

DOES THE PERMANENT INCOME HYPOTHESIS EXIST IN 10 ASIAN COUNTRIES?

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Introduction

Hall [18] changed the direction of research on consumption by hypothesizing that consumers are rational and forward-looking, and base their current spending behavior on their expectation of future income, during their entire career. He examined U.S. macroeconomic time series data, and found that regression of consumption on current income is not significant, but consumption based on expected future income is significant. This is consistent with the permanent income hypothesis/life cycle hypothesis (PIH/LCH). However, researchers examining data from other countries have found that consumption levels are strongly affected by current incomes, and this is a contradiction to the expectations of the PIH/LCH (e.g. [10], [16]).

Most of the literature discussing problems with the PIH/LCH has focused on liquidity constraints (e.g. [14], [19], [23], [24], [36], [5], [6], [7], and [11]). Liquidity constraint in economic theory is a form of imperfection in the capital market. It causes difficulties for models based on intertemporal consumption. Many economic models require individuals to save or borrow money from time to time. A liquidity constraint is an arbitrary limit on the amount an individual can borrow, or an arbitrary alteration in the interest rate they pay. By raising the costs of borrowing, they prevent individuals from fully optimizing their behavior over time. Actually existing liquidity constraints are mainly due to risk-based behavior by lenders such as banks. Liquidity constraints prevent consumers from adopting consumption strategies based on their permanent income, and forces them to consume based on their current level of income.

Other issues have also been discussed. In [17], [36], [21], [34], and [1] have noted the problem of aggregation bias when using macroeconomic data. Caballero [4] and Carroll [8] pointed out the phenomenon of precautionary saving and its effect on spending. Baxter and Jermann [2] noted that home production and consumption have an

inverse relationship with marketplace production and consumption. And, Flavin ([14], [15]) and Shea [35] noted that myopia is one of the characteristics of consumers. All of these factors are potential constraints which may cause a consumer's spending to be limited by their current income. These studies focus on liquidity constraints, and attempts to assess whether liquidity constraints affect the behavior of consumers.

There have been two main approaches to determining the proportion of liquidity-constrained consumers in an economy. The first is the Euler equation approach. This approach, which was proposed by [18], is based on the estimation of the intertemporal first-order condition for the optimal choice of a fully forward-looking representative consumer. The second is the error-correction model approach which was popularized by [10] and [20].

The studies of [10] and [20] were the first to measure liquidity constraints using an error correction model (ECM). In addition, Madsen and McAleer [29] re-examines the liquidity constraint hypothesis against the uncertainty and the behavioural life-cycle hypotheses using macropanel data for 22 OECD (The Organization for Economic Cooperation and Development) countries. The empirical results provide very strong support for the uncertainty and the behavioural life-cycle (BLC) hypotheses and no support for the liquidity constraint hypothesis. More recently, Ref. [16] used a unit root test, cointegration test, and a single-equation error-correction methodology to test whether liquidity constraints exist in ten different Asian countries. However, time series data analysis of an individual country may not account for the relationship of consumption behavior between countries, and likely causes inefficient estimation results. Therefore, this study uses the panel unit root test, panel cointegration test, and panel-type error correction model to test the liquidity constraint, in order to improve the estimate of a single country, by accounting for the interactive relationships of consumption behavior between

countries. In addition, this study will test the strength of liquidity constraints of ten Asian countries during the 1997 Asian financial crisis.

The ten Asian developing countries included in the study are Indonesia, Malaysia, Myanmar, Nepal, Philippines, Singapore, South Korea, Sri Lanka, Taiwan and Thailand. The model is used to test each country using annual data from 1950 to 2006. The empirical results show that liquidity constraints exist in all ten Asian countries; and therefore, the PIH/LCH is not upheld. The results also show that the strength of liquidity constraints in our sample countries increases after the 1997 Asian financial crisis.

The roadmap for the remainder of this paper is as follows. Section 1 provides a brief discussion of the theoretical structure and empirical procedure of the study. Section 2 presents and reviews the empirical results. Finally, Section 3 summarizes the conclusions.

1. Theoretical Structure and Empirical Procedure

1.1 Theoretical Structure

According to the PIH/LCH, the utility function of a rational consumer pursuing the greatest utility over their lifetime is as follows:

$$\text{Max } E_t \sum_{j=0}^{\infty} \left(\frac{1}{1+\delta} \right)^j U(C_{t+j}) \quad (1)$$

where E_t is the conditional expectation; C_t is actual consumption at time t ; δ is the rate of subjective time preference (>0). $U(C_t)$ is the utility function at time t . Assuming constant relative risk-aversion (CRRA), $U(C_t) = C_t^{1-\alpha} / (1-\alpha)$, $\alpha > 0$, $U' > 0$, $U'' < 0$. Consumers attempting to maximize their lifetime utility face the following budget constraints:

$$A_{t+j+1} = (1+r_{t+j})(A_{t+j} + Y_{t+j} - C_{t+j}) \quad (2)$$

A_t is real assets at time t ; r_t is the real interest rate; and Y_t is real income. According to equations (1) and (2), consumption will be effected by the current income and past income, and then the empirical model for this research can be established.

1.2 Empirical Procedure

Our empirical analyses of panel data consist of the following four steps. First, we test for a pa-

nel unit root. Second, we test for cointegration among panel data employing the panel cointegration test developed by [30], [32], [25]; and a Fisher-type test using an underlying Johansen methodology [28]. Third, the long-run equilibrium relationship is estimated using the fully modified ordinary least squares (FMOLS) technique for heterogeneous cointegrated panels [31]. Finally, once the panel cointegration is established, we establish a panel-type ECM to further test whether the PIH / LCH is valid.

1.2.1 The Panel Unit Root Test

In [26] (LLC), initiated research on the panel unit root with heterogeneous dynamics, fixed effects, and an individual-specific determinant trend. However, they assumed the presence of a homogeneous autoregressive root under the alternative. More recently, in [22] (IPS) proposed a between-group panel unit root test that permits heterogeneity of the autoregressive root under the alternative. Yet, Breitung [3] (UB) found that a loss of power resulted from the bias correction terms in LLC and a detrending bias in IPS. Hence, Maddala and Wu [28] and Choi [9] suggested that the same kinds of panel unit root tests be performed using a Fisher statistic. However, the null of all unit root tests is having a unit root in a series, but there is a confusing alternative, which is stationarity in LLC and UB test, and there are also some cross sections without a unit root based on the IPS test, as well as the Fisher-ADF (Augmented Dickey Fuller) and Fisher-PP (Phillips-Perron) tests. With this in mind, we conducted the LLC and UB tests which assumed a common unit root process; meanwhile, the assumptions of individual unit root processes in the IPS test were found to match the Fisher-type tests, which used the ADF and PP tests.

The tests were computed using the Bartlett kernel. Besides this, the LLC, UB, IPS, Fisher-ADF and Fisher-PP tests examine the null hypothesis of non-stationarity. The Fisher tests were computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

1.2.2 The panel cointegration tests

The extensive interest in and the availability of panel data has led to an emphasis on extending various statistical tests to panel data. Recent li-

terature has focused on tests of cointegration in a panel setting. We use the following types of panel cointegration tests: [30], [32], [25] and a Fisher-type test using an underlying Johansen methodology [28]. The Pedroni and Kao tests are based on Engle-Granger [12] two-step (residual-based) cointegration tests. The Fisher test is a combined Johansen test.

The Engle-Granger [12] cointegration test is based on an examination of the residuals of a spurious regression performed using $I(1)$ variables. If the variables are cointegrated then the residuals should be $I(0)$. On the other hand if the variables are not cointegrated then the residuals will be $I(1)$. These studies of [30], [32], and [25] extend the Engle-Granger framework to tests involving panel data. Pedroni proposes several tests for cointegration that allow for heterogeneous intercepts and trend coefficients across cross-sections. The test of [25] follows the same basic approach as the Pedroni tests, but specifies cross-section specific intercepts and homogeneous coefficients, on the first-stage regressors. Fisher [13] derives a combined test that uses the results of the individual independent tests. Maddala and Wu [28] use Fisher's results to propose an alternative approach to testing for cointegration in panel data, by combining tests from individual cross-sections to obtain a test statistic for the full panel. Overall, ten testing methods of the [30] cointegration test were used: the panel ν -statistic, the panel ρ -statistic, the panel PP-statistic, and the panel ADF-statistic, the group ρ -statistic, the group PP-statistic, and the group ADF-statistic. The Kao cointegration test and Johansen Fisher panel cointegration test: *max-eigenvalue* and *trace* were also used.

In the presence of unit root variables, the effect of super-consistency may not dominate the endogenous effect of the regressors if OLS is employed. Pedroni [31] showed how the FMOLS approach can be modified to draw an inference of being cointegrated with the heterogeneous dynamics. In the FMOLS setting, non-parametric techniques are explored to transform the residuals of the cointegration regression, in order to get rid of nuisance parameters. Here, the traditional panel data cannot resolve the probability of there being problems of endogeneity among the independent variables. Furthermore, the nonstationary data also cannot be analyzed using the traditional panel data approach [33].

1.2.3 Panel-Based ECM Model

When panel cointegration exists, the panel-based ECM model shown below can be used:

$$\Delta c_{it} = \alpha_i + \lambda_i \Delta y_{it} + \sum_{j=1}^p \beta_{ij} \Delta y_{it-j} + \sum_{j=1}^q \phi_{ij} \Delta c_{it-j} + \delta_i \text{ecm}_{it-1} + \varepsilon_{it} \quad (3)$$

The error-correction term ecm_{it-1} can be considered as $(c_{it} - \alpha_i - \delta_i t - \beta_i y_{it})$, where c_{it} is real private consumption per capita to measure household consumption, y_{it} is real income per capita to measure disposable income, and income is GDP, in equation (3), if δ_i is significant and negative, this indicates that consumers adjust consumption in response to short-term changes in income, as well as to previous disequilibria $(c_{it} - \alpha_i - \delta_i t - \beta_i y_{it})$, which can be interpreted as a feedback response to obtain a desired long-run condition. The parameter λ_i is then used to measure the fraction of consumers who are liquidity-constrained (according to the Euler equation in [16]). When λ_i is significantly different from zero, this implies a liquidity constraint exists in country i , and that the PIH / LCH is not upheld.

1.2.4 Analysis of Effect of 1997 Asian Financial Crisis

In this section, analysis is made of consumption behavior following the Asian financial crisis, which placed huge liquidity restraints on Asian countries. The hypothesis is that consumption will be lower, due to tighter liquidity. In order to test this hypothesis, equation (3) is modified as follows:

$$\Delta c_{it} = \begin{cases} \alpha_{1i} + \lambda_{1i} \Delta y_{it} + \sum_{j=1}^p \beta_{1ij} \Delta y_{it-j} + \sum_{j=1}^q \phi_{1ij} \Delta c_{it-j} + \delta_{1i} \text{ecm}_{it-1} + \varepsilon_{1it} & \text{if } t < 1997 \\ \alpha_{2i} + \lambda_{2i} \Delta y_{it} + \sum_{j=1}^p \beta_{2ij} \Delta y_{it-j} + \sum_{j=1}^q \phi_{2ij} \Delta c_{it-j} + \delta_{2i} \text{ecm}_{it-1} + \varepsilon_{2it} & \text{if } t \geq 1997 \end{cases} \quad (4)$$

According to equation (4), the size of λ_{1i} is compared with λ_{2i} , in order to analyze the effect of the Asian financial crisis on liquidity constraints in the ten Asian countries. Thus, if a financial crisis reduces consumption, we would expect to see an increase in the point estimate of λ_i in the second sub-sample period.

2. Empirical Evidence

2.1 Data Sources

The ten developing Asian countries included in the study are Indonesia, Malaysia, Myanmar, Nepal, Philippines, Singapore, South Korea, Sri Lanka, Taiwan and Thailand. The model uses annual data from each country, from 1950 to 2006. All nominal variables are deflated using the Consumer Price Index (CPI) or GDP deflator. Data was collected from various issues of International Financial Statistics published by the International Monetary Fund (IMF). All variables were transformed into logarithms.

2.2 Empirical Results

Table 1 presents the results of the panel unit root tests. At the 1% significance level, the five kinds of statistics provide strong evidence in support of the two series (c_{it} and y_{it}) having a unit root; only a statistics reject the null of non-statio-

narity in the Fisher-PP test. These tests also show that all of the variables follow an I(1) process. These results were used to test for cointegration to determine if there is a long-run relationship of equilibrium among these two variables, in order to control for the econometric specifications.

In order to inspect the theories related to the contribution of y_{it} to c_{it} over the long-run, cointegration tests were performed for the panel using [30], [32], and [25] procedures. Table 2 contains the results from the panel cointegration tests in which the dependent variables are the measures of c_{it} with y_{it} . Except for the Panel v, Panel ρ , Panel ADF, and Group ρ statistics, the other statistics significantly reject the null of no cointegration. Thus, it can be seen that c_{it} and y_{it} move together over the long-run. The next step consists of the long-run equations which are estimated using the FMOLS estimation technique for heterogeneous cointegrated panels.

Table 3 provides the results of the country-by-country and panel FMOLS tests where the dependent variable is c_{it} . The panel estimator with

Tab. 1: Results for Panel Unit Root Tests

	c_{it}	y_{it}
Levels		
LLC	1.773	0.839
UB	0.950	0.455
IPS	4.316	4.045
Fisher-ADF	21.49	6.782
Fisher-PP	17.65	39.98***
First difference		
LLC	-38.91***	-10.43***
UB	-10.60***	-7.697***
IPS	-26.48***	-17.01***
Fisher-ADF	230.4***	233.4***
Fisher-PP	249.6***	259.4***

Notes: LLC, UB and IPS represent the panel unit root tests of [29][26], [30][22], and [31][3], respectively. Fisher-ADF and Fisher-PP represent the Maddala and Wu [27][28] Fisher-ADF and Fisher-PP panel unit root tests, respectively. *** indicates significance at the 1% level. Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Source: own

Tab. 2: Results for Panel Cointegration Tests

Test statistics	Statistics
Panel v -Statistic	1.415
Panel ρ -Statistic	-0.572
Panel PP-Statistic	-3.113***
Panel ADF-Statistic	-1.461
Group ρ -Statistic	-0.836
Group PP-Statistic	-4.167***
Group ADF-Statistic	2.017*
Kao Cointegration Test	-3.176***
Johansen Fisher Panel Cointegration Test- trace Statistic	36.12**
Johansen Fisher Panel Cointegration Test- max-eigenvalue Statistic	36.49**

Notes: The statistics are asymptotically distributed as normal in [24][30]. The variance ratio test is right-sided, while the others are left-sided. In Johansen Fisher Panel Cointegration Test, trace and max-eigenvalue test are according to the p -value of [36][27]. ***, **, and * denote the rejection of the null of no cointegration at the 1, 5%, and 10% levels, respectively.

Source: own

common time dummies of 0.715 for y_{it} is shown at the bottom of Table 3. All of the coefficients of y_{it} are statistically significant at the 1% level, and the effect is positive. Implicit here is that a 1% in-

crease in real income leads to a 0.715% increase in real consumption in our sample of Asian economies. On a per country basis, y_{it} has a significantly positive impact on c_{it} in all our sample countries. It

Tab. 3: Fully Modified Ols Estimates

Country groupings	y_{it}	t-values
Indonesia	0.804	(11.59)***
Malaysia	0.633	(5.581)***
Myanmar	0.745	(7.503)***
Nepal	0.696	(6.173)***
Philippines	0.718	(7.060)***
Singapore	0.667	(6.469)***
South Korea	0.798	(11.99)***
Sri Lanka	0.732	(7.475)***
Taiwan	0.756	(9.053)***
Thailand	0.714	(7.443)***
Panel	0.715	(7.825)***

Notes: t-values are in parentheses. *** indicate statistical significance at the 1% level.

Source: own

is evident that larger increases in incomes tend to raise the consumption from country-specific aggregate demand shocks. As shown in Table 3, in all ten countries, the coefficients of y_{it} are positive and statistically significant. The smallest value is 0.633 in Malaysia, and the largest is 0.804 in Indonesia. To conclude, the country-by-country and panel cointegration test results clearly indicate that c_{it} and y_{it} are cointegrated in all ten of the Asian economies that were investigated.

As the two variables are cointegrated, the panel-based error correction model can be used to test whether liquidity constrains consumption. When the panel-based ECM is estimated, an instrument variable estimator must be used because of the correlation between the error term and the lagged dependent variables in the dynamic panel data model. After careful examination, we found that it was necessary to satisfy the classical assumptions on the error term when the lag length is 1 ($k = 1$), and so 2 and 3 periods were used as instruments for the lagged dependent variables.

Turning now to the results of the error-correction model, the variables of interest are the significance of Δy_{it} and the ecm_{it-1} term. In all cases, both Δy_{it} and ecm_{it-1} are significantly different from zero at the 1% level, as shown in Table 4. The ecm_{it-1} variable correctly is negative, and this provides supporting evidence for the presence of liquidity constraints for each country investigated [16].

The next important question is: did λ_i change during the 1997 crises? If the financial crisis caused liquidity constraints in financial markets to be progressively raised, then estimating Equation (4) for successive time periods should tend to indicate a rise in the λ_i parameter. In this study, we estimate separate λ_i equations for different time periods. We have divided the time period into two sub-sample periods of 1950–1996 and 1997–2006 for our tests. In all ten of the Asian countries in this study, the Asian financial crisis

caused a decrease in incomes and an increase in liquidity constraints.

Table 4 shows the results from estimating Equation (4) for the two sub-sample periods. The results from the error-correction model suggest that the estimates of Δy_{it} are significantly different from zero in all ten Asian countries investigated. In fact the parameters of λ_i are statistically significant at the 5% level in both sub-time periods. The ecm_{it-1} term, is only negative and significantly different from zero and in the 1950–1996 period, and the ecm_{it-1} term correctly is negative, implying that consumption and income are strongly cointegrated; however, this phenomenon is not present in the 2006–2007 period. This provides support for the presence of liquidity constraints in the ten Asian developing countries studied. As for the size of the estimates of λ_i , it has increased after the 1997 Asian financial crisis. This implies that the crisis caused great shock waves in Asian financial markets and reduced the wealth of governments, businesses, and households. The weakness in financial intermediaries and financial instruments, along with deterioration in the money supply and capital markets will lead to the formation of an inefficient financial system. And as a result, one important implication of the financial crisis was that it raised liquidity constraints. This indicates that consumers could not adjust consumption in response to short-run structural changes in income, as well as to previous disequilibria; and this can't be interpreted as a response to long-run condition and thus, the PIH/LCH, is not upheld in these countries.

Conclusions

Panel analysis provides more information, degrees of freedom, and estimation efficiency; to reduce the multi-collinear and measurement error. Therefore, this study used the panel unit root test, panel cointegration test, and panel-based

Tab. 4: Testing for Liquidity Constraints

Variable	Full sample 1950–2006	Sub-sample periods 1950–1996	Sub-sample periods 1997–2006
Δy_{it}	0.699 (24.76)***	0.690 (22.54)***	0.737 (9.319)***
ecm_{it-1}	-0.018 (-2.457)**	-0.021 (-2.434)**	-0.007 (-0.423)

Notes: t-Values are in parentheses. ecm_{it-1} is the error-correction term. ** and *** indicate statistical significance at the 5% and 1% level, respectively.

Source: own

ECM model to test whether liquidity constraints are present in ten Asian countries. The results of the cointegration test show that consumption and current income are strongly co integrated. On the other hand, the results of the panel-based ECM model reveals that liquidity constraints are present in the ten Asian countries, and therefore the PIH/LCH, is not upheld in these countries. In addition, the results show that the size of liquidity constraints increased after the Asian financial crisis. The likely explanation of this is that households were not able to smooth their consumption relative to their permanent income through short-term borrowing, as liquidity is tighter and borrowing constraints are stronger. Therefore the financial crisis resulted in consumption levels that are more sensitive to current income levels, and this provides further support against the case for the PIH/LCH, in these countries.

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Doručeno redakci: 5. 11. 2009

Recenzováno: 30. 12. 2009, 13. 1. 2010

Schváleno k publikováni: 20. 9. 2011

APPENDIX A. Abbreviations Illustration

ADF	Augmented Dickey Fuller
BLC	Behavioral Life-Cycle
CPI	Consumer Price Index
CRRA	Constant Relative Risk-Aversion
ECM	Error Correction Model
FMOLS	Fully Modified Ordinary Least Squares
GDP	Gross Domestic Product
IMF	International Monetary Fund
IPS (2003)	Im et al. (2003)
LLC (2002)	Levin et al. (2002)
OECD	The Organization for Economic Cooperation and Development
PIH/LCH	Permanent Income Hypothesis / Life Cycle Hypothesis
PP	Phillips-Perron
UB	Breitung (2000)

ABSTRACT**DOES THE PERMANENT INCOME HYPOTHESIS EXIST IN 10 ASIAN COUNTRIES?****Kuan-Min Wang**

This paper applies a recent advance in panel analysis to estimate the panel cointegration and panel-type error correction model for a set of ten Asian countries using annual data covering the period 1950–2006. The study investigates whether the permanent income hypothesis holds true in the ten Asian countries; and whether liquidity constraints affect consumer spending. Our empirical analyses of panel data consist of the following four steps. First, we test for a panel unit root. Second, we test for cointegration among panel data employing the panel cointegration test; and a Fisher-type test using an underlying Johansen methodology. Third, the long-run equilibrium relationship is estimated using the fully modified ordinary least squares technique for heterogeneous cointegrated panels. Finally, once the panel cointegration is established, we establish a panel-type error correction model to further test whether the permanent income hypothesis/life cycle hypothesis is valid. The empirical results show that consumption and current income are strongly cointegrated, liquidity constraints exist in all ten Asian countries, and this implies that the permanent income hypothesis is not upheld. In addition, the effect of the 1997 Asian financial crisis on the size of liquidity constraints is investigated, and the results show that liquidity constraints increased after the Asian financial crisis. The likely explanation of this is that households were not able to smooth their consumption relative to their permanent income through short-term borrowing, as liquidity is tighter and borrowing constraints are stronger. Therefore the financial crisis resulted in consumption levels that are more sensitive to current income levels, and this provides further support against the case for the permanent income hypothesis/life cycle hypothesis, in these countries.

Key Words: permanent income hypothesis, liquidity constraint, panel cointegration, panel-type ECM.

JEL Classification: C23, E21.