AN INVESTMENT EQUATION FOR FIJI

By

Rup Singh
School of Economics
The University of the South Pacific
Suva, Fiji
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Rup Singh
singh_r@usp.ac.fj

University of the South Pacific, Suva (Fiji)

Abstract

In this paper a variant of the accelerator model of investment, augmented with the real rate of interest, is estimated for Fiji. Our estimates with two alternative techniques viz., the LSE-Hendry GETS and the Johansen Maximum Likelihood methods (JML) indicate that the long-run output elasticity is unity and the interest rate elasticity is high at -0.40. Therefore, the recent interest rate hikes by the Reserve Bank of Fiji (RBF) are likely to depress the already depressed investment climate in Fiji. Furthermore, our estimates show that the expected rate of inflation and political uncertainties have significant negative impact on private investment.

KEYWORDS: Private Investment in Fiji, General to Specific Approach and Johansen Maximum Likelihood Estimates.

* This paper is based on a chapter of my masters thesis titled: A Macroeconometric Model for Fiji. I am grateful to Professor B. B. Rao for his comments and guidance throughout my thesis and in this paper and to Associate Professor B. C. Prasad for his encouragement and suggestions for improvements. However errors in this paper are my responsibility.
1 INTRODUCTION

Investment is the most volatile component of aggregate demand and therefore, an important determinant of output fluctuations. Further, firms’ investment demand and households’ supply of savings jointly determine how much of an economy’s output is added to its stock of capital. Thus, investment determines the level of aggregate supply. It also links the goods and money markets and therefore, is a primary link through which interest rate (monetary policy) affects the economy.

There are two major theories of investment - the Keynesian and neo-classical. However, they have been extensively modified along many directions. In this paper, we use alternative time series methods and show that a variant of the Keynesian model argumented with the cost of capital adequately explains private investment in Fiji. The paper is organized as follows: Sections 2 and 3, respectively, provide a brief survey of theories and investment trends in Fiji. Existing empirical works on Fiji are reviewed in section 4. Section 5 discusses our specification and empirical results and conclusions are stated in the final section.

2 OVERVIEW OF INVESTMENT THEORIES

In the basic neo-classical theory of Jorgenson, investment takes place when marginal benefit of investment equals marginal cost. The marginal benefit and costs, respectively, are estimated by expected future output and profit and costs associated with buying or renting additional capital. Thus, in Jorgenson’s model, both the growth rate of output and user cost of capital (UCK, henceforth) play important roles. However, their relative importance depends on the elasticity of substitution between labor and capital ($\sigma_{L,K}$). If the nature of the production function is Cobb-Douglous, in which $\sigma_{L,K}$ is unity, both factors receive same weights in investment equations. However, if a fixed coefficient production function is used, where $\sigma_{L,K}$ is zero, the cost of capital has no effect on investment. Some assumptions of the Jorgenson’s model include instantaneous and complete adjustment of capital and perfect reversibility of investment. However, in reality, there are significant costs associated with ordering and installing new plants/machinery and in training workers to use new technology. Further, the price of capital may rise if firms face an inelastic supply for capital. In many cases, investment decisions may not be instantaneous as fixed investment is generally irreversible. Thus, long-range planning is important.
The Keynesian approach mostly emphasizes the role of growth of output in investment equations. In addition, expectations, uncertainties and other fiscal and financial factors are also considered. One such approach, which according to Baddeley (2003) is due to Clark (1917) and Harrod (1936/39), is the accelerator theory where investment is seen as the process of adjusting the current stock of capital to a desired level. In each period, firms actually plan to close a fraction (γ) of the gap between actual and desired stock of capital. The actual capital stock at the end of current period may be expressed as:

\[ K_t = K_{t-1} + \gamma(K^* - K_{t-1}) \quad (2) \]

In order to attain the desired level, firms need to make a net investment \((I_t)\) of \(K_t - K_{t-1}\). Substituting this into (2) yields the definition of net investment:

\[ I_t = \gamma(K^* - K_{t-1}) \quad (3) \]

Adding depreciation cost of \(\delta K_{t-1}\) to (3) would yield gross investment. Note the greater the value of \(\gamma\), the higher is the speed of adjustment. Some limitations of this model are that it fails to account for the dynamics of investment decisions based on expectations and uncertainties. Further, since it implicitly assumes technical rigidities in production \(\sigma_{L,K} \approx 0\). Therefore, the possibility of factor substitution due to relative factor prices adjustments are ignored.

While empirical studies in the developed countries have used Jorgenson’s framework, in the developing countries, simpler variants of the Keynesian accelerator models are popular because it is hard to get reliable data on some of the components of UCK. Therefore, the user cost of capital is often proxied with the real rate of interest. Briefly, UCK can be estimated by evaluating the costs incurred in retaining a unit of capital. These are first, the interest income forgone by selling off capital as opposed to retaining it. This has the real cost of \(r_t P^i K_t\), where \(r_t\) is the real rate of interest and \(P^i K_t\) is the real market value of capital. Second, firms incur depreciation costs of \(\delta_t P^i K_t\), where \(\delta_t\) is the effective rate of depreciation. Third, the price of capital may fall due to technological improvements in new machines which causes capital loss. This can be expressed as \(-P^{i*} K_t\). Putting the three components together yields a measure of UCK:

\[ UCK_t = r_t P^i K_t + \delta P^i K_t - P^{i*} K_t \quad (1) \]

The after-tax profit function for a typical profit maximizer would be:

\[ PQ - WL - \left[ r_t + \delta - \left( \frac{P^{i*} K_t}{P^i K_t} \right) P^i K_t - Tx \right] P^i K_t \quad (1') \]

where \(PQ\) is the total revenue, \(WL\) is the wage cost and \(Tx\) is the
Baddeley (2003) tested for empirical support for these theories using quarterly data from the UK over the period 1972Q4-2001Q1. She estimated the basic accelerator and Jorgensan models using OLS by specifying her equations in lagged levels of variables. However, she did not get any impressive results with these formulations. For the accelerator model, she found an insignificant long-run output elasticity but the elasticity with respect to capacity utilisation was significant. This may be due to some collinearity between these two explainatory variables. In her Jorgenson specification, she found an insignificant long-run elasticity of -0.013 for UCK but claims to have obtained a unit output elasticity. Baddeley argued that her results are distorted due to structural changes during the sample period but she made no attempt to introduce shift dummies. In spite of her unsatisfactory empirical results Baddeley work is impressive for the exposition and survey of investment theories.

3 INVESTMENT TRENDS IN FIJI

Low investment has been a major problem in Fiji with current levels well below what is desired. The ratio of investment to output (investment ratio, henceforth) has declined from above 20% in 1970s to around half its level in mid 1980s and has since remained low. While government investment ratio has largely been stagnant at around 3.5%, data shows that there is a clear reduction in public investment expenditure since 1982. The private investment ratio has been volatile from as high as 15% in 1971 to below 10% in 1987. Since then, it has remained low. These trends seem to be the direct consequences of the two military coups which might have affected the investor confidence. However, recently, there are some activities in commercial

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1 However, in reality, only a certain proportion of these costs are tax deductible. To factor this out, suppose $\phi_1$ proportion of depreciation, $\phi_2$ of interest rate and $\phi_3$ of capital loss are tax deductible and the proportionate tax rate is $tx$. Thus equation (1') may be re-written as:

$$(PQ - WL)(1 - tx) - \left[ (1 - \phi_1 tx)r_t + (1 - \phi_2 tx)\delta - (1 - \phi_3 tx)\left(\frac{P_i^* K_t}{P^* K_t}\right)\right] P^i K_t$$

Note the definition of $UCK$ and associated limitations in its approximation. I am grateful to Professor Rao for helping with the derivation of the implied $UCK$.

2 She has also tested for other models such as the Keynesian-Kaleckian and q-theory using the USA data. However, we have not reported these results since our interest is in the two major investment theories and her empirical results based on these alternative theories are impressive.
building projects and also investment in residential property development.\(^3\) Lured by higher profit expectations in the growing tourism sector, private investment in tourism resorts such as at the Momi-bay and Natadola Resorts, Sofitel Island Resort, Hilton at Denarau are increasing. These have an estimated potential investment value of around $500m in current prices to be spread over two-to-three years.

The recent pickup in investment activity has been possible through low interest rates on lending and better management of investment proposals by the Fiji Trade and Investment Bureau. However, the recent interest rate hikes (in 2004 and 2005) by the RBF are likely to depress the low investment climate in Fiji. The overall private investment has been on a downward trend indicating that various incentives put in place since 1987, such as the Tax Free Factory/Tax Free Zone scheme, Schedule 5 Export Tax Incentive, depreciation allowances, hotel investment incentives and loss carry forward have not fully succeeded in increasing private investment to their high levels in the early 1970/80s. This could be because investors place greater priority on macroeconomic stability, good governance and adequate property rights. It is important to note that incentives alone will not encourage investments as political and economic stability and law & order play a significant role in raising investment in Fiji.

Following controversial arguments surrounding the level of investment required to sustain 5% output growth, Rao (2004) showed that the required investment ratio should be above 25%. Using the growth accounting framework, he estimated that a 15% investment ratio is consistent with only a growth target of less than 3%.\(^4\) Therefore, if the target growth rate is 5%, the gap in investment ratio is more than 10%. However, with the low growth projections for 2005-2007 by the Fiji Islands Bureau of Statistics (BOS) and RBF, this seems highly unlikely. Rao as well as other prominent academic economists of the USP, for example Prasad (2003) and Shah (2004), suggest that a 5% output target is unsustainable in the medium to long-terms. They indicate that in order to improve growth performance, important institutional changes, improvement in land tenure system, property rights and other institutional factors together with investment promotional

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\(^3\) Some of the major projects are: The Rewa Bridge, Fiji School of Medicine Campus, Prouds Gallery, New Colonial Building, Fiji Islands Revenue and Customs and Great Council of Chiefs’ Building and Maritime and Ports Authority Complex.

\(^4\) Although Rao’s framework seemed to be controversial, there is support for his framework in Bosworth and Collins (2003). In a personal communication, Professor Rao informed that he was not aware of this paper at the time he wrote his paper.
polices are necessary. However, as Rao (2004) has noted these require considerable time and political will and take a long time to materialise.

4 EMPIRICAL STUDIES IN FIJI

One of the earliest estimates of the investment equation is Murphy (1992). He has modeled private sector investment (as a ratio to capital stock), as part of a small macroeconometric model for Fiji. The main explanatory variable was the real net rate of return on investment (RET, henceforth) which is used as a proxy for the expected profit rate. His estimated investment function is as follows:

\[
(I/K)_t = 0.031 + 0.166 \left[ RET_t - \frac{\delta_t + RL_t - \pi^e_t}{100} \right] + 0.003T
\]

\( (0.98) \quad (1.39) \quad (1.37) \) (3)

\( SEE = 0.014, DW = 1.00, Period : 1974 - 1986 \)

Where \( I_t \) and \( K_t \) are real private sector investment and stock of capital, respectively, \( T \) is time trend, \( RET_t \) represents real rate of return on investment and \( \delta_t \) and \( RL_t \) are the rate of depreciation and long term nominal interest rate, respectively. \( \pi^e_t \) is the medium term expected rate of inflation. Note that although the estimated coefficients are correctly signed, they are statistically insignificant at the conventional levels. Moreover, the sample size is too small to say that these are convincing results. Therefore, we have tried to re-estimate Murphy’s equation with an extended sample of 1970-2002. However, we encountered problems in computing his RET. He estimates RET using an optimization model as the weighted average of relative prices determined by the corresponding proportion of the quantities to total output. Unfortunately, we did not get any meaningful estimates of RET for our sample. Further communication with Murphy for clarification were not fruitful. Thus we could not pursue further on Murphy’s specification.

More recently, Jayaraman (2003) and Seruvatu and Jayaraman (2001) have estimated private sector investment equations for the periods 1977-1994 and 1966-1998, respectively. Both have good surveys of the literature and discuss some important trends in investment. However, while some attention is given to the time series properties of variables in Seruvatu and Jayaraman (2001), in Jayarman (2003), the investment equation was estimated using the standard OLS approach without testing for the stationarity of the variables. Therefore, we
shall disregard Jayaraman (2003) since the summary statistics of the estimates are spurious. Although in Seruvatu and Jayaraman (2001) all variables have been tested for their stationarity, there is no evidence that these tests have been used correctly. Nonetheless, their results obtained with the error-correction model (ECM) are as follows:

$$\Delta \ln (I/P)_t = -2.017 - 0.451 \text{COUP} + 0.808 \Delta \ln \text{TOT}_{t-1}$$

$$(-1.79)^{**} (-2.90)^* (--)$$

$$- 0.371 \Delta \ln (I/P)_{t-1}$$

$$(-3.35)^*$$

\[ (5) \]

*Period*: 1966 – 1998, $\hat{R}^2 = 0.35$, $\text{SEE} = 0.15$

$$\chi^2_{sc}(1) = 1.42(0.49), \chi^2_{ff}(1) = 0.67(0.66)$$

$$\chi^2_n(2) = 0.80(0.67), \chi^2_{hs}(1) = 0.322(0.57)$$

Where $I_t$ and $P_t$ are nominal private investment and GDP deflator, respectively, TOT is the terms of trade index and COUP is a dummy for military coups in Fiji. All variables, except the COUP, are in logarithms and the $t$-ratios are in parentheses below the coefficients. For the $\chi^2$ statistics, the $p$-values are in parentheses. * and ** indicate 5% and 10% significance levels, respectively. The summary statistics, respectively, are for the first order serial correlation ($\chi^2_{sc}$), functional form mis-specification ($\chi^2_{ff}$), non-normality in residuals ($\chi^2_n$) and heteroscedasticity ($\chi^2_{hs}$). (--) indicates that the statistic was not reported in their paper.

There seem to be several weaknesses in their study. First, their unit root tests (not reported here) imply that logs of the real private investment, real GDP and real private sector credit are stationary, not $I(1)$ as they wrongly conclude, since the computed test statistics are greater than the critical values. This clearly rejects the null that these are $I(1)$ variables. Second, it is doubtful if in fact these variables are stationary since it is well known that GDP as well as several other macroeconomic variables contain unit roots. Third, the actual specification used to estimate (5) seems to be inappropriate because there is no lagged error correction term. Therefore, their estimates fail to capture the long-run relationship between the levels of the dependent and the explanatory variables. Further, although they mention about the error correction term it is not clear how they have obtained it. Therefore, it seems that Seruvatu and Jayaraman have simply regressed the first difference of the dependent variable on the first differences of the explanatory variables and their lagged values. Consequently, it
is doubtful if their results are useful as neither their specification nor their estimation procedures are appropriate. Nevertheless, the aforesaid studies are pioneering attempts, but due to their limitations, it is necessary to start with a clean slate.

5 OUR SPECIFICATION AND RESULTS

It is well known that the Jorgenson neo-classical investment equation is more general than the Keynesian accelerator model. The relative weights given to changes in output and $UCK$, however, depends on the elasticity of substitution between the factors of production. As discussed earlier, if the production function is based on the fixed coefficients technology, $UCK$ has no role in investment equations. These are well known results and an easy to follow explanation can be found in Rao (1980). However, following the path-breaking neo-classical growth model by Solow (1956), there is hardly anyone now who believes in the fixed coefficients production function. Therefore, our specification is based on the assumption that technology is flexible and investment depends on both the growth rate of output and the user cost of capital. Due to data limitations on $UCK$, we have used the real rate of interest as a proxy and this is a standard practice when data on $UCK$ are not available or difficult to estimate. The dependent variable, as in some earlier studies in Fji, is the proportion of private sector investment to GDP i.e., the investment ratio. Therefore, our basic specification is:

$$\ln\left(\frac{I}{Y}\right)_t = \alpha_0 + \alpha_1 \Delta \ln Y_t + \alpha_2 R_t + u_t$$

(6)

where:

- $ln(\frac{I}{Y})_t = \text{Log of real private sector investment ratio}$
- $\ln Y_t = \text{Log of real GDP at factor cost}$
- $R_t = \text{Real long term interest rate}$
- $u_t = \text{error term with the usual classical properties}$

We first tested the variables for stationarity using various unit root tests available in Microfit 4.2 and Eviews 5.1. It was found that $\ln(\frac{I}{Y})_t$, $R_t$ and $\ln Y_t$ are non-stationary in levels but their first differences are stationary at the 5% level. Later it was necessary to include the growth rate of inflation, $\Delta^2 P_t$, which was also stationary.  

\footnote{The Schwartz Bayesian Criteria (SBC) was used to select the lag length.} Description of the variables and data sources are in Appendix.
5.1 THE GETS APPROACH

In what follows, we report the results obtained with GETS formulation. These are estimated with the non-linear least square (NLLS) in Microfit 4.2. Our basic equation is estimated with a time trend and growth in the expected rate of inflation \( \Delta 2 \ln P_{t-1} \) together with two dummy variables to capture the impact of the political instabilities (COUP) and the devaluation of the Fiji dollar (DEV), respectively. Following sequential deletion of insignificant variables, we obtained the GETS estimates reported in column (6a) of Table-1. Note that all variables are correctly signed and none of the \( \chi^2 \) summary statistics are significant at the 5% level. Devaluation of the dollar seems to be insignificant (not reported), while the COUP has negative impact. The implied long-run output elasticity is 1.38 and the interest rate elasticity, at the mean rate of 2.80%, is -0.13. The growth in expected inflation is significant and has the expected negative impact on investment. However, the output elasticity is only significant at higher than 10% level.

To improve our results, we have used a few parameter restrictions. First, we tested if the output elasticity is unity and the null was easily accepted. This is given in (6b). Note that there are significant improvements in our results. Further, it can be seen that the coefficients of \( R_{t-1} \) and \( \Delta R_t \) are similar in signs and magnitudes. The same is the case with the coefficients of COUP and \( \Delta \ln (I/Y)_{t-2} \). Thus we tested if they are equal and both sets of nulls are easily accepted. Therefore, we re-estimated 6(b) with these constraints and obtained our preferred equation (6c). Note that the two crucial elasticities of output and interest rate now are well determined. The implied interest rate elasticity at its mean rate is -0.171 and is significant. The COUP and growth in expected inflation rates have significant negative impact on private investment. The \( \chi^2 \) summary statistics of (6c) are good but the SER is high at 0.144, which is not far from the past empirical studies on Fiji. All variables are significant at 5% level. Figure-1 shows the actual and fitted values of the growth of the investment ratio which indicates that the model tracks oscillations reasonably well, given the dynamic nature of investment.

In all cases 1 lag was found to be adequate. The absolute ADF statistics with 95% critical values in parenthesis are: \( \ln (I/Y)_t = 0.895(3.580), \Delta \ln (I/Y)_t = 4.433(2.975), \ln Y_t = 1.232(3.580), \Delta \ln Y_t = 4.459(2.975), R_t = 2.551(3.580), \Delta R_t = 4.433(2.975) \) and \( \Delta \ln P_t = 4.606(3.580) \). Since \( \Delta \ln P_t \) is stationary, there is no need to proceed further for this variable. The conclusions were same with the PP tests. However, we have not reported the details to conserve space. These are available from the author upon request.
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<th>(6b)</th>
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<td>(—–)</td>
<td>(—–)</td>
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<td>(-1.94)**</td>
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<td>(0.51)</td>
<td>(0.67)</td>
<td>(0.86)</td>
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The superscript c indicates constrained estimates. The t-ratios for the variables and p-values for the χ^2 tests are in parantheses. * and ** indicate 5% and 10% significance levels, respectively. λ measures the speed of adjustment and the estimation period is 1972-2002.
We tested for temporal stability of (6c) using the TIMVAR tests and neither the CUSUM nor CUSUM SQUARES indicated any instability. The test results are given in Figures-2 and 3.  

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6 A fit of the actual vs. predicted values of the growth of the investment ratio gives $\bar{R}^2$ of 0.744 and the SEE of 0.128. It has a slope of 1 and the constant term is zero.
5.2 THE JML APPROACH

In this section, we report results obtained with the JML procedure. The reason for using an alternative technique are two fold. First as
Smith (2000) and Rao (2005b) have pointed out, statistical techniques are tools for preparing summaries of facts. If two techniques give similar summaries, that will improve our confidence. Second, since JML technique is based on a systems approach, it will minimise any endogeneity bias in our estimates.

We conducted the cointegration test on $ln(I/Y)_t$, $R_t$ and $lnY_t$ by treating $\Delta lnP_t$ and COUP as exogenous variables with an intercept and a trend term in a VAR (4) framework. The Akaike Information Criteria (AIC) suggested the lag length of 2 while the SBC indicated a lag length of 4 periods. Given our small sample size, we used the shorter lag length. Both the eigenvalue and the trace statistic rejected the null of no cointegrating vectors. The eigenvalue accepted the alternative of at least one cointegrating relationship. The eigenvalues test statistics were 28.84 (25.42), with the critical value in the parentheses, for the null that there were no cointegrating vectors and 18.42 (19.22) for the null of at least one CV. The trace statistics suggested that there were two cointegrating equations. The trace statistics were 55.64 (42.34) for the null of no long run relationship and 8.38 (12.39) for at least 2 CVs. The 95% critical values are reported in parenthesis. Thus we tested for two cointegrating vectors but the second CV was not meaningful. It had a large output elasticity and incorrect sign for the real rate of interest elasticity. Therefore, the only cointegrating vector implied by the eigenvalue normalized on $ln(I/Y)_t$ is:

$$(-1.000ln(I/Y)_t + 1.095 lnY_t - 0.154 R_t - 0.040 T)$$ (7)

The implied long-run elasticity with respect to output is 1.10 which is not significantly different from our GETS results of unity. The real interest rate elasticity, at its mean rate of 2.80% is -0.43, which is also plausible although it is on the higher side compared to the GETS estimates. However, as is required, we subjected the above CV to further tests. First, we tested for identification by regressing the first difference of each variable on their respective one period lagged error terms with an intercept and a trend term. The results suggest that the CV reported in (7) represents investment equation since only $ECM(I/Y)_{t-1}$ was significant with correct negative sign in $\Delta ln(I/Y)_t$ equation. The other two ECMs, obtained by normalising the CV on output (ECMY) and interest rate (ECMR) were insignificant in their respective regressions. The t-ratios for the

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7 These are comparable to other estimates such as Hall and Jorgenson (1967) and Jorgenson and Stephenson (1967) who estimated an output elasticity of unity. Eisner and Nadiri (1968) estimated output elasticity of 0.70 and cost of capital elasticity of -0.20. Bean (1981) found an output elasticity of 0.91 and the elasticity of UCK was -0.05. These results are cited from Baddeley (2003).
lagged error terms, when the dependent variables are respectively, $\Delta \ln(I/Y)_t$, $\Delta \ln Y_t$ and $\Delta R_t$ are -2.391, 0.078 and -1.524. Although $ECMR_{t-1}$ has correct sign, it is not significant at conventional levels. Therefore it is reasonable to interpret (7) as the implied investment equation. Further, following Enders (2004) another set of three ECM equations were estimated with the one period lagged residuals from (7), $ECM(I/Y)_{t-1}$, being included as one of the dependent variables in each of the equations. The $ECM_{t-1}$ was only significant in the equation where the dependent variable was $\Delta \ln(I/Y)_t$. The t-ratios for the $ECM_{t-1}$ in each of the three equations in order of $\Delta \ln(I/Y)_t$, $\Delta \ln Y_t$ and $\Delta R_t$ were, respectively, -2.391, -0.077 and -1.524. Since the disequilibrium in investment does not significantly contribute to the explanation of $\ln Y_t$ and $R_t$, we treated these two variables as being weakly exogenous to the investment equation.

In estimating our VECM model, we have used $ECM(I/Y)_{t-1}$ as one of the independent variables and applied GETS in the second stage of estimation to select a parsimonious dynamic equation. Starting with lags upto 4 periods and by sequentially deleting insignificant variables, we obtained our unconstraint parsimonious VECM model given below:

$$
\Delta \ln(I/Y)_t = -6.655 + 0.041T - 0.266\Delta \ln(I/Y)_{t-2} + 0.050\Delta R_{t-4}
$$

\begin{align*}
&(-6.30)^* \quad (5.14)^* \quad (-2.16)^* \quad (2.58)^* \\
&- 2.544\Delta \ln Y_t - 0.118\Delta R_t - 0.278\Delta \ln(I/Y)_{t-4} \\
&(-4.14)^* \quad (-3.67)^* \quad (-2.07)^* \\
&- 13.296\Delta^2 \ln P_{t-1} - 7.862\Delta^2 \ln P_{t-2} - 7.943\Delta^2 \ln P_t \\
&(-5.84)^* \quad (-3.38)^* \quad (-3.34)^* \\
&- 0.682ECM(I/Y)_{t-1} - 0.169COUP \\
&(-6.19)^* \quad (-1.53)
\end{align*}

(7a)

$R^2 = 0.718, \ SEE = 0.138$ \hspace{1cm} Period : 1976 – 2002

$$
\chi^2_{scl} = 4.529 (0.03), \chi^2_{ff} = 238 (0.63)
$$

$$
\chi^2_n = 0.710 (0.70), \chi^2_{hs} = 0.051 (0.82)
$$

Note that the error correction term is highly significant and suggest adjustment of around 68% in one year. The COUP dummy and the growth in inflation expectations seem to have strong negative impact on investment. However, there are signs of first order serial correlation as the $\chi^2_{sc}$ is significant at 5%, but not at 1% level. To further improve our results, we imposed some parameter restrictions.
noting that $\Delta \ln(I/Y)_{t-2}$ and $\Delta \ln(I/Y)_{t-4}$ together with $\Delta^2 \ln P_t$ and $\Delta^2 \ln P_{t-2}$ have similar signs and magnitudes, respectively. Moreover, the coefficients of $\Delta R_t$ and $COUP$ are close. When tested if these paired restrictions are valid with the Wald test all the three nulls were accepted at the 5% level. We re-estimated (8a) with these restrictions and obtained our most preferred VECM model:

$$\Delta \ln(I/Y)_t = -6.693 + 0.038T - 0.261[\Delta \ln(I/Y)_{t-2} + \Delta \ln(I/Y)_{t-4}]$$
$$(-7.81)^* (7.00)^* (-2.88)^*$$
$$-7.898[\Delta^2 \ln P_t + \Delta^2 \ln P_{t-2}] - 13.374\Delta^2 \ln P_{t-1}$$
$$(-5.00)^* (-6.40)^*$$
$$-2.589\Delta \ln Y_t - 0.119[\Delta R_t + COUP]$$
$$(-4.81)^* (-4.12)^*$$
$$+ 0.050\Delta R_{t-4} - 0.688ECM(I/Y)_{t-1}$$
$$(2.93)^* (-7.75)^*$$

$$R^2 = 0.761, SEE = 0.127 \quad Period: 1976 - 2002$$
$$\chi^2_{sc1} = 2.590 (0.11), \chi^2_{ff} = 0.202 (0.65)$$
$$\chi^2_n = 1.154 (0.56), \chi^2_{hs} = 0.161 (0.69)$$

The SEE dropped to around 0.127 and other variables gained in significance because improved degrees of freedom. The error correction term is strongly significant and none of the summary $\chi^2$ statistics are significant at the 5% level. Inflation expectations and the COUP have significant negative impact on investment. While it is hard to quantify the impact of accelerating inflation expectations, the coup seems to have a permanent negative impact on investment ratio. We plotted the actual and fitted values of growth of investment ratio in Figure-4 and our model seems to predict changes in the ratio reasonably well. The TIMVAR stability tests results shown in Figures-5 and 6 imply that our preferred investment function is temporarily stable.

Note that the interest rate elasticities obtained with GETS and JML are significant and JML indicates that it is as high as -0.40. Since JML estimates are our preferred estimates it can be said that

8 The fit of the actual and predicted values of the growth of the investment ratio gives an $\bar{R}^2$ of 0.828 and SEE of 0.107. The slope is unity and the constant term is zero. These are close but preferred to the GETS results. This is due to the fact that the systems method is more efficient and generates better forecasts.
FIGURE 4
Actual vs. Predicted Values

FIGURE 5
CUSUM TEST-8b
each 50 basis points increase in the rate of interest by the RBF, assuming constant inflation rate, will further reduce the already low investment ratio in Fiji by around 20 basis points. While the economy requires additional investment, this policy stance of the RBF is contradictory to expectations since there has been two such interest rate hikes since mid-2004. The justification offered by the RBF is that higher interest rates will curtail the high growth of consumption which has implications for BOP and therefore for foreign exchange reserves, is not convincing. It may be noted that while interest rate has a direct negative effect on investment, it has no impact on consumption. Justifications for this may be found in Rao (2005a) and Rao and Singh (2004). These studies have shown that with low and volatile per capital incomes together with under-developed financial markets and credit constraints offer consumers limited or no opportunities for inter temporal substitution. Therefore, interest rates or other similar financial variables have almost zero impact on consumption. However, these studies have suggested that the availability of consumer credit has implications for consumption. Thus, if the RBF is targeting consumption it should control money supply and not the rate of interest. As reported by Rao and Singh (2005), the supply of money should be targeted as the demand for money (M1) seems to be stable in Fiji.
6 CONCLUSION

In this paper, we have conducted a brief survey of investment literature and noted previous studies on investment functions in Fiji. Since there are limitations in earlier works, we estimated afresh, a variant of the accelerator model augmented with the real rate of interest, as a proxy for cost of capital. Our estimates show that the implied output elasticity is unity and the interest rate elasticity is as high as -0.40. Inflation expectations and the political instabilities seems to have a strong negative effects on investment. Moreover, while the available investment incentives seem to have failed to attract new investments, interest rate hikes by the RBF will only decrease investment without any negative effect on consumption. Therefore there may not be reductions in imports. In fact controlling money supply is a good alternative policy option for the RBF since consumption responds well to the availability of credit. Targeting consumption through interest rate to control foreign reserves is unlikely to succeed. However, apart from the money supply the RBF perhaps has no other option but to devalue the domestic currency in order to maintain the current the account balance. Therefore, if serious considerations to money supply is not given, a devaluation is unavoidable in the near future.

DATA APPENDIX

$I_t =$ Nominal private sector investment deflated by GDP deflator. It also includes investment expenditure of statutory bodies. Source: Reserve Bank of Fiji, Quarterly Review, (December 2003).

$Y_t =$ Nominal GDP at factor cost deflated by GDP deflator. Sources: Reserve Bank of Fiji, Quarterly Reviews (various years) and International Financial Statistics CD-ROM, (December 2003).

$R_t =$ Real long term (5-yr) interest rate. Computed as the difference between nominal long term interest rate and GDP deflator inflation rate. Sources: Reserve Bank of Fiji, Quarterly Reviews (various years) and International Financial Statistics CD-ROM, (December 2003).


COUP = Dummy variable for the two political coups in Fiji. Data constructed as 1 since the first coup in 1987 to 2002 and 0 for all other periods.

DEV = Dummy variable for the two devaluations of the Fiji dollar. Data constructed as 1 for 1987-88 & 1997-98 and 0 for all other periods.
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