Testing the Permanent Income Hypothesis in the Developing and Developed Countries: A Comparison between Fiji and Australia*

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Abstract

Hall (1978) has stimulated considerable controversy and empirical work on testing the permanent income hypothesis (PIH). Much of the empirical work is on the developed countries where opportunities for inter-temporal substitution are generally higher than in the developing countries. Therefore, it is expected that PIH would be valid for only a smaller proportion of consumers in the developing countries. This paper uses the extended framework of Campbell and Mankiw (1989) to estimate the proportion of consumers for whom PIH is valid in Fiji and Australia. Our results show that PIH consumers are about 40% higher in Australia than in Fiji.

JEL: E0, E41, E52;

KEYWORDS: Consumption function, Developing countries, Permanent income hypothesis, Halls random walk hypothesis, Campbell-Mankiw tests.

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1 Introduction

Consumption expenditure is the largest component of output and the marginal propensity to consume (MPC) determines the size of the multiplier and the dynamic effects of shocks to the economy. If the multiplier is large, fluctuations in economic activity would be large. While the Keynesian absolute income hypothesis of consumption (AIH) implies a large MPC and multiplier, theories based on the inter-temporal utility maximization hypothesis, such as the permanent income hypothesis (PIH) of Friedman (1958) and the life-cycle hypothesis (LCH) of Modigliani and Brumberg (1954) imply that MPC and multiplier will be much smaller. Furthermore, the validity of the Ricardian equivalence theory (RET) also depends on the validity of PIH and LCH. Therefore, it is important to understand the relative importance of these consumption theories. Although PIH and LCH share a similar optimization model and conclusions, PIH is more popular in empirical works.

Hall has revived interest in testing these rival consumption theories with Hall (1978), in which he has argued that if expectations are rational, current consumption is the best predictor of future consumption. Therefore, the change in consumption is a random walk. Subsequently, there has been considerable interest in testing Hall's random walk hypothesis. In this paper we shall utilize an important extension of Campbell and Mankiw (1989) in which the AIH and PIH are nested and the proportions of consumers adhering to these theories can be estimated.

Since much of the existing empirical work on this controversy has used data from the developed countries, it would be useful to test with data from the developing countries. It is reasonable to expect that the proportion of PIH consumers would be relatively smaller in the developing countries because of limited inter-temporal consumption substitution possibilities. In this paper we test this conjecture with data from Fiji and Australia using a common approach.[1] The outline of this paper is as follows. Section 2 briefly reviews Hall's contribution. Section 3 reviews the alternative framework of Campbell and Mankiw (1989) to estimate the proportion of PIH and AIH consumers. Our empirical results for Fiji and Australia, for the period 1970-2005, are in Section 4. Conclusions and limitations are stated in Section 5.

[1]The justification for selecting these two countries is as follows. Fiji is of interest because, unlike in several developing countries, a good proportion of consumers use hire purchase facilities. Australia and Fiji are geographically close and share some common values and life styles.

2 Hall's Random Walk Hypothesis

As in the earlier Keynesian versus neoclassical debates, the consumption debate has generated a large number of theoretical and empirical works. A new dimension to this old controversy was added by Hall (1978) wherein he argued that if expectations of life-time or permanent income are rational, PIH and LCH imply that the change in consumption should be a random walk. This can be deduced from the first order condition of the standard inter-temporal utility maximization modelwhich gives the equilibrium condition:[2]

$$E_t[U'(C_{t+1})] = \left[\frac{1+\rho}{1+r}\right] U'(C_t) \tag{1}$$

where E stands for the expectated value, C is real consumption, $U'(C)$ is the marginal utility of consumption, ρ is the subjective rate of time preference and r is the real rate of interest at which the representative consumer can lend and borrow. The above result implies that C_t should equal the best forecast of consumption in the next period, except for the constant $[(1+\rho)/(1+r)]$. The simplifying assumptions made in this model are that the utility function is quadratic and separable in time (e.g., a CRRA function) and in equilibrium $r = \rho$. These assumptions and equation (1) give the famous Hall equation:

$$\begin{aligned} C_{t+1} &= C_t + \epsilon_t \\ &or \\ \Delta C_t &= \epsilon_t \end{aligned} \tag{2}$$

where $\epsilon \sim N(0, \sigma)$. This implies that all the available information is used in period t to predict future consumption C_{t+1}.

Hall's initial tests were favorable to PIH. However, Flavin (1981) and Campbell and Mankiw (1989) have found that either the data (mainly from the developed countries) do not support or only partially support PIH. The Campbell-Mankiw approach is noteworthy for its wider scope and claims to explain the stylized facts. It also nests the rival consumption theories. Methodologically models of synthesis nesting rival paradigms are attractive because the real world seldom conforms to the idealized assumptions of theories such as all markets are perfectly competitive or imperfectly competitive and all consumers behave the same way etc. The Campbell-Mankiw synthesis, is based on the assumption that while λ proportion of consumers base their consumption decisions on the AIH, the remainder of $(1-\lambda)$ proportion are forward looking and use PIH for consumption decisions.

[2] Since this is a well known result, and derivations are available in advanced textbooks, e.g., Romer (2001), there is no need for an elaboration here.

In applying these model to a developing country like Fiji, it is to be expected that λ will be higher because opportunities for consumption smoothing in the developing countries are much less. On the other hand a theory with good foundations, such as the PIH, is expected to be equally applicable to the developed and developing countries at least in equilibrium. When testing this theory it should be kept in mind that Campbell and Mankiw's estimates of λ, for the U.S.A. have been very sensitive to the method of estimation and the choice of the instrumental variables. Their estimates of λ ranged from 0.3 to 0.65[3] Because of the large margin in these estimates, it is difficult to expect that the estimate of λ for Fiji would be exceed 0.65 for the U.S.A. For this reason we have selected Australia for comparison with Fiji and with a common method of estimation.

A couple of earlier studies have used the Campbell-Mankiw approach to estimate λ in the developing countries. Patnaik (1997) found that λ for India is about 0.5, which is less than 0.65 for U.S.A. Rao (2005) found that λ is about 0.75 for Fiji. Both estimates, like the Campbell-Mankiw estimates, have some limitations.[4]

3 Campbell-Mankiw Consumption Function

The Campbell-Mankiw specification assumes that a certain proportion $(1-\lambda)$ of consumers are forward-looking and consume their permanent income and the remainder of λ proportion use the rule of thumb of consuming their current incomes. The condition in equation (1) can be derived from the following standard optimization problem and a CRRA type utility function:

$$Max.\ U = \sum_{t=0}^{T} \frac{C_t}{(1+\rho)^t} \leq A_0 + \sum_{t=0}^{T} \frac{1}{(1+r)^t} Y_t \tag{3}$$

$$U(C_t) = \frac{C_t^{(1-\theta)}}{1-\theta} \tag{4}$$

where A_0 is initial assets, r is the real rate of interest, ρ is the subjective rate of time preference and θ is the risk aversion coefficient. The solution for this optimization is:

[3] The lower estimate is based on OLS and the higher estimate was made with an instrumental variable procedure using indirect least squares.

[4] Rao (2005) has used the indirect least squares, as in Campbell and Mankiw. Although his choice of instruments is similar to Campbell and Mankiw and passed the χ^2 test, it is desirable to use the Sargan χ^2 test based on the assumption that the sum of squared errors of the structural and instrumental equations are minimized simultaneously. This test is available in Microfit (1997) in its non-linear two-stage least squares instrumental variables option.

$$\frac{C_t}{C_{t-1}} = \left[\frac{1+\rho}{1+r}\right]^{\frac{1}{\theta}} = \left[\frac{1+\rho}{1+r}\right]^{\sigma} \tag{5}$$

where the inter-temporal substitution parameter σ equals $(1/\theta)$. The above, with a multiplicative stochastic error term υ and $ln(\upsilon) = \epsilon \sim N(0, \delta)$, for estimation is:

$$\Delta\ lnC_t = \sigma\ \Big(\ ln(1+\rho) -\ ln(1+r)\Big) + \epsilon_t \tag{6}$$

In the empirical work ρ is treated as constant and $ln(1+r)$ is linearized around $r = 0$ so that $ln(1+r) \approx r$. With these simplification, the PIH consumption equation is:

$$\Delta\ lnC_t = \mu - \sigma\ r + \epsilon_t \tag{7}$$

It may be noted that the sign of the coefficient of r is negative because the optimization model took into account only the substitution effect of r. However, an increase in r also increases income and if this income effect is dominant, the sign of the coefficient of r could be zero or positive; see Romer (2006, pp. 353-66).[5]

The Campbell-Mankiw equation adds changes in current income to the specification in equation (7) because they hypothosize that λ proportion of consumers use current income for consumption. These assumptions give the consumption equation:

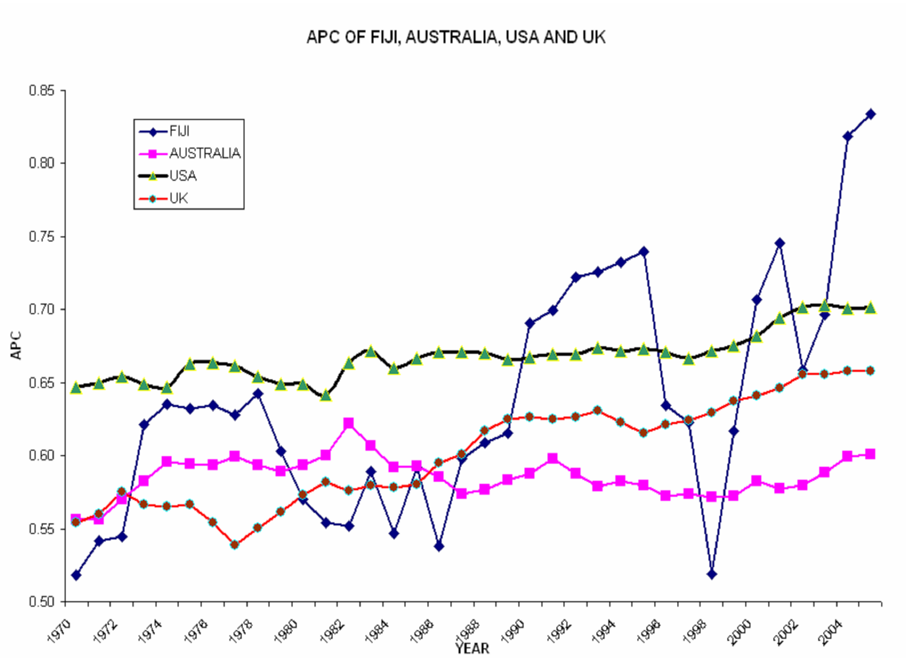
$$\Delta C_t = \mu + \lambda \Delta Y_t \pm (1-\lambda)\sigma r_t + \epsilon_t \tag{8}$$

[5]Originally Hall (1978, 1988) found that σ was insignificant and sometimes became negative. Similarly Hansen and Singleton (1996) found σ was negative. In the Campbell and Mankiw estimates σ ranged from +0.15 to +0.016 and was often insignificant.

On the other hand Ogaki and Reinhart (1998) have found that σ for the U.S.A. was between 0.32 to 0.45 and significant. Fuse (2004) found that σ for Japan is significant and is about 4, which no doubt seems to be an overestimate. However, the implications of the size of σ as an indicator of the risk aversion coefficient θ do not seem to have received much attention in these works. For example, the findings of Hall, Hansen and Singleton and Campbell and Mankiw imply that U.S. consumers are infinitely risk averse. On the other hand, comparing the Ogaki and Reinhart U.S. estimate with Fuse's estimates for Japan implies that U.S. consumers are 9 to 12 times more risk averse than Japanese consumers.

It is also important to note that the sign of σ depends on the relative strengths of the income and substitution effects due to a changes in r. An increase in the expected permanent income, due to improved earnings in assets, increases current consumption. This is the income effect. On the other hand, when r increases, future consumption becomes more attractive and current consumption decreases. This is the negative substitution effect. Therefore, the sign of the coefficient of r in equation (4) can be positive or negative or zero; see Romer (2006, pp.363-66). In general where consumers have substantial mortgages, e.g., in the advanced countries like Australia, the substitution effect and higher mortgage payments are likely to make the coefficient of r negative.

Figure 1: Average Propensity to Consume



Before we estimate (8) for Fiji, it would be useful to briefly look at the differences between the behaviour of consumption and output in Fiji and some selected developed countries. Figure-1 and Table-1 compare consumption patterns in Fiji with Australia, U.K. and U.S.A.

In Table 1 while Fiji's mean APC is not much higher than in the U.S.A. and Australia it shows considerable fluctuations. The standard deviation of Fiji's APC is more than twice in the developed countries, indicating that current income, instead of permanent income, might have played a larger role in consumption decisions. It is also interesting to note from Figure-1 that, from the early 1980s, APC has shown a mild upward trend in the developed countries. Bayoumi (1994) and Miles (1992) suggest that this is due to easing of the liquidity constraints in the post de-regulation of financial markets. Muellbauer and Murphy (1990) suggest that this is due to an increase in the wealth effect, caused by the increase in house prices e.g. in the U.K. Attanasio and Weber (1994) attribute this to improved expectations of permanent income due to the rise in productivity. The implication of these observations is that, for a variety of reasons among which easing of the availability of credit is an important factor, opportunities for

Comparisons of Consumption Patterns
Fiji, Australia, U.K. and U.S.A. 1970-2005

	Fiji	Australia	UK	USA
Mean APC	0.637	0.586	0.602	0.668
STD APC	0.080	0.013	0.036	0.013
Mean growth of Y	1.310	1.370	0.850	1.352
STD of growth in Y	1.951	0.701	0.852	0.862
Mean growth of C	1.904	1.474	1.237	1.452
STD of growth in C	3.887	0581	1.002	0.713

Notes: APC is the ratio of consumption to output and STD is the standard deviation. See the Data Appendix for sources.

consumption smoothing in the developed countries have increased from the early 1980s. Since no such effect is noticeable in Fiji's consumption pattern, it may be said that current income could be a major factor in consumption decisions and the large variations in Fiji's APC could be due to the large variations in the rate of growth of its income. Therefore, modeling consumption in Fiji is a challenging task.

In light of these observations equation (8) seems to be in need of a few modifications for testing with the Fiji data. First, the interest rates in the developing countries are subject to various government and central bank controls and are unlikely to be market determined. Therefore,we have used a weighted average of the lending rates for Fiji, which are subject to less controls, as our short run rate of interest. Second, interest rates have been kept low in Fiji to encourage investment. Lenders often use different criteria (such as social status, employment in the public sector etc.) to evaluate credit risks to ration hire purchase credit. Therefore, the availability of credit, rather than the interest rate, could be a major constraint on consumption smoothing. Thirdly, as pointed out earlier, estimates of σ for $U.S.A.$ were found to be insignificant, but the significance of the availability of credit is not investigated within the PIH framework. Our proxy variable for the availability of credit is somewhat similar to the shadow price of the cost of credit. In that sense our alternative specification, by substituting the availability of credit for the rate of interest in (8), is not altogether arbitrary. Finally, with the credit availability as proxy variables, in place of the real rate of interest, it is difficult to interpret σ as the true substitution parameter.

4 Empirical Results

Alternative estmates of equation (8) with data from Fiji and Australia for the period 1974-2005 are given in Table 2. All the equations are estimated with the non-linear two stage instrumental variables option in Microfit. Lagged values of the variables are used as instruments. The Sargan χ^2 test is used for the validation of the selected instruments. In none of the equations this test statistic is significant at the 5% level validating our choice of instrumental variables. The real rate of interest is computed by subtracting from the nominal rate the expected rate of inflation. We have used alternative measures of the expected rate of inflation. The expected rate of inflation is computed in two ways. First, it is measured as the average of the current and one period ahead rates of inflation and this measure is denoted as RR_{S1}. Second, the expected rate of inflation is measured as the average rate of the current and previous period inflation rates and real short term interest rate measured in this way is denoted as RR_{S2}. Similar notation is used for the real long run rate of interest.

In the first four rows of Table 2, estimates of equation (8), with the short and long run real rates of interest are reported. This equation is augmented with a goods and services tax dummy ($TDUM$) for Fiji which is 1 from 1991.[6]

Our credit availability variable is proxied with the difference between the short and long term nominal interest rates. This is a well known proxy and can be derived from the $ISLM$ model.[7] Our alternative versions of equation (8) with the credit availability proxy ($CREDIT$) is:

$$\Delta C_t = \mu + \lambda \Delta Y_t + (1 - \lambda)\sigma CREDIT_t + \epsilon_t \tag{9}$$

where $CREDIT$ is the difference between the nominal short and long term rates of interest. Although this variable is found to be significant, a measure in which $CREDIT$ is computed as the deviation from its mean value performed better. Estimates of equation (9), with this measure, are in row 5 of Table 2. In rows (6) to (9) equation (9) is estimated for Australia with the two measures of the rate of interest. An important difference between the estimates for Fiji and Australia is that the sign of the coeffcient of the real rate of interest. While in Fiji it is positive, it is negative for Australia, implying that in Fiji the positive income effect of the real rate of interest dominated the negative substitution effect. Furthermore, the coefficient of

[6] A goods and services tax was also introduced in Australia from 2000 but its coefficient was not significant and we have ignored this dummy.

[7] When money supply increases, LM shifts down, causing a decline in the short term nominal rate of interest. However, since more money means higher inflationary expectations, the nominal long term rate of interest increases. Thus an increase in the spread between the short and long term interest rates is a good proxy for an increases in credit.

Table-2
Estimates of the Campbell-Mankiw Equations
for Fiji and Australia 1974–2005

$$\Delta lnC_t = \mu + \lambda \Delta lnY_t + (1-\lambda)\sigma Z_t + \gamma TDUM$$

Z_t	μ	λ	σ	$TDUM$	SE
1. RR_{s1}	-0.020	0.507	0.011	-0.027	0.055
p-values	(0.021)	(0.001)	(0.001)	(0.021)	
2. RR_{s2}	-0.007	0.475	0.007	-0.029	0.058
p-values	(0.084)	(0.001)	(0.005)	(0.018)	
3. RR_{L1}	-0.001	**0.527**	0.013	-0.031	0.055
p-values	(0.860)$*$	(0.001)	(0.003)	(0.026)	
4. RR_{L2}	-0.008	0.497	0.008	-0.032	0.057
p-values	(0.171)$*$	(0.000)	(0.007)	(0.012)	
5. $CREDIT$	0.000	0.479	0.042	-0.014	0.063
p-values	(0.961)$*$	(0.002)	(0.035)	(0.148)$*$	
		Estimates for Australia 1974-2005			
6. RR_{s1}	-0.969	0.271	-0.001		0.011
p-values	(0.000)	(0.023)	(0.099)$*$		
7. RR_{s2}	-0.971	**0.300**	-0.001		0.011
p-values	(0.000)	(0.003)	(0.010)		
8. RR_{L1}	-0.963	0.244	-0.002		0.010
p-values	(0.000)	(0.022)	(0.005)		
9.RR_{L2}	-0.966	0.281	-0.002		0.010
p-values	(0.000)	(0.008)	(0.006)		

Notes: 1. p values are White adjusted. 2. * indicates insignificance at 5% level. 3. See Data Appendix for data sources.

the real rate of interest is significant at the 5% level, except in row (6) for Australia where it is significant at the 10% level.

Irrespective of which measure of the interest rate is used estimates of λ have remained fairly stable in both countries. These estimates ranged from 0.527 to 0.475 for Fiji. For Australia they ranged from 0.300 to 0.244. Needless to say these ranges are very small compared to the range of estimates for the U.S.A. by Campbell and Mankiw. It is also of interest to note that the equation with the $CREDIT$ variable performed well for Fiji in row (5). Its coefficient is positive and significant at the 5% level. Use of this variable in place of the rate of interest did not affect the estimate of λ for Fiji.[8]

It is difficult to select the best equation for each country because the estimates and the standard errors (SEs) are very close. Therefore, we selected the equation where the estimate of λ is the highest. It so happens that these equations in row (3) for Fiji and row (7) for Australia also have trivially minimum SEs. From these equations, it can be said that while 47% in Fiji are PIH consumers and in Australia this is higher at 70%. A Wald test that these two estimates are equal is rejected at the 10% level in the Fiji equation and 1.2% level in the equation for Australia.[9] Therefore, we may say that the proportion of PIH consumers in Australia is about 40% higher than in Fiji. It would be interesting to further investigate the validity of this observation in a larger sample of the developing and developed countries. But this is beyond the scope of the present paper.

The estimates of the elasticity coefficients do not seem to reflect adequately the relative risk aversion coefficients (θs) because they imply similar values for both countries or even higher values for Australia. It is hard to believe that Australian consumers are more risk averse than Fijian consumers or that $\theta = 10$ in Australia.[10] The reason for this could be due to the mixed substitution and income effects captured by the parameter σ and further work, which is also beyond the scope of the present paper, seems to be necessary.

[8]It is not of much interest to estimate equations with $CREDIT$ for the developed countries because the availability of credit is generally well signaled by the market determined rates of interest.

[9]The χ^2 test statistics with p-values in the square brackets, are 2.7423 [0.098] when the Fiji equation is used and 6.2859 [0.012] when the Australian equation is used. This difference is due to the much improved SE in the latter equation.

[10]We have measured the rate of interest in full percentage values. Therefore, the implied value of the risk aversion coefficient by the estimate of σ should be devided with 100. The implied value of θ for Fiji is 7.7.

5 Conclusions and Limitations

This paper has used the Campbell-Mankiw framework to test the significance of PIH and the Keynesian AIH hypotheses for a developing and a developed country. It is found that the proportion of PIH consumers are about 40% higher in Australia than in Fiji.

In the effects of the real rate of interest, the positive income effect seems to have dominated the negative substitution effect for Fiji. But in Australia the negative substitution effect (which could be higher than our estimates of σ) is more dominant. This is reasonable because one would expect that consumers are less risk averse in a developed country. These findings have some implications for monetary policy and the Ricardian equivalence theorem (RET). In Fiji, an increase in the rate of interest, instead of decreasing may actually increase consumption due the dominant positive income effect. Thus this finding raises doubts on the Reserve Bank of Fiji's belief that consumption expenditure can be decreased by increasing the interest rates. On the other hand, higher interest rates do decrease consumption in Australia.

Since the proportion of PIH consumers is lower in Fiji and interest rate effects are positive it is not unreasonable to say that RET is less likely to hold in the developing countries like Fiji. Therefore, the effects of budget deficits may not be insignificant.

The risk aversion coefficients implied by our estimates of σs are not plausible because it is a mixture of the positive income and negative substitution effects of changes in the real rate of interest. For this reason, one would expect a higher value for the pure substitution effect for Australia and a smaller value for Fiji. To capture more accurately these substitution effects, it is necessary to extend the inter-temporal optimization framework and this is beyond the scope of the present paper.

It is hoped that our results and methodology will encourage further work in two directions. First, hopefully further work with a larger sample of developing and developed countries confirm or refute our findings based on a sample of only two countries. Second, there is a need to extend the optimization models with only a single constraint to bring in more constraints like the role of the availability of credit and also separate the income and substitution effects due to changes in the rate of interest.

Data Appendix

Fiji

C = Real consumption computed by deflating nominal consumption with GDP deflator at the base 1995 for real consumption. (Fiji Island Bureau of Statistics, Key Statistics, various issues, latest December 2006).

Y = Real disposable income is computed as (1-t) real GDP, where income tax rate (t) is computed as the proportion of direct taxes on labour and capital to their gross returns. (Fiji Islands Bureau of Statistics, Key Statistics, various issues, latest December 2006). Direct taxes include personal tax, company tax, dividend tax, and PAYE. Gross returns include compensation of employees and operating surplus.

RIS = Short-term rate of interest is the weighted average of lending rates for short-to-medium term private sector borrowing for various activities. (Reserve Bank of Fiji Quarterly Review, various issues, latest December 2006).

RIL = Long-term rate of interest is 5 years or more government bond yield. (International Monetary Fund, International Financial Statistics, CD ROM 2002, latest 2006). Real rates of interests are computed by deducting from nominal rates the expected rate of inflation measured in GDP deflator. The expected rate of inflation is computed in two ways. First, it is measured as the average of the current and one period ahead rates of inflation. Second, the expected rate of inflation is measured as the average rate of the current and previous period inflation rates. These measures of inflation are used for computing short-term as well as long-term real rate of interest.

TDUM = Tax dummy for VAT, 1 in 1991 to 1993 and zero in other periods.

CREDIT = Proxy for availability of consumer credit is computed as the difference between nominal short-term to medium-term (RIS) and long-term interest rate (RIL).

Australia Real income, consumption and GDP deflator data are downloaded from the UN database. Real values are in 1990 prices. Short term interest rate is the average June rate on 180 day bills and long run rate of interest is the five year bond yield. Interest rate data are from the Reserve Bank of Australia publications.

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