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An Empirical Re-assessment Using the Bounds Testing Approach

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ABSTRACT

This paper re-examines Gani's (1998) findings on the determinants of migrant flows from Fiji to New Zealand through employing the bounds testing procedure to cointegration, within an autoregressive distributive lag framework. The main findings are that in the long run all variables are statistically insignificant, although correctly signed with the exception of the unemployment differential. In the short run, in sharp contrast to Gani's (1998) findings, political instability is consistently the most important determinant of migration flows while the standard of living and real wage differentials are statistically insignificant across all specifications.

JEL: C32, F22

1. Introduction

New Zealand is the third major destination for immigrants from Fiji. In 1997, of the total number of immigrants leaving Fiji, 33 per cent went to the United States, 31 per cent went to Australia, 20 per cent went to New Zealand and 10 per cent went to Canada (Gani, 2000: 96-97, Mohanty, 2002: 7). Prior to 1987 only about 5,500 Fijians had migrated to New Zealand. The pace of immigration from Fiji to New Zealand, however, has intensified following the first Fiji coup in 1987. At the time of the 1996 census there were 19,000 Fiji-born people living in New Zealand, of which, 11,880 (64 per cent) had been there for less than nine years (Mohanty, 2002: 8).

The increase in the level of migration from Fiji to New Zealand following the first coup in 1987 has mirrored a more general trend in the number of immigrants leaving Fiji. The official statistics indicate that about 80,000 Fiji citizens have immigrated with an annual average of over 5,000 people between 1987 and 2001. The rate of immigration surged following the 2000 coup. In 2000 and 2001 alone, the number of immigrants were 5,275 and 6,316 respectively (Kumar and Prasad, 2002: 11). These are significant numbers given that Fiji has a population of only 775,000. Most of those who have emigrated since 1987 have been professional or skilled workers including architects, engineers, accountants, teachers and medical professionals.

Previous studies of migration from Fiji to New Zealand include both non-econometric studies (Connell 1985, 1987, Bedford and Levick 1988) and econometric studies (Gani and Ward 1995, Gani 1998). The latter two studies are a subset of a growing literature which has examined the determinants of migration from developing to developed countries. Other studies include Devoretz and Maki (1983) and Akbar and Devoretz (1993) who consider the determinants of migration from developing countries to Canada. Huang (1987) and MacPhee and Hassan (1990) examine the determinants of migration flows to the United States and Lam (2002) explores the reasons for migration from Hong Kong following the end of British rule.

Of the previous econometric studies of the determinants of migration from Fiji to New Zealand, Gani and Ward (1995) examine the determinants of migration of skilled professionals using panel data for 19 occupational groups between 1987 and 1990. Their main findings were that the number of professional migrants from Fiji was positively related to real income in New Zealand and political instability in Fiji. Gani (1998) examines the determinants of immigration from Fiji to New

Zealand within a human capital framework using time series data from 1970 to 1994. He uses the error correction framework with the Engle-Granger (1987) approach to cointegration. His main finding was that unemployment and wage differentials were the major determinants of migration from Fiji to New Zealand, while living standard differentials and political instability in Fiji were statistically insignificant.

The objective of this paper is to re-examine Gani's (1998) findings on the determinants of migrant flows from Fiji to New Zealand using time series data from 1972 to 2001. This study differs from that of Gani (1998) in the following respects. First, we use a slightly longer time period, which has the advantage that it encompasses the 2000 coup and therefore takes account of the effect of continuing political instability in Fiji on migration decisions after the period of Gani's (1998) study concluded. Second, whereas Gani (1998) employs the Engle-Granger (1987) approach to cointegration we use the bounds testing procedure to cointegration, within an autoregressive distributive lag (ARDL) framework, developed by Pesaran and others (Pesaran and Pesaran 1997, Pesaran and Shin 1999, Pesaran *et al* 2001).

Given the relatively small sample size in both the current study and that of Gani (1998), the bounds testing approach to cointegration is preferable to the Engle-Granger (1987) method of cointegration. It is well known that estimates using the Engle-Granger (1987) method of cointegration are not robust for small sample sizes (see eg Mah 2000, Tang and Nair 2002). However, Pesaran and Shin (1999) show that with the ARDL framework, the OLS estimators of the short run parameters are $\sqrt{T}$-consistent and the ARDL based estimators of the long run coefficients are super-consistent in small sample sizes. Previous studies have applied the bounds test to relatively small sample sizes with as few as 20 observations in considering a range of research issues (see eg Pattichis 1999, Tang 2001, Tang and Nair 2002).

The third difference between this study and that of Gani (1998) is that we use improved proxies for political instability. Gani (1998: 65) speculates that a possible reason for his finding that political instability was statistically insignificant is that his coup dummy variable might not be capturing the intended effect. A problem with Gani's (1998) analysis is that in constructing a coup dummy, he assigns the value of 1 for years prior to the first coup in 1987 and zero for the rest of the period. This is econometrically incorrect. The shock should be the other way around with the coup dummy taking the value zero for the years prior to 1987 and 1 thereafter. We use two proxies for political instability. First, we employ a properly constructed coup dummy capturing the correct shock.

Second, we use a democracy index for Fiji compiled by the Freedom House, which measures the level of political freedom.

The fourth difference between this study and that of Gani (1998) is that we explicitly test the stability of the long run parameters. This is the first time this has been done in the literature on the determinants of immigration flows. Hanson (1992) warns that if the parameters of the model are unstable, the results will be unreliable. Consequently we apply Hanson's (1992) tests for parameter stability. We corroborate the results with a recent test for parameter stability advocated by Pesaran and Pesaran (1997).

The balance of the paper is set out as follows. The next section presents the empirical specification. Section III outlines the econometric methodology. Section IV presents the results. Foreshadowing the main results, we find that in the long run all variables are statistically insignificant, but are correctly signed with the exception of the unemployment differential. In the short run, in contrast to Gani's (1998) findings, political instability is consistently the most important determinant of migration flows while standard of living and real wage differentials are statistically insignificant across all specifications.

Section V reports the results of tests for parameter stability and the final section summarizes the main implications of the findings.

2. Empirical Specification

Following Gani (1998) and most other modern economic analysis of the migration decision, the empirical specification is based on Sjaastad's (1962) human capital model of migration. Sjaastad (1962) argued that a person will migrate if the present value of expected increased earnings exceeds the present value of investment costs. In practice, instead of attempting to directly measure the net present value of migration, empirical researchers have utilized a regression equation where the number of migrants is specified as a function of variables measuring earnings and costs of migration. The model of the determinants of migration takes the following form:

$$\begin{aligned} ln\,M_t &= \alpha_0 + \alpha_1\, ln\,Y_t + \alpha_2\, lnW_t + \alpha_3\, lnU_t + \alpha_4\, lnT_t + \alpha_5\, ln\,PI_t \\ &+ \alpha_6 Time_t + \varepsilon_t \end{aligned} \tag{1}$$

Two specifications of the dependent variable have been used in the empirical literature. Akbar and Deverotz (1993) use the absolute number of migrants, while Brosnan and Poot (1987) and Gani (1998) use migrants as a proportion of the population in the origin country. Allowing for these different equations we estimated two versions of equation (1). In the first specification M is the total number of migrants from Fiji to New Zealand and in the second specification M is the total number of migrants from Fiji to New Zealand as a proportion of Fiji's population.

W is the real average weekly wage in New Zealand less the real average weekly wage in Fiji (both in US dollars). The real wage in New Zealand is about three to four times higher than in Fiji and the differential has increased over time. We expect that as the wage differential between New Zealand and Fiji widens, it will have a positive impact on migration from Fiji to New Zealand. U is the unemployment rate in Fiji less the unemployment rate in New Zealand. We use unpublished statistics on unemployment in Fiji obtained from the Fiji Bureau of Statistics.[i] The unemployment rate in Fiji has been consistently higher than the comparable figures for New Zealand. *A priori*, the expectation is that the level of migration from Fiji to New Zealand will be positively related to the difference in unemployment rates.

Y is the standard of living differential. The standard of living is proxied by real per capita income in New Zealand less real per capita income in Fiji (both in US dollars). Similar to real wages and unemployment, there is a significant gap between the per capita incomes of New Zealand and

Fiji and the income differential has shown a slight increase over time. We expect that as the standard of living in New Zealand improves in relation to Fiji, more people will migrate from Fiji to New Zealand.

T is the costs of migration. The costs are potentially broad including the monetary costs of moving, the opportunity cost of income foregone while moving and the psychic displeasure felt from leaving family and friends (Gani, 1998: 61). Because it is difficult to adequately capture all these costs in a time series analysis, we follow the extant literature and restrict our measure of cost to the real cost of transport. In our analysis transport costs are proxied by the one way economy class airfare from Nadi in Fiji to Auckland in New Zealand. We expect that the real cost of transport will have a negative effect on the decision to migrate from Fiji to New Zealand.

PI represents political instability. Political instability since the first coup in 1987 has had a deleterious effect on Fiji's economic and social fabric including loss of life, damage to property, fear of persecution and general loss of confidence in the economy. Moreover, as Naidu (1997: 2) notes "the loss of skilled and professional citizens has severely weakened Fiji's administrative, financial, legal social, political and economic institutions". This stands in contrast to New Zealand's long tradition of participatory democracy going back to the 1890s. As indicated in the introduction we use two proxies for political instability. First, we proxy PI with a dummy variable, which takes the value of one for 1987-2000 and zero otherwise. Second, we use the democracy index compiled by Freedom House. An increase in the value of the index represents lower levels of political freedom.[ii] We expect that increases in political instability coupled with lower levels of political freedom will have a positive effect on migration from Fiji to New Zealand. Finally, a time trend is used to capture secular trends in migration and ε is a normally distributed error term.

Equation 1 is estimated using annual data for the period 1972-2001, because while data on migration from Fiji to New Zealand and on most of the explanatory variables are available for a longer time period, the democracy index is only available for the 1972-2001 period. The democracy index is sourced from Freedom House. The data on migration levels from Fiji, Fiji's population, real average weekly income and unemployment in Fiji are sourced from the Fiji Bureau of Statistics. Real weekly wages in New Zealand is extracted from the New Zealand Yearbook while the unemployment rate is sourced from the New Zealand Department of Statistics. Real per capita gross domestic incomes for both countries are extracted from the World Bank World Tables. Finally, the one way economy class airfare from Nadi in Fiji to Auckland in New Zealand is extracted from the *ABC World Airways Guide/OAG World Airways Guide (Red Book)*, published by the Reed Group.

3. Cointegration Methodology

As discussed in the introduction, we use the bounds testing approach to cointegration within an ARDL framework. The augmented ARDL $(p, q_1, q_2, \ldots, q_k)$ model can be written as follows (Pesaran and Pesaran, 1997: 397-399, Pesaran *et al* 2001):

$$\Omega(L,p)y_t = \alpha_0 + \sum_{i=1}^{k} \beta_i(L,q_i)x_{it} + \delta' w_t + \mu_t \tag{2}$$

where

$$\Omega(L,p) = 1 - \Omega_1\delta_1 L^1 - \Omega_2\delta_2 L^2 - \ldots - \Omega_p L^p, \tag{3}$$

$$\beta_i(L,q_i) = \beta_{io} + \beta_{i1}L + \beta_{i2}L^2 + \ldots + \beta_{iqi}L^{qi}, \; i = 1,2,\ldots, k, \tag{4}$$

Here y_t is the dependent variable; α_o is a constant; L is a lag operator such that $Ly_t = y_{t-1}$; and w_t is a $s \times 1$ vector of deterministic variables such as the seasonal dummies, time trends, or exogenous variables with fixed lags. The x_{it} in Equation (2) is the i independent variable (i=1,2,...,k). In the long-run $y_t = y_{t-1} = \ldots = y_{t-p}$; $x_{it} = x_{i,t-1} = \ldots = x_{i,t-q}$ where $x_{i,t-q}$ denotes the q^{th} lag of the i^{th} variable.

The long-run coefficient for a response of y_t to a unit change in x_{it} are estimated by:

$$\beta_i = \frac{\hat{\beta}_i(1,\hat{q}_i)}{\Omega(1,\hat{p})} = \frac{\hat{\beta}_{i0} + \hat{\beta}_{i1} + \ldots + \hat{\beta}_{i\hat{q}}}{1 - \hat{\Omega}_1 - \hat{\Omega}_2 - \ldots - \hat{\Omega}_{\hat{p}}},\ i = 1,2,\ldots,k \tag{5}$$

where $\hat{p}$ and $\hat{q}_i$, $i = 1,2,\ldots,k$ are the selected (estimated) values of p and q_i, $i = 1,2,\ldots k$. Similarly, the long-run coefficients associated with the deterministic/exogenous variables with fixed lags are estimated by:

$$\delta' = \frac{\hat{\delta}(\hat{p},\hat{q}_1,\hat{q}_2,\ldots,\hat{q}_k)}{1 - \hat{\Omega}_1 - \hat{\Omega}_2 - \ldots - \hat{\Omega}_p}, \tag{6}$$

where $\hat{\delta}(\hat{p},\hat{q}_1,\hat{q}_2,\ldots,\hat{q}_k)$ denotes the ordinary least squares estimate of δ in Equation (2) – the selected ARDL model. The error correction (EC) representation of the $\text{ARDL}(\hat{p},\hat{q}_1.\hat{q}_{2,\ldots,}\hat{q}_k)$ model can be obtained by writing Equation (2) in terms of the lagged levels and the first differences of $y_t, x_{1t}, x_{2t,\ldots,} x_{kt}$ and w_t:

$$\Delta y_t = \Delta\alpha_0 - \sum_{j=1}^{\hat{p}-1}\Omega_j^{*}\Delta y_{t-j} + \sum_{i=1}^{k}\beta_{i0}\Delta x_{it} - \sum_{i=1}^{k}\sum_{j=1}^{\hat{q}_i-1}\beta_{ij}^{*}\Delta x_{i,t-j} + \delta'\Delta w_t$$
$$- \Omega(1,\hat{p})ECM_{t-1} + \mu_t \qquad (7)$$

where ECM_t is the correction term defined by

$$ECM_t = y_t - \hat{\alpha} - \sum_{i=1}^{k}\hat{\beta}_i x_{it} - \delta' w_t \qquad (8)$$

Here Δ is the first difference operator; Ω_j^{*}, β_{ij}^{*} and δ' are the coefficients relating to the short-run dynamics of the model's convergence to equilibrium while $\Omega(1,\hat{p})$ measures the speed of adjustment. The bounds testing procedure involves two stages. The first stage is to establish the existence of a long-run relationship in equation (1). This is based on estimating error correction models by treating each variable, in turn, as a dependent variable. For example, when emigration is taken as a dependent variable the Unrestricted Error Correction Mechanism (UECM) is of the form:

$$\Delta \ln M_t = a_{0M} + \sum_{i=1}^{n} b_{iM}\Delta \ln M_{t-i} + \sum_{i=0}^{n} c_{iM}\Delta \ln Y_{t-i} + \sum_{i=0}^{n} d_{iM}\Delta \ln W_{t-i}$$
$$+ \sum_{i=0}^{n} e_{iM}\Delta \ln U_{t-i} + \sum_{i=0}^{n} f_{iM}\Delta \ln T_{t-i} + \sum_{i=0}^{n} g_{iM}\Delta \ln PI_{t-i} + h_{iM}Time_t \qquad (9)$$
$$+ \lambda_{1M}\ln M_{t-i} + \lambda_{2M}\ln Y_{t-i} + \lambda_{3M}\ln W_{t-i} + \lambda_{4M}\ln U_{t-i} + \lambda_{5M}\ln T_{t-i}$$
$$+ \lambda_{^\wedge M}\ln PI_{t-i} + \varepsilon_{1t}$$

Similarly, by taking the wage differential, unemployment differential, living standard differential, real cost of transport and democracy index as the dependent variable, error correction models can be constructed. The F test is used for testing the existence of a long-run relationship. When a long-run relationship exists, the F test indicates which variable should be normalised. We can take the variables in Equation 9 as an example. The null hypothesis of no cointegration amongst the variables in Equation 9 is $(H_0 : \lambda_{1M} = \lambda_{2M} = \lambda_{3M} = \lambda_{4M} = \lambda_{5M} = \lambda_{6M} = 0)$ against the alternative hypothesis $(H_1 : \lambda_{1M} \neq \lambda_{2M} \neq \lambda_{3M} \neq \lambda_{4M} \neq \lambda_{5M} \neq \lambda_{5M} \neq 0)$. This can also be denoted as follows: $F_M(M|Y,W,U,T,PI)$. The F test for the null hypothesis of no cointegration amongst the variables in other Error Correction Mechanisms can be constructed in a similar fashion to that described here for Equation 9.

The F test has a non-standard distribution which depends upon whether variables included in the ARDL model are $I(0)$ or $I(1)$ and the number of regressors. Two sets of critical values are reported in Pesaran and Pesaran (1997), which provide critical value bounds for all classifications of the regressors into purely $I(1)$, purely $I(0)$ or mutually cointegrated. If the computed F statistics falls outside the critical bounds, a conclusive decision can be made regarding cointegration without knowing the order of integration of the regressors. For instance, if the empirical analysis shows that the estimated $F_M(.)$ is higher than the upper bound of the critical values then the null hypothesis of no cointegration is rejected. Once a long-run relationship has been established, in the second stage, a further two step procedure to estimate the model is carried out. First the orders of the lags in the ARDL model are selected using an appropriate lag selection criteria such as the Schwartz Bayesian Criteria (SBC) and in the second step the selected model is estimated by ordinary least squares.

4. Empirical Results

In the first step of the ARDL analysis we tested for the presence of long-run relationships in equation (1). As we use annual data, the maximum number of lags in the ARDL was set equal to 2. The calculated F-statistics are reported in Table 1. In both versions of equation (1), $F_M(.)$ is higher than the upper bound critical value. In model 1 where the absolute number of immigrants is the dependent variable, the calculated F-statistic of 5.134 is greater than the upper critical value bound of 4.329 at the 5 per cent significance level. In model 2 where migration as a proportion of the population in Fiji is the dependent variable, the calculated F-statistic of 5.496 is greater than the upper critical value bound of 5.331 at the 1 per cent significance level. Thus, the null hypothesis of no cointegration cannot be accepted and there is a long run cointegration relationship amongst the variables in each of the models.

Once we established that a long-run cointegration relationship existed, Equation (1) was estimated using the following ARDL (m,n,p,q,r,s) specification:

$$\begin{aligned} lnM_t &= \alpha_0 + \sum_{i=1}^{m}\alpha_1 lnM_{t-i} + \sum_{i=0}^{n}\alpha_2 lnY_{t-i} + \sum_{i=0}^{p}\alpha_3 lnW_{t-i} \\ &+ \sum_{i=0}^{q}\alpha_4 lnU_{t-i} + \sum_{i=0}^{r}\alpha_5 lnT_{t-i} + \sum_{i=0}^{s}\alpha_6 lnPI_{t-i} + \alpha_7 Time + \varepsilon_t \end{aligned} \qquad (10)$$

In estimating Equation (10) a maximum of 2 lags was used (i_{max}=2). The estimated models presented here are based on minimizing the SBC. The empirical results for each of the models, obtained through normalising on the log of migration and log of migration as a proportion of population, in the long run are reported in table 2. Equation (1) and hence (10) were also estimated without the PI variable. The test for cointegration was also conducted excluding the PI variable. The findings indicated the existence of a long-run relationship among the variables without the PI (democracy index) variable. For brevity, these results are not presented here. The existence of cointegration allows the short-run model to be estimated. In doing so, we use the coup dummy variable as a proxy for PI. The empirical results for each of the models in the short run, together with diagnostic tests are presented in table 3.

Beginning with the long run results in table 2 all variables are statistically insignificant, although correctly signed with the exception of the unemployment differential, which has a negative sign. Using the Engle-Granger (1987) framework, Gani (1998) found that in the long run the living standards differential and real cost of transport was statistically insignificant, while the unemployment and wage differentials were statistically significant. This result is not surprising given the Engle-Granger (1987) method tends to give unreliable results with finite samples, in particular when applied to a model with more than one explanatory variable.

Turning to the short run results in table 3, the error term EC_{t-1} is statistically significant for each of the models with the correct sign, confirming that a long run equilibrium relationship exists between the variables. The error correction coefficient varies between –0.223 and –0.333, which suggests that once shocked convergence to equilibrium in each of the models is moderate. In each case, the short-run models pass all of the diagnostic tests for autocorrelation, functional form, normality of the residuals and heteroskedasticity. The fit of the models in each case is relatively good, although it is much better with the democracy index than the coup dummy variable.

The living standard and wage differentials are consistently statistically insignificant across all short run models. Gani (1998) also found that the living standard differential was statistically insignificant, while the wage differential was statistically significant in his short run model. As Gani (1998: 65) points out it is possible that differences in per capita real income are too narrow to measure differences in living standards and therefore it does not properly reflect the effect of differences in living standards on the migration decision. As Lam (2002) emphasizes, another factor is that while the real average wage is higher in the receiving country, migrants expectations of future earnings often go unrealized. In some cases this is because their qualifications are not recognized in the receiving country or because they face other forms of discrimination in the labour market. This is reinforced by the fact that most people who are in a position to migrate already belong to the upper income category of Fiji society and therefore enjoy higher living standards than average Fijians.

While not directly comparable, previous studies, which have used reduced-form supply-demand models to analyze the determinants of skilled migration have used real income in the destination country to capture the effect of the expected improvement in economic welfare on the migration decision. These studies have got mixed results for this variable. Akbar and Devoretz (1993) and Gani and Ward (1995) found that real income in Canada (for the period 1976-86) and New Zealand respectively was a positive and statistically significant determinant of skilled migration. However, Devoretz and Maki (1983) and MacPhee and Hassan (1990) found that real income in Canada (for the period 1966-73) and the United States respectively was not a statistically significant determinant of skilled migration.

The real cost of transport has the expected sign in all short run models and is statistically significant at the 5 per cent level in both of the models, which use the coup dummy variable to proxy political instability. This latter result differs from Gani (1998) where the cost of migration is statistically insignificant with the wrong sign. Our finding for the models with the coup dummy is consistent with Brosnan and Poot's (1987) study of Trans-Tasman migration, which also found the cost of migration to have a negative and statistically significant effect on migration.

The unemployment differential has an unexpected negative sign and is statistically significant in the models where the democracy index proxies political instability. There are two possible reasons for this result. First, this finding might partly reflect Fiji's large informal sector. While the unemployment rate in Fiji is high, many of these unemployed workers are absorbed into the informal sector (Prasad 1998). Second, most of the people immigrating from Fiji to New Zealand following the coups have been skilled professionals, rather than people who find it difficult to find jobs in Fiji (Mohanty 2001, 2002a). Of course skilled professionals are also more attractive to destination countries and as such professionals with skills that are in demand will find it easier to immigrate than those who are unemployed. In 1986 New Zealand changed its immigration regulations to encourage professional immigrants with qualifications. New Zealand's current goal is "to allow entry to migrants who would make the highest contribution to employment and income growth" (Winkelmann 2001: 8). This focus of immigration policy makes it much easier for Indo-Fijians with skills and money to invest to move to New Zealand (Brake 1993).

On the face of it our result for the unemployment differential differs from Gani (1998). Gani (1998) also finds the unemployment differential to be negative and statistically significant. However, Gani (1998) purports to measure the unemployment differential as the unemployment rate in New Zealand less the unemployment rate in Fiji. If the unemployment differential is measured in this way, a negative sign on the unemployment differential is expected. We measure the unemployment differential as the unemployment rate in Fiji less the unemployment rate in New Zealand because the unemployment rate in Fiji has been consistently higher than the unemployment rate in New Zealand.[iii] Thus, measuring the unemployment differential in the manner Gani (1998) does gives negative values. This precludes taking the natural log and thus rules out using a log specification. What is puzzling, though, is that according to Gani's (1998) empirical specification he also takes the natural log of the unemployment differential (see Gani 1998: 59). It is not clear how he does this given how he constructs the unemployment differential.

In contrast to Gani (1998) both proxies for political instability are statistically significant with the expected sign. The democracy index is significant at 1 per cent in both the current period and with a one period lag. The result for the one period lag is consistent with the fact that migration is often associated with a time lag. The finding for political instability is consistent with Gani and Ward (1995) who find that political instability is significant and positively related to the migration flow of professionals from Fiji to New Zealand. It is also consistent with the findings of Huang (1987) and Lam (2002) for other countries. Huang (1987) found that an index of political and civil rights was the major factor explaining indirect skilled migration to the United States, while the effect of income differentials was quite small. Lam (2002) found that lack of political confidence in the Chinese government was the major determinant of outward migration from Hong Kong following the end of British rule in 1997.

5. Constancy of Cointegration Space

Hansen (1992) cautions that estimated parameters of a time series may vary over time. In the light of this, parameter tests are important, since unstable parameters can result in the model being misspecified, which has the potential to bias the results. To test for parameter stability we use the Pesaran and Pesaran (1997) and Hansen (1992) tests.

According to Pesaran and Pesaran (1997), the short-run dynamics are essential in testing for the stability of the long-run coefficients. The Pesaran and Pesaran (1997) test amounts to estimating the following error correction model.

$$\begin{aligned} \Delta lnM_t &= \alpha_0 + \sum_{i=1}^{m}\alpha_1 \Delta lnM_{t-i} + \sum_{i=0}^{n}\alpha_2 \Delta lnY_{t-i} + \sum_{i=0}^{p}\alpha_3 \Delta lnW_{t-i} \\ &+ \sum_{i=0}^{q}\alpha_4 \Delta lnU_{t-i} + \sum_{i=0}^{r}\alpha_5 \Delta lnT_{t-i} + \sum_{i=0}^{s}\alpha_6 \Delta lnPI_{t-i} + \kappa ECM_{t-1} + \varepsilon_t \end{aligned} \tag{11}$$

Once Equation (11) has been estimated, Pesaran and Pesaran (1997) suggest applying the cumulative sum of recursive residuals (CUSUM) and the CUSUM square (CUSUMSQ) tests proposed by Brown *et al* (1975) to assess the parameter constancy. Equation (11) was estimated by ordinary least squares and the residuals were subjected to the CUSUM and CUSUMSQ test. Figures 1 and 2 plot the CUSUM and CUSUMSQ statistics for the two versions of equation (11). The results clearly indicate parameter constancy since the plot of the CUSUM and CUSUMSQ statistics are confined within the 5% critical bounds of parameter stability.

As a further check on parameter stability the parameter non-constancy tests for $I(1)$ processes advocated by Hansen (1992) were employed. Hansen (1992) proposes three tests – $SupF$, $MeanF$, and L_C – which all have the same null hypothesis but differ in their choice of alternative hypothesis. The $SupF$ test is predicated on ideas inherent in the classical Chow F-tests. The alternative hypothesis is a sudden shift in regime at an unknown point in time, and amounts to calculating the Chow F-statistic. This test statistic takes the following form: $SupF = SupF_{t/T}$, where $F_{t/T}$ is the F-test statistic. To perform the $SupF$ test requires truncation of the sample size T. We follow the approach in Hansen (1992) and use the subset $[0.15T, 0.85T]$.

The $MeanF$ test is appropriate when the question under investigation is whether or not the specified model is a good model that captures a stable relationship (Hansen, 1992). It is computed as an average of the $F_{t/T}$. Finally, the L_C statistic is recommended if the likelihood of parameter variation is relatively constant throughout the sample. The test results and their probability values are reported in Table 4. They indicate parameter stability, since the probability values for each test, for both versions of equation (11), are greater than 0.05. Thus, the results of the Hansen test statistics are consistent with those of the Pesaran and Pesaran (1997) test.

6. Conclusions and policy implications

In this paper we examine the short run and long run determinants of migration from Fiji to New Zealand. The main motivation for the study was to reconsider the findings of an earlier study by Gani (1998) on the same subject. The present study differs from Gani (1998) in several respects. The most important difference is that we use a more recent cointegration technique – the bounds testing approach – that provides more robust results in finite sample sizes than the Engle Granger (1987) approach used by Gani (1998). Moreover, we have suggested that Gani's (1998) construction of the coup dummy variable was incorrect for he assigns the value one for the pre-coup years and zero for the coup years. In addition to correcting this, we also use a democracy index for Fiji to proxy political instability. Further, given that our data set is longer, it enables us to model the impact of the 2000 coup in Fiji. Lastly on the methodological front, we explicitly tested the stability of our model using the Hansen (1992) suite of tests and the Pesaran and Pesaran (1997) test for parameter stability.

Our statistical tests indicate that the variables in our migration model are cointegrated. This is corroborated by the finding that the error correction term is negatively signed and statistically significant. Amongst our key results, in sharp contrast to the finding of Gani (1998), and as expected, we find that political instability has a positive and statistically significant impact on migration from Fiji to New Zealand in the short-run. This has important policy implications for Fiji. The high rates of professional and skilled migration have been a concern for policy makers for over a decade.

The impact of the human capital loss is being felt particularly in the education and medical sectors. Of the total number of migrants leaving Fiji between 1987 and 2000, teachers have been the single largest professional group that Fiji has lost. Migration of teachers makes up 30 per cent of total migrants. This is having a disastrous effect on the quality of education in Fiji, particularly at the primary and secondary school level. While new graduates are coming through to compensate for the numbers immigrating, it is impossible to replace the years of experience lost, at least in the short-term.

During the 1987-2000 period migration of medical workers made up 14 per cent of total migrants leaving Fiji. The fact that Fiji is losing its nurses in large numbers is of particular concern. One report suggests that in 1999 149 nurses of all ranks migrated, in 2000 the comparable number was 124 and in 2001 the figure was 130.[iv] This has had a negative effect on the quality of medical services in the country. Losing these professionals, together with the loss of accountants and architects, which make up around 37 per cent of the total migrants, represent ominous signs for Fiji given that skilled human capital is a vital ingredient for economic growth and development.

In light of this, it is essential that Fiji retain its skilled and professional labour. Our empirical results suggest that if this is to be achieved political stability must rank high as a priority. Political conflicts should be resolved within the confines of the constitution, which would curtail fears of insecurity and contribute to confidence in the nation. We believe that confidence grows with equal distribution of resources, equal opportunities for employment, and non-discriminatory policies, something that has unfortunately not been present in Fiji ever since the first military coups in 1987.

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Table 1: F-statistics for Cointegration Relationship

Critical value bounds of the F statistic						
	90% level		95% level		99% level	
k	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$
5	2.782	3.827	3.189	4.329	4.011	5.331

Calculated F-statistics		
	Model 1(Dependent variable is $\ln M_t$)	Model 2 (Dependent variable is $\ln(M_t/P_t)$)
$F_M(M\|Y,W,U,T,PI)$	5.1347	5.4960
$F_Y(Y\|M,W,U,T,PI)$	2.7897	2.8511
$F_W(W\|Y,M,U,T,PI)$	0.9442	0.8689
$F_U(U\|Y,W,M,T,PI)$	3.0555	3.1773
$F_T(T\|Y,W,U,M,PI)$	1.6375	1.6820
$F_{PI}(PI\|Y,W,U,T,M)$	2.6515	2.7032

Notes: The critical value bounds are from Table F in Pesaran and Pesaran, (1997: 484). k is the number of regressors.

Table 2: Estimated long-run coefficients using the ARDL approach

Regressor	Model 1 (Dependent variable is lnM_t)	Model 2 (Dependent variable is $ln(M_t/P_t)$)
lnY_t	5.9078	6.3995
	(1.0051)	(0.9874)
lnW_t	0.1137	0.1837
	(0.0792)	(0.1141)
lnU_t	-3.1541	-3.6460
	(-1.4758)	(-1.4779)
lnT_t	-3.4151	-3.9093
	(-0.8525)	(-0.8723)
$lnPI_t$	0.4263	0.2006
	(0.3121)	(0.1301)
Time	0.2376**	0.2585**
	(2.3029)	(2.2146)
Constant	-27.2529	-41.6482
	(-0.4093)	(-0.5798)

Note: ** denotes statistical significance at the 5% level.

Table 3: Short-run coefficients

Regressors	Model 1	Model 1 (without the democracy index)	Model 2	Model 2 (without the democracy index)
ΔlnY_t	1.9278	0.3723	1.9661	0.3261
	(1.0505)	(0.2537)	(1.0354)	(0.2208)
ΔlnW_t	0.0553	1.3409	0.0378	1.3039
	(0.1193)	(1.2230)	(0.0814)	(1.1818)
ΔlnU_t	-1.0983**	-0.3175	-1.0497*	-0.2645
	(-2.1429)	(-0.9622)	(-1.9948)	(-0.7964)
ΔlnT_t	-1.1777	-1.8221**	-1.1365	-1.8348**
	(-1.1924)	(-2.3446)	(-1.1232)	(-2.3491)
$\Delta\Delta PI_t$ (Democracy index)	1.0110***	-	1.0261***	-
	(2.7953)		(2.7631)	
$\Delta ln PI_{t-1}$ (Democracy Index)	0.8025**	-	0.7543**	-
	(2.6251)		(2.3918)	
$Coup_t$	-	0.4388**	-	0.4255**
		(2.4419)		(2.3503)
ECM_{t-1}	-0.3012*	-0.2234**	-0.3328*	-0.2341**
	(-1.7438)	(-2.1451)	(-1.8222)	(-2.2078)
Constant	-12.5462	-0.2847	-9.0697	-0.2668
	(-0.5621)	(-1.5440)	(-0.4022)	(-1.4370)
Diagnostic tests				
R^2	0.9056	0.4222	0.9001	0.4150
$\overline{R}^2$	0.8584	0.2777	0.8501	0.2688
$\chi^2_{Auto}(1)$	0.8328	1.0102	0.8290	0.7403
$\chi^2_{Norm}(2)$	0.0961	1.3464	0.2073	1.2206
$\chi^2_{Hetero}(1)$	0.1896	0.0565	0.5322	0.0093
$\chi^2_{RESET}(1)$	0.6934	0.0097	0.1122	0.0034

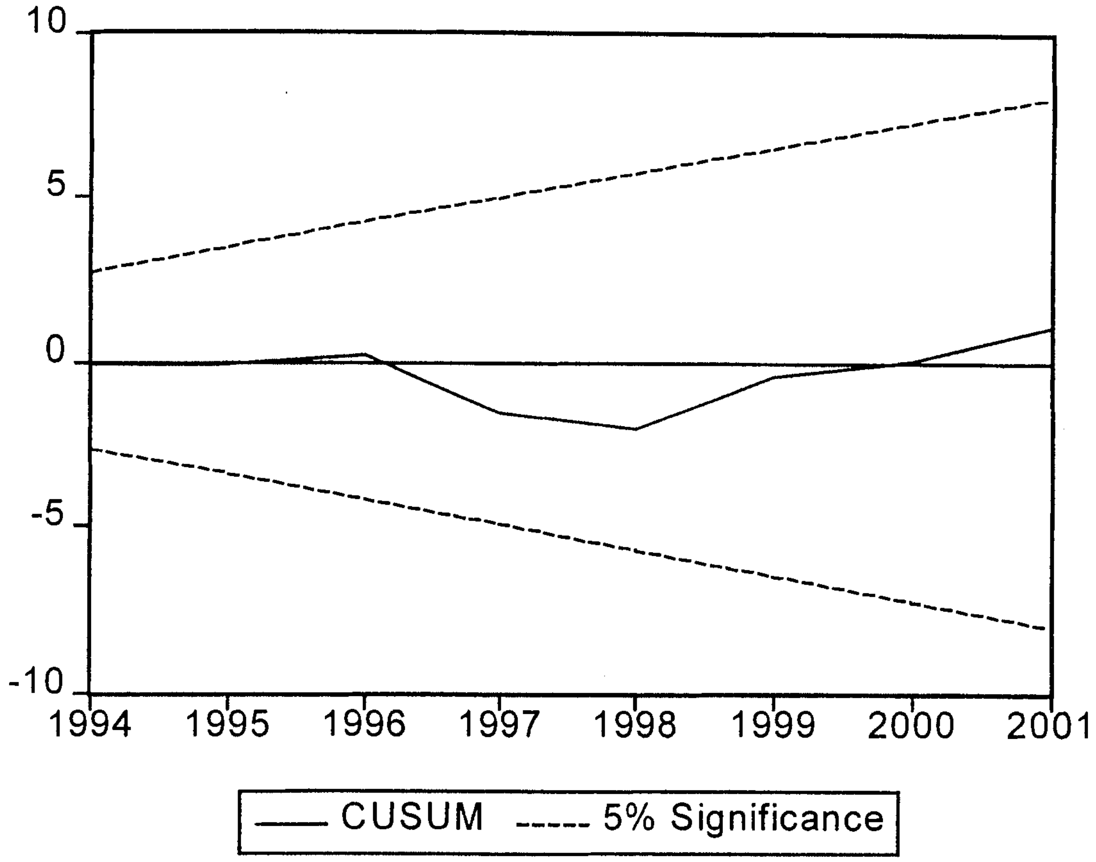
Notes: *(**)*** indicates statistical significance at the 10%, 5% and 1% levels respectively. The critical values for $\chi^2(1)$=3.84 and $\chi^2(2)$=5.99 at the 5% significance level.

Table 4: Hansen tests for parameter stability

Tests	Test statistic	Probability value
Model 1		
L_C	0.0681	>0.20
MeanF	0.7319	>0.20
SupF	1.9508	>0.20
Model 2		
L_C	0.0648	>0.20
MeanF	0.6976	>0.20
SupF	1.8043	>0.20

Note: The test program is available from http//www.ssc.wisc.edu/bhansen/

Figure 1: CUSUM and CUSUM Squares plot for model 1



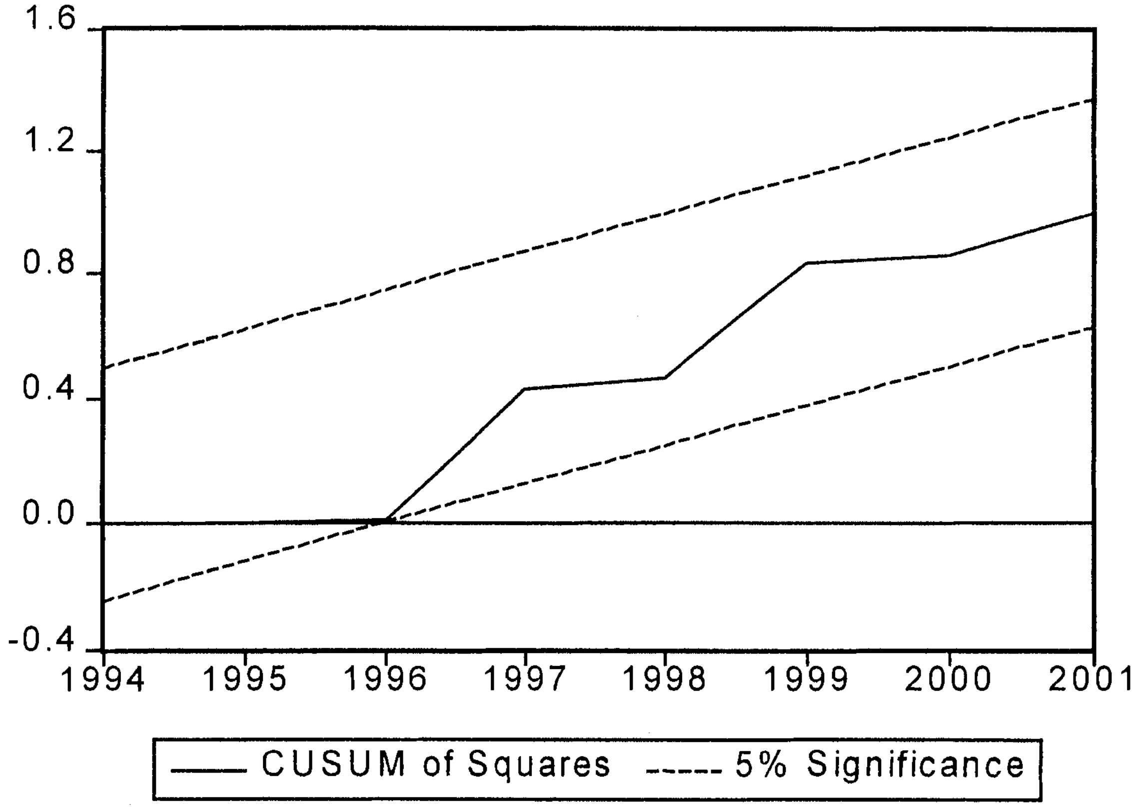
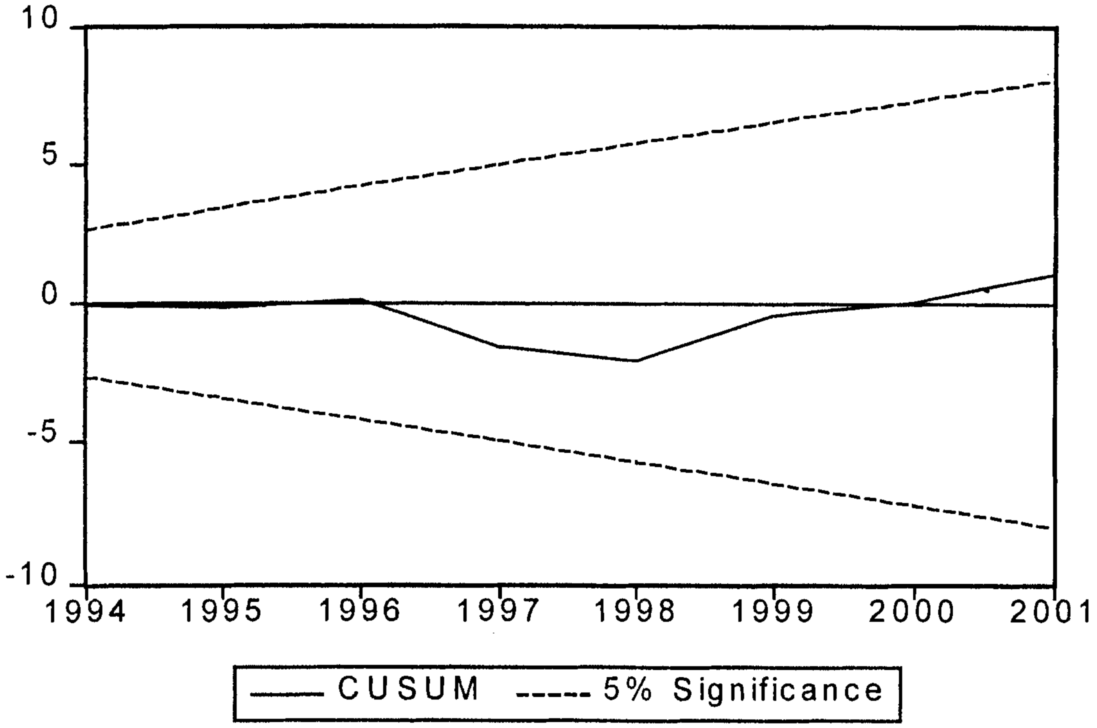
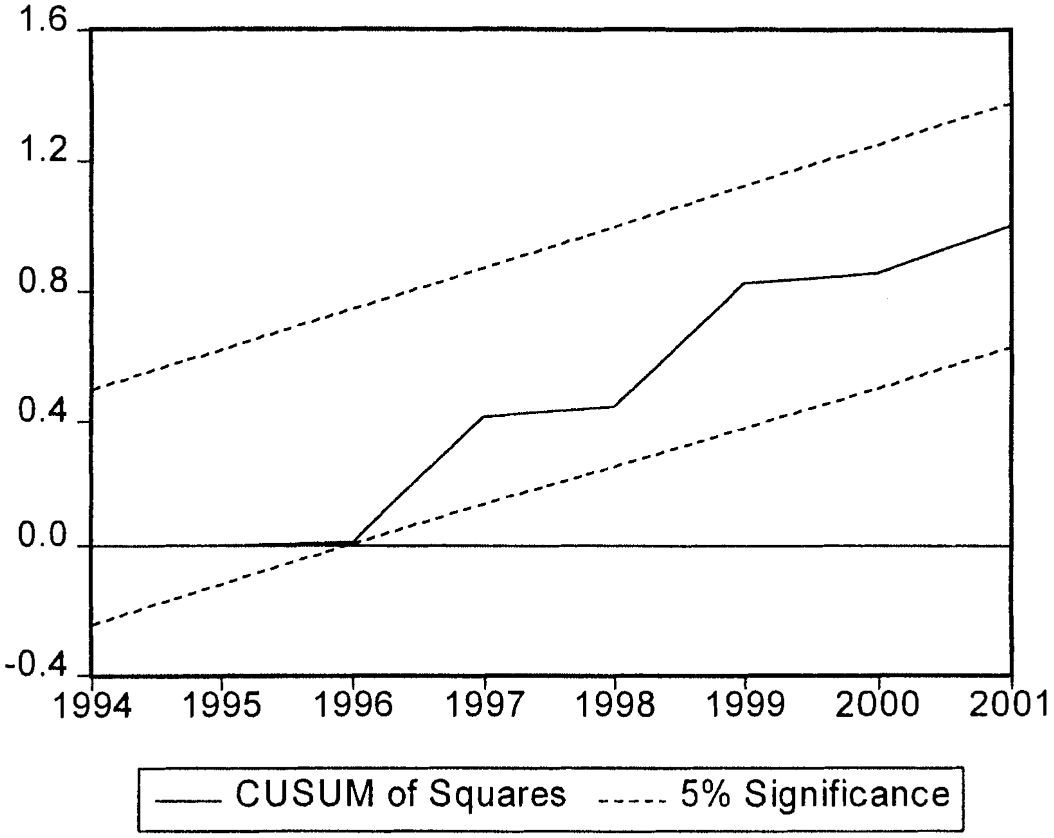


Figure 2: CUSUM and CUSUM Squares plot for model 2





Endnotes

[i] These figures are higher than the official unemployment statistics published by the Fiji Bureau of Statistics. The unpublished statistics are much closer to estimates of the actual unemployment rate by academics and others who have long argued that Fiji's official unemployment statistics understate the true amount. Chand (1998), for instance, estimates unemployment to be 20 per cent in 1998.

[ii] The democracy index is described as follows: "The characters representing scores for each year are, from left to right, political rights, civil liberties, and freedom status. Each of the first two is measured on a one-to-seven scale, with one representing the highest degree of freedom and seven the lowest. 'F', 'PF' and 'NF' respectively stand for 'free', 'partly free' and 'not free' Countries whose combined averages for political rights and for civil liberties fall between 1.0 and 2.5 are designated 'free' between 3.0 and 5.5 'partly free' and between 5.5 and 7.0 'not free'". For a fuller explanation of the methodology involved see http://www.freedomhouse.org/ratings/index.htm.

[iii] It is worth noting that Gani (1998) uses the official unemployment rate in Fiji, which is lower than the unpublished estimates of Fiji's unemployment that we use. The official unemployment rate in Fiji, however, is still consistently higher than the unemployment rate in New Zealand.

[iv] "Nurse Exodus", *Daily Post* (Suva, Fiji) March 23, 2003.

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