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MODELLING PRIVATE CONSUMPTION IN CHINA FROM 1987 TO 2012

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ABSTRACT

This study estimates the consumption function of China by applying the Absolute Income Hypothesis and the Permanent income Hypothesis. The study applies Autoregressive Distributed Lag model and co-integration analysis to estimate the consumption function in China, in utilizing a time series dataset from 1987 to 2012. The results of this study reveal that in the long run current income and wealth are statistically significant, whereas variables such as unemployment and interest rates are not significant vis-à-vis private consumption. However, in the short run all of the regressors are statistically significant and hence have an impact on real private consumption. The [-0.095] value of Error Correction Mechanism (-1) that maintains a negative sign and significant with certain level of significance, shows the speed of adjustment of private consumption that turns into a state of equilibrium in next period from disequilibria.

Keywords: Absolute Income Hypothesis, Permanent Income Hypothesis, Private Consumption, China

INTRODUCTION

The relationship between disposable income and consumption is a key component of Macroeconomics literature. For the first time Jon Maynard Keynes who is the founder of Keynesian economics, introduced the systematic relationship between consumption and disposable income that subsequently provides a very strong based for other theoretical and empirical studies carried out on consumption function. Keynes treated the relationship between consumption and disposable income in an ordinary sense and assigned a specific name, Psychological Law of Consumption, to this relationship. However, once Kuznets (1940) underlines certain empirical limitations in Keynes's Psychological Law of Consumption, it opened a window of opportunity for other key economists to introduce their own respective Consumption theories to deal with the Kuznets's empirical puzzle. For example, Duesenberry (1948) comes with his theory of Relative Income Hypothesis (RIH) that argues that income is the function of relative income. Similarly, Modigliani and Brumbergh (1954) introduce the famous Cycle Income Hypothesis theory of consumption. According to Cycle Income Hypothesis (CIH) the household's consumption is the function of lifetime expected income.

Among these consumption hypotheses the most prominent theory is the Permanent Income Hypothesis (PIH) that was proposed by Friedman (1957). The Permanent Income Hypothesis affirms affirms that the household response to the consumption

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on permanent income instead of relative or current income. However, the Permanent Income Hypothesis and Cycle Income Hypothesis have much resemblance to each other, as they reach to the same conclusion and are also derived from the same mathematical model. Hence, the majority of economists treat both the hypotheses with similar theoretical preposition. Therefore, to the economics literature the theory is understood as the Life Cycle Permanent Income Hypothesis (LCPIH).

Looking into the composition of Chinese Gross Domestic Product (GDP), one would realize that Aggregate consumption is one of the major parts of China's GDP. Thereby a curiosity always exists among the researchers and policy makers to understand and analysis the dynamics, pattern and nature of private consumption in China. Aggregate demand is a major component of economy that not only maintains the economic growth but equally it is an important source of generating more employment. As it is commonly known, the private consumption plays a key role in boosting up the aggregate demand along with the aggregate saving, which is the counterpart of aggregate consumption. Therefore, while understanding the aggregate consumption will also help in understanding the saving. Aggregate savings go to investment that help in capital accumulation and accelerate economic growth in the country.

RIH presented by Duesenberry (1948) postulates that households respond only to the relative income. Modigliani and Brumbergh (1954) introduce a new theory of consumption i.e. LCH stating that the income of a household is distributed among different phases of household life i.e. childhood, teenage, working age and life after retirement. Only in the working age phase household maintains a positive saving. Thus through saving the household tries to smooth is consumption. According to Friedman (1957) household's consumption is the function of permanent income where Permanent Income is the worth of allowance of household lifelong income and possessions. Hall (1978) applies rational expectation to the Permanent Income Hypothesis and draws a conclusion that consumption follows a Random Walk. Davidson et al. (1978) estimates the aggregate consumption function for the UK by using the error correction model. This study sat the trend for other researchers to investigate the consumption function with non-stationary time series data. Fakhraii and Mansuori (2008), with the help of the Autoregressive Distributed Lag (ARDL) approach, estimate the long run as well as short run consumption function for Iran. They conclude that there is significant link between variables that are including in the model and consumption theory. Khan et al. (2014) use annual data from 1971 to 2013 to estimate the real private consumption model for Pakistan in applying the Autoregressive Distributed Lag (ARDL) model. They show that only in the long run labor income and wealth have significant effect on real private consumption while in the short run current income; wealth unemployment and real interest rate have a strong and positive impact on the private consumption.

Caglayan (2012) studies house hold consumption expenditure in which he uses disposable income, education age, wealth and money supply as independent variables. He finds that national disposable is positively significant with household consumption expenditure.

Kazmi (2015) shows the relationship between consumption, wealth income, rate of interest and unemployment rate, using an ARDL model. The paper illustrates that both the wealth variable and unemployment are significant in determining long run

consumption growth. Furthermore, the paper presents that the parsimonious short run model has the potential to provide reliable consumption forecasts in the medium term.

Zafar and Islam's (2015) provides a time series analysis of aggregate consumption function for Pakistan by using a quarterly data from year 1973(1)-2010(4). The results of their study show that in Pakistan current consumption is a good predictor of future consumption, where 86% of the income has been consumed in the long run while rest is the saving. Their work further demonstrates that Inflation is unanticipated but not accelerating.

Lawson (2013) examines the use of what are known as random assignment schemes as a way to model household expenditure. This approach is based on the idea of predicting the behavioural response of a microsimulation unit by finding a donor, which is in some sense similar to the receiving unit.

A careful search of relevant literature reveals that a sizable research has carried out on consumption modeling using many countries and societies as case studies particularly the developed countries. However, the review of the existing literature shows that no any systematic research is conducted on private consumption behaviour in China.

The remainder of the paper is presented as follows. Second section presents and describes methodology, while third section discusses the results and discussions. Fourth section presents the conclusion.

METHODOLOGY

According to AIH PIH and LCH consumption is the function of households' income and wealth. Given these consumption hypotheses, model may be specified represent the consumption function of China.

$$C_t \quad f(Y_t, W_t, X) \tag{1}$$

Where, (C) is private consumption, (Y) is GDP and (W) stands for wealth in a given period while (X) is the vector of all short run determinists.

In order to estimate the Chinese consumption function we applied the Autoregressive Distributed Lag model of co-integration and estimate the short as well the long run consumption function. We apply Autoregressive Distributed Lag approach instead of other co-integration approaches that include Engle-Granger (1987), Johansen (1988) and Johansen-Juselius (1990), simply because the Autoregressive Distributed Lag co-integration analysis has some advantages over other co-integration methods of being more robust and consistent.

Moreover, the Autoregressive Distributed Lag approach derives both the long as well as the short run coefficients of this model at once. Compare to other co-integration models the Autoregressive Distributed Lag incorporates more variables into the final specification. Pattichis (1999) and Mah (2000) postulate that in a case of small samples, when the sample size is between 30 to 80 observations, the Autoregressive Distributed Lag approach is more robust than any other co-integration technique. In addition to this the Autoregressive Distributed Lag technique is applicable on data in spite of the order of integration. It shows if the the variables are integrated of order one or zero, or the variables are integrated with order – zero and one. In data generating process the

Autoregressive Distributed Lag approach takes adequate numbers of lags and considers general to specific modeling framework to obtain the optimal lag length. For this purpose the Autoregressive Distributed Lag model estimates $_kp)1($ regressions. P is the number of maximum lags. Likewise, K is the numbers of variables in the model.

For the model selection we used SBC, RBC, AIC and HQC criteria. Thus, keeping in view all of the advantages, as pointed out above, of ARDL model over other co-integration methods, it is plausible to chose the ARDL in order to empirically test the long and the short run consumption function in China. The ARDL model for equation (1) is specified as under:

$$\Delta \log C_t = \alpha_0 + \sum_{i=0}^{j} \alpha_{1i} \Delta \log Y_{t-i} + \sum_{i=0}^{j} \alpha_{2i} \Delta \log W_{t-i} + \sum_{i=0}^{j} \alpha_{3i} \Delta \log C_{t-i} + \sum_{i=0}^{j} \alpha_{4i} r_{t-i} + \sum_{i=0}^{j} \alpha_{5i} ur_{t-i} + \gamma_1 \log Y_{t-1} + \gamma_2 \log W_{t-1} + \gamma_3 \log C_{t-1} + \gamma_4 r_{t-1} + \gamma_5 ur_{t-1} + u_t \quad (2)$$

The coefficients of short run, which contain the short run information are:

$_{iiii}4321,,,$ and $_{i5}$ while the coefficients of long run, which contain the long run information are: $H_0 = \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$

The null and alternative hypotheses for co-integration are as under:

$$H_1 = \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0$$

To test these hypotheses of co-integration we applied bounds test of Pesaran et al. (2001). The critical statistical values recommended by Pesaran et al. (2001) are based upon two sets, one assume that all of variables are integrated of order zero (I (0)) while the second test assumes that the included variables are Integrated with the order of one (I(1)). Considering these parameters we make decision about co-integration on the basis of following guide lines:

When the Calculated ($_cF$) F-statistics is greater, when comparing it with the upper critical statistical values, we tend to reject the null hypothesis. However, when the is less than the lower critical statistical value, we cannot reject the null hypothesis against the alternative hypothesis of the co-integration. However, when falls between upper and lower critical values we end up with the inconclusive results. Once the co-integration appears among variables in the model, then obviously we can estimate the long run relationship of the variables. For the purpose we use the following model:

$$\Delta \log C_t = \alpha_0 + \sum_{i=0}^{j} \alpha_{1i} \Delta \log Y_{t-i} + \sum_{i=0}^{j} \alpha_{2i} \Delta \log W_{t-i} + \sum_{i=0}^{j} \alpha_{3i} \Delta \log C_{t-i} + \sum_{i=0}^{j} \alpha_{4i} r_{t-i} + \sum_{i=0}^{j} \alpha_{5i} ur_{t-i} + u_t \quad (3)$$

To estimate the Error Correction Mechanism (ECM) factor we estimate the following equation:

$$\Delta \log C_t = \alpha + \lambda_1 \log Y_{t-1} + \lambda_2 \log W_{t-1} + \lambda_3 \log C_{t-1} + \lambda_5 \log r_{t-1} + \lambda_5 ur_{t-1} + \phi ECM + \mu_t \quad (4)$$

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2.1. Data And Variables

This study extracts an annual dataset of the period 1985 to 2013. The variables that are used are included Real Private Consumption, Labor Income, Wealth and Unemployment Rate and Interest Rate. For Private Consumption we use a proxy of Nominal Private Consumption and obtain its real values by deflating with the Consumer Price Index (CPI). The Real Private Consumption consists of the consumption of durables and nondurable goods. GDP is used a proxy for labour income, as we know that GDP is strongly correlated with labor income. We deflate the nominal GDP with GDP deflator in order to obtain the real GDP. For the sake of capturing the effect of income uncertainties a proxy of unemployment is incorporated in this model. To control the impact of interest rate we use a proxy of discount rate. But to get the real values we correct it with inflation rate (using both GDP deflator and CPI).

2. RESULTS AND DISCUSSIONS

2.1. Unit Root Test

It is important to mention that before applying the ARDL model to co-integration analysis we check the order of stationary for variables to ensure that all of the variables are integration of I(0) or I(1) or mixed of both. Because in case of the presence of variable(s) that are integrated of order two, we cannot apply the ARDL approach to get co integrated analysis.

Table 1 offers the results of Augmented Dickey Fuller (ADF), Phillip-Perron (PP) test, which give us the idea that CON, GDP and Ur are stationary at I (1). The Unit Root Test result, shown in table 1, real that the LOGW is stationary at I(0) with and Ur is stationary at I(1). Only in the case of R, ADF and PP test give us different result , according ADF, R is stationary at I(0) while according to PP, R stationary at I(1).

Table 1: Unit Root Tests of ADF and PP

	ADF		PP	
Variables	**Intercept**	**Intercept and trend**	**Intercept**	**Intercept and Trend**
Log Con	-2.1443(0.2302)	-1.4616 (0.8157)	-2.1443 (0.2302)	-1.4961 (0.8157)
log Con	-3.8766 (0.0073)	-4.2865 (0.0126)	-38737 (0.0073)	-4.2865 (0.0126)
GDP	4.9299 (0.9999)	-0.0077 (0.9937)	5.1817 (0.9999)	-0.0044 (0.9937)
GDP	-2.5476 (0.1174)	-4.4058 (0.0098)	-2.4305 (0.1444)	-4.4051 (0.0098)
Log W	-3.4580 (0.0187)	-2.9991 (0.1554)	-2.4580 (0.0187)	-2.3734 (0.3827)
Ur	-0.3234 (0.9079)	-2.6998 (0.2448)	-0.0455 (0.9453)	-2.7996 (0.2102)
Ur	-3.8502 (0.0077)	-3.6646 (0.0451)	-3.4406 (0.0194)	-3.2031 (0.1073)
R	-4.037 (0.0050)	-4.0772 (0.0195)	-2.5740 (0.1114)	-3.0140 (0.1482)
r	-4.8702 (0.0007)	-4.9132 (0.0032)	-4.8653 (0.0007)	-4.5232 (0.0089)

The results of Dickey Fuller Generalized Least Square (DF-GLS) are presented in table 2. The results verify that CON, GDP, LOGW and UR are stationary at I (1) while, R is stationary at level.

Table 2: Unit root test of DF- GLS

Variables	**DF-GLS**	
	Intercept	**Intercept and Trend**
Log Con	-0.02323	-1.3642
log Con	-3.9631***	-4.4699***
GDP	-0.3865	-1.2142
GDP	-2.4703**	-4.5302***
Log W	0.9155	0.0085
log W	-3.1006***	-3.9498***
Ur	0.1673	-2.8727
Ur	-3.9630***	-3.7874***
R	-2.6972***	-4.3463***

Table 3 presents the results of Ng Perron Test, which show that CON is stationary at I (1) whereas GDP and R are stationary at level. Similarly, the results in table 3 present that LOGW and UR are stationary at I(1).

Table 3: Unit Root Test of Ng Perron Test

Variables	**MZa**	**MZt**	**MSB**	**MPT**
Log Con with c	-0.1592	-0.08723	0.5475	20.7805
Log Con with c & t	-2.3741	-0.9936	-0.4185	34.2702
log Con with c	-11.5803	-2.3862	0.2060	2.1921
log Con with c & t	-8.69022	-2.0765	0.2389	10.5118
GDP with c	-560.262	-16.6905	0.02979	0.08091
GDP with c and t	-5.75242	-1.45893	0.25362	15.3475
Log W with c	0.9736	0.8871	0.9111	58.2925
Log W with c & t	-4.8074	-1.4687	0.3055	18.4410

log W with c	-9.8151	-2.2075	0.2248	2.52600
log W with c & t	-10.5389	-2.2953	0.2178	8.6474
Ur with c	1.3076	0.7416	0.5672	28.1555
Ur with c & t	-9.8583	-2.1394	0.2170	9.5788
Ur with c	-11.7444	-1.9309	0.1644	3.7778
Ur with c & t	-11.9048	-2.0976	0.1762	9.2884
R with c	-8.9195	-2.1050	0.2360	2.7720
r with c & t	-20.0592	-3.1643	0.1577	4.5585
90 % CL with c & t	-14.2000	-2.62000	0.18500	6.67000
95 % CL with c & t	-17.3000	-2.91000	0.16800	5.48000
99 % CL with c & t	-23.8000	-3.42000	0.14300	4.03000
90 % CL with c	-5.70000	-1.62000	0.27500	4.45000
95 % CL with c	-8.10000	-1.98000	0.23300	3.17000
99 % CL with c	3.8000	-2.58000	0.17400	1.78000

Where: c for constant, c & t for constant and trend and CL is confidence level

Table 4 shows that all variables are cointegrated of either I (1) or 1 (0). Hence, it clearly shows that we can apply the ARDL to co-integration model.

Table 4: Orders of Integration

Variables	ADF	PP	DF-GLS	NG - Perron
Con	I(1)	I(1)	I(1)	I(1)
GDP	I(1)	I(1)	I(1)	I(1)
Wealth	I(0)	I(0)	I(1)	I(1)
Ur	I(1)	I(1)	I(1)	I(1)
R	I(0)	I(1)	I(0)	I(0)

2.1. Co-integration for ARDL Approach

To test and check the co-integration among the included variables the study applies Bound test of Pesaran and Pesaran (1997), and the results of this test are presented in table 5. As shown in the table, the calculated value of F-test (cF) is equal to 23.7851 that is greater than the value of upper bound at the significance level of 10%, 5 % and 1 %, respectively. This therefore reveals that that there is long run association among the included variables of the model.

Table 5: Bound Critical Values for Co-integration among Variables

F statistics calculated	The level of Significance	Bound Critical Values	
23.7851		I(0)	I(1)
	10 %	2.67	3.58
	5%	3.27	4.30
	1%	4.61	5.96

Table 6 presents the results that are obtained using the ARDL model of co-integration. The results show that all of the variables that are included in the model appear to be statistically significant except of the lag of the unemployment variable. For the estimation of the model and choosing the lag length of the variables, we use both SBC and AIC criteria a for lag section SBC and AIC respectively. Moreover, the model qualifies all of the standard diagnostic tests except functional form. The results of diagnostic test are presented in table 7.

Table -6: ARDL (1, 0, 1, 1, 0)

ARDL (1,0,1,1,0): selected based on SBC			ARDL (1,0,1,1,1): selected based AIC	
Variables	Coefficients	P- Values	Coefficients	P- Values
Log Con(-1)	0.9049	0.000	0.9191	0.000
GDP	-.2043	0.381	-0.1907	0.401
Log W	0.8617	0.000	0.8313	0.000
Log W(-1)	-0.7525	0.000	-0.7446	0.000
Ur	-0.05018	0.109	-0.0797	0.040
Ur (-1)			0.0557	0.178
R	-0.00888	0.000	-0.0092	0.000
R (-1)	0.00568	0.009		

Table 7: Diagnostic test

Name of Diagnostic test	CHSQ	P- Values
Residual Serial Correlation Test using Lagrange Multiplier	2.5298	0.112
Ramsey's RESET Test of Functional Form	3.6602	0.056
Jarque-Bere , Normality test	0.6119	0.736
Based on the regression of squared residuals on squared fitted values	3.1049	0.078

Table 8 portrays the coefficients of the model, reported for long run, showing that the coefficients of GDP, wealth are significant in the long run, while the coefficients of unemployment rate and interest rate are insignificant. The coefficients of GDP and wealth report that 1% increase in the GDP follows by an increase of the private consumption by 0.62% on average. Similarly 1 percent increase in wealth leads to add to private consumption by 0.52 percent. Looking at the results in table 8 we observe that the coefficients of Gross Domestic Product and wealth are close to each other in the long run. It therefore reveals that in the long run the households have the ability to predict their future income. In addition to this, it also important to underline that, the liberalization of financial market in China is helped households in transferring their future income to present consumption through the relaxation of the liquidity constraint.

Table 8: Long Run Results of ARDL

	ARDL (1,0,1,1,0) : selected based on SBC		ARDL (1,0,1,1,1) : selected based AIC	
Variables	**Coefficients**	**P- Values**	**Coefficients**	**P- Values**
GDP	-0.214	0.245	-0.235	0.225
Wealth	1.1484	0.000	1.0717	0.000
Ur	-0.5277	0.174	-0.0468	0.109
R	-0.0336	0.115	-0.2969	0.494

The empirically results from Error Correction Mechanism (ECM) using ARDL approach are presented in table 9. The results show that the coefficient of ECM which is considered by adjustment parameter is [-0.0951]. It shows that the speed of variables from the disequilibrium to the equilibrium in next period.

Table 9: Error Correction Mechanism (ecm) Of Ardl Approach

	ARDL (1,0,1,1,0) : selected based on SBC		ARDL (1,0,1,1,1): selected based AIC	
Variables	Coefficients	P- Values	Coefficients	P- Values
GDP	-0.204	0.380	-0.197	0.400

W	0.8617	0.000	0.8313	0.000
Ur	-0.0501	0.107	-0.0797	0.039
r	-0.00888	0.000	-0.00924	0.000
Ecm (-1)	-0.0951	0.027	-0.8080	0.057
ARDL (1,0,1,1,0) selected based on SBC			ARDL (1,0,1,1,1) selected based AIC	
R - Squared	0.9168		R - Squared	0.9255
SE of regression	0.0395		S.E of regression	0.0385
DW	2.2902		DW	2.229
AIC	42.36		AIC	42.730
SBC	38.09		SBC	37.863
F- Sata.	49.63 (0.000)		F- Sata.	52.82 (0.000)

It is interesting to mention that the model meets the criteria of normal diagnostic tests. For the stability test of the model, Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares Recursive Residuals (CUSUMSQ) are used. In figures 1 and 2 the graphs of CUSUM and CUSUMSQ respectively are plotted. Both of the graphs lie within the statistically critical bounds of 5%. It confirms the structural stability of the model.

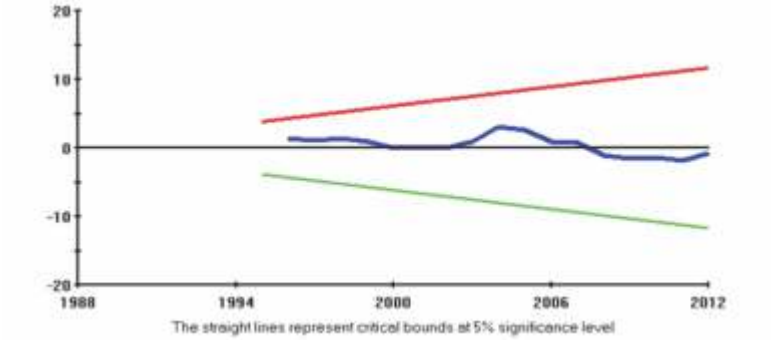

Figure 1: Plot of Cumulative Sum of Recursive Residuals

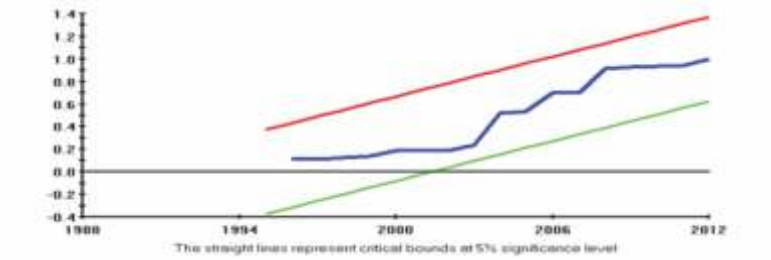

Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals

CONCLUSION

This study is designed to estimate the consumption function of Chinese society in light of two key and traditional consumption models, the AIH and the PIH. The used the ARDL model of co-integration to estimate the long run and short run relationship of the variables of real private consumption and income, wealth, unemployment rate and interest rate. It is interesting to note that the empirical results of this paper show positive,

stable and significant relationship among real private consumption, income and wealth in both long and short run. However, the unemployment and interest rate have negative effect of private consumption but statistically insignificant in long run and significant in the short run.

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