic slumps, such as the outbreaks of the Asian Financial Crisis in 1998, SARS in 2003 and the Global Financial Tsunami in 2008, when asset prices and real labour income fell.
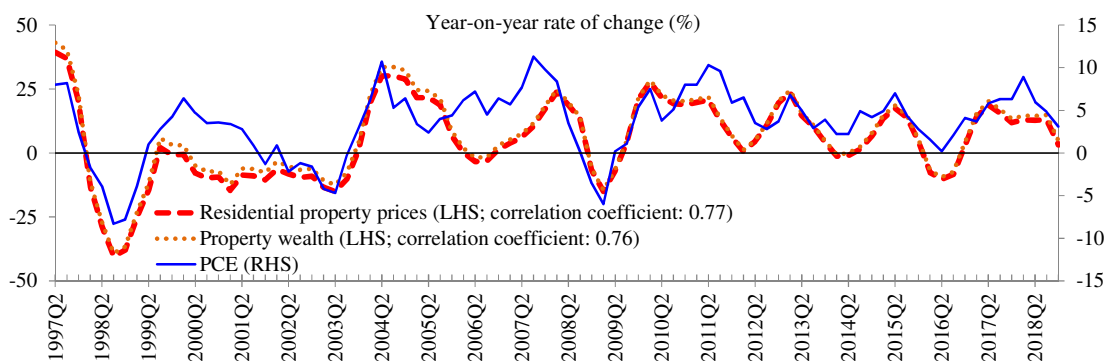
Chart 1: Plots of PCE with final demand in real terms
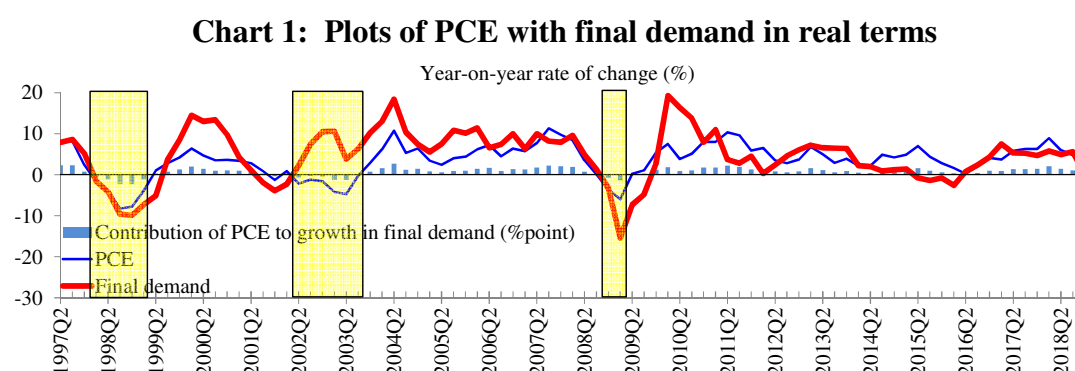
Source: C&SD.

6.   *Chart 2* displays the year-on-year real growth in PCE alongside that of each wealth and income proxy over the past two decades or so, showing that PCE growth was generally in line with that of property wealth, equity wealth and labour income. Correlation analysis also provides a quick measure of the strength and direction of association of each pair of variables. Judging from the correlation coefficients[8], all of which are statistically significant at the 1% level, PCE growth has a stronger positive correlation with the growth of residential property prices (+0.77) and the HSI (+0.61) than with that of labour income (+0.48).
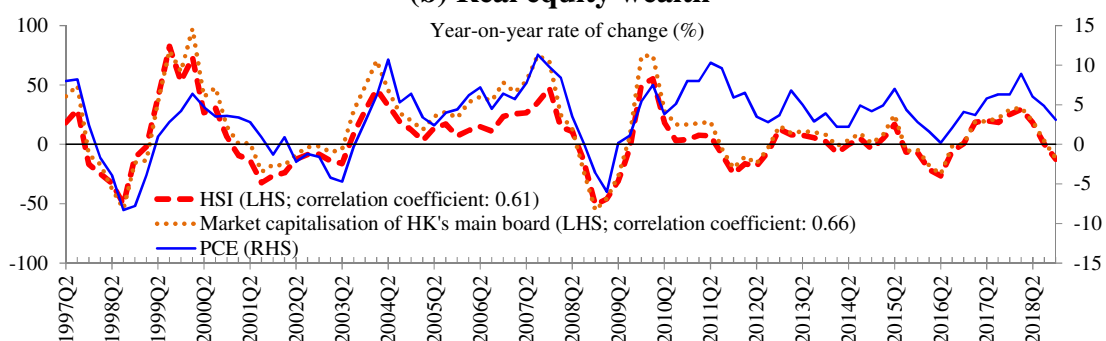
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[8]   A correlation coefficient ranges from -1 to +1. "+1" indicates the strongest positive correlation possible, and -1 indicates the strongest negative correlation possible; "0" indicates no correlation.

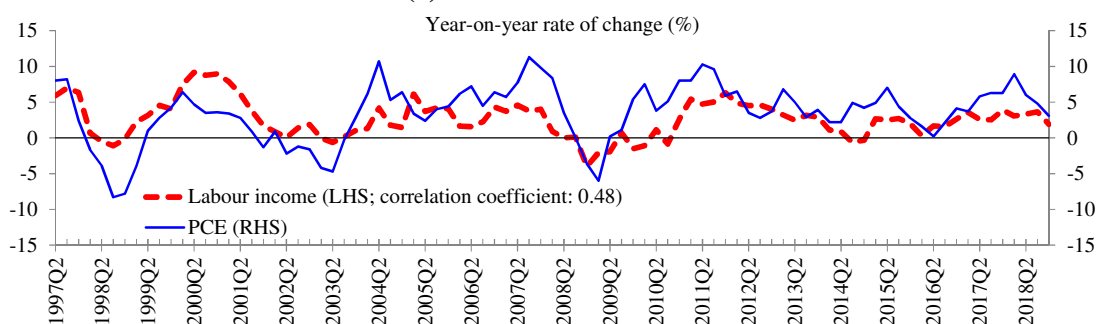**Chart 2: Plots of PCE with key explanatory variables in real terms**
(a) Real property wealth

Year-on-year rate of change (%)

- Residential property prices (LHS; correlation coefficient: 0.77)
- Property wealth (LHS; correlation coefficient: 0.76)
- PCE (RHS)

(b) Real equity wealth

Year-on-year rate of change (%)

- HSI (LHS; correlation coefficient: 0.61)
- Market capitalisation of HK's main board (LHS; correlation coefficient: 0.66)
- PCE (RHS)

(c) Real labour income

Year-on-year rate of change (%)

- Labour income (LHS; correlation coefficient: 0.48)
- PCE (RHS)

Sources: C&SD; RVD; HKEX.

IV.   METHODOLOGY

7.   While the correlation analysis above has demonstrated a close association between the growth of PCE and asset values over the past two decades or so, the links between private consumption and the explanatory variables can be quantified more rigorously with econometric models. The model for estimating the wealth effects is constructed based on the key elements of the life cycle model as follows:

$$\ln(pce_t) = b_0 + b_1 * \ln(pw_t) + b_2 * \ln(ew_t) + b_3 * \ln(lbinc_{t-1}) + e_t \quad (\textbf{Equation 1})$$

All variables are quarterly and in real terms. The dependent variable on the left is PCE, a measure of the overall consumption spending of Hong Kong's residents. The

explanatory variables on the right are property wealth (pw_t), equity wealth (ew_t) and labour income ($lbinc_{t-1}$).

8.   As a first step toward building an ECM model, a first-differenced OLS model[9] is estimated. **Equation 1** is transformed as

$$\Delta pce_t = B_1 * \Delta pw_t + B_2 * \Delta ew_t + B_3 * \Delta lbinc_{t-1} + v_t \quad \textbf{(Model 1)}$$

where the Δ operator denotes a log quarterly first difference (e.g., $\Delta pce_t = \ln(pce_t) - \ln(pce_{t-1})$). The first differences thus represent quarter-to-quarter percentage changes.

9.   As for the second model, the Engle-Granger (1987)[10] two-step ECM approach is used. This requires a cointegrating relationship between PCE, wealth and labour income, i.e. the existence of a relationship between these variables that pulls the system in disequilibrium back to its long-run equilibrium. The null hypothesis of no cointegrating relationship is rejected at at least a 5% significance level[11]. An advantage of the ECM over **Model 1** is that the ECM introduces an error correction term which is basically the last period's deviation from the long-run equilibrium ($e_{t-1} = \ln(pce_{t-1}) - b_0 - b_1 * \ln(pw_{t-1}) - b_2 * \ln(ew_{t-1}) - b_3 * \ln(lbinc_{t-2})$); its coefficient ($B_4$) captures the speed of adjustment back to the equilibrium. For gradual convergence to a stable equilibrium, this coefficient should be negative and lie between 0 and 1. Further, its magnitude provides information on the speed of adjustment: the greater the magnitude, the faster this occurs. In the Engle-Granger two-step ECM approach, the first step is to estimate **Equation 1** by OLS and to obtain the predicted residuals $e_t\hat{}$. Then, the predicted residuals, lagged by one quarter ($\hat{e}_{t-1}$), are introduced as an error correction term to create **Model 2**:

$$\Delta pce_t = B_0{}' + B_1{}' * \Delta pw_t + B_2{}' * \Delta ew_t + B_3{}' * \Delta lbinc_{t-1} + B_4{}' * \hat{e}_{t-1} + z_t \quad \textbf{(Model 2)}$$

V.   RESULTS

10.   Estimation results from **Models 1 and 2** are shown in *Table 2*. The coefficients on property wealth and equity wealth are positive and statistically significant at the 1% level, indicating the existence of wealth effects from property and the stock market. The coefficient on property wealth was larger than that on

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[9]   A first-differenced OLS model can be thought of as a special case of an ECM that captures short-run effects of the explanatory variables but not any reversion to a long-run equilibrium.

[10]   Engle, R. and Granger, C. 1987. "Cointegration and error correction: representation, estimation and testing." *Econometrica*, 55(2), 251-276.

[11]   The Engle-Granger cointegration test is essentially the unit root test applied to the residual of a cointegrating regression. Please refer to MacKinnon (2010) for the critical values. MacKinnon, J. 2010. "Critical values for cointegration tests." Working Paper 1227, Department of Economics, Queen's University.

equity wealth, suggesting a larger effect of property wealth over equity wealth. As for **Model 1,** the coefficient on property wealth (0.111 or 0.113) implies that a 10% quarter-to-quarter increase in real property wealth at an aggregate level would lead to a 1.1% quarter-to-quarter boost in PCE in Hong Kong. Meanwhile, the coefficient on stock market wealth (0.049 or 0.051) suggests that a 10% quarter-to-quarter increase in stock market wealth would increase PCE by around 0.5%. Separately, the positive coefficient on the labour income with 1-quarter lag (0.299 or 0.354) implies that a 10% quarter-to-quarter increase in labour income in the current quarter would increase PCE by around 3.0%-3.5% in the next quarter. The Durbin-Watson statistics are close to 2 for both models, indicating that the issue of positive autocorrelation has been alleviated after first-differencing.

11.   For **Model 2**, the Engle-Granger cointegration test results suggest that the null hypothesis of no cointegrating relationship between PCE, wealth and labour income is rejected at at least a 5% significance level. The negative coefficient (-0.133 or -0.137) on the error correction term suggests that any disequilibrium in the short run would be adjusted gradually towards the long-run equilibrium, and that the system corrects roughly 13%-14% of the disequilibrium in the current quarter within the next quarter. Compared with **Model 1**, **Model 2** suggests a slightly larger short-run wealth effect from the property market, whereas the wealth effect from the stock market is broadly similar. A 10% quarter-to-quarter increase in real property wealth at an aggregate level would lead to a 1.2% boost in PCE in Hong Kong. A 10% quarter-to-quarter increase in real stock market wealth would increase PCE by around 0.5%.

12.   The above findings are comparable to other published studies using similar estimation strategies in the sense that they also found wealth effects from these two types of assets in Hong Kong. Similar to Peng, Cheung and Leung (2001) and Cutler (2005), the above estimation results indicate a somewhat larger wealth effect from property wealth than equity wealth. In essence, the above estimates on property wealth are within the range of estimates from these published studies, while those on equity wealth are also broadly comparable to the estimates in Cutler (2005).

Table 2: Estimation results

Dependent variable: PCE

Model	1	2
Estimation method	OLS in first differences	ECM
Independent variables		
Property wealth *(proxied by residential property prices)*	**0.111*****	**0.120*****
Equity wealth *(proxied by the HSI)*	**0.049*****	**0.052*****
Labour income, lagged 1 quarter	**0.354*****	**0.205***
Error correction term	**----**	**-0.137****
Sample period	**1997Q2: 2018Q4**	
Adjusted R-squared	**0.31**	**0.46**
Durbin-Watson statistic	**2.00**	**2.17**

Dependent variable: PCE

Model	1	2
Estimation method	OLS in first differences	ECM
Independent variables		
Property wealth *(proxied by product of the price and stock levels of private domestic units in Hong Kong)*	**0.113*****	**0.120*****
Equity wealth *(proxied by the Hong Kong Main Board's market capitalisation)*	**0.051*****	**0.047*****
Labour income, lagged 1 quarter	**0.299*****	**0.191***
Error correction term	**----**	**-0.133****
Sample period	**1997Q2: 2018Q4**	
Adjusted R-squared	**0.37**	**0.47**
Durbin-Watson statistic	**2.17**	**2.23**

Notes: All variables are in real terms and in logarithmic form.

*** , ** and * denote statistical significance at the 1%, 5% and 10% significance levels respectively.

VI. LIMITATIONS

13. On the whole, the quantitative analysis above offers simple estimates of the wealth effects from property and equity assets on PCE in Hong Kong, subject to a number of limitations. First, it has to be noted that the wealth proxies do not necessarily reflect the actual change in overall wealth owned by local households in Hong Kong. For instance, local households could invest in alternative assets (e.g. foreign currency), the value of which may not be directly related to Hong Kong's property and equity assets. Alternatively, if there is a change in the proportion of property and equity assets owned by local households and non-local investors, the growth in wealth owned by local households may deviate from that indicated by the wealth proxies. Second, these simple econometric models have not taken into account the possible dynamic interaction between PCE and wealth. As such, while the findings above may be useful for reference, the estimation results should be interpreted with caution.

VII. CONCLUDING REMARKS

14. Over the past two decades or so, PCE has exhibited a positive correlation with household wealth in terms of both property and equity assets, as well as with labour income. This note, based on data from 1997Q2 to 2018Q4, uses econometric methods to estimate the magnitude of the wealth effects from property and equity markets in Hong Kong. Specifically, a 10% quarter-to-quarter increase in real property wealth at an aggregate level would lead to around a 1.1%-1.2% boost in PCE, whereas a 10% increase in stock market wealth would boost PCE by a smaller extent, by around 0.5%. These results are generally consistent with the findings from previous empirical studies for Hong Kong.