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Aid and Dutch Disease in the South Pacific

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Abstract

The impact of aid inflows on relative prices and output is ambiguous. Aid inflows that increase domestic expenditure are likely to cause real exchange rate appreciation, *ceteris paribus*. However, if this expenditure raises the capital stock in the traded goods sector, then output in this sector might not contract, at least in the steady state. Moreover, if investment in the nontraded goods sector is relatively high and/or productive, then there is not necessarily any real exchange rate appreciation in the steady state. We use time-series data to examine the impact of aid inflows on output and real exchange rates in ten South Pacific island states, and find aid inflows to produce a variety of outcomes in economies of different kinds.

Key words: aid, Dutch Disease, South Pacific

JEL classification: F41, O56

1. Introduction

There is already a large literature examining the macroeconomic consequences of aid inflows in developing countries. Part of this literature deals with the impact of aid on relative prices and output. An increase in foreign exchange income, from any source, is likely to impact on domestic relative prices (Corden, 1984). Under fixed nominal exchange rates in a small open economy, the effect is straightforward. The price of internationally traded goods is fixed on world markets, and increased domestic expenditure will raise only the price of goods that are not internationally traded. This relative price change will lead to a change in the composition of output, with the traded goods sector contracting, and a change in the sectoral allocation of resources. These changes do not *necessarily* lead to a reduction in social welfare, but welfare concerns arise when there are changes in the income distribution – especially when the poor own factors of production specific to the traded goods sector – and when there are externalities that motivate traded sector subsidies *ex ante*. In this case, the relative price changes work in the opposite direction to the appropriate subsidy, reducing aggregate productivity, so aggregate output falls, justifying the description of the relative price effect as 'Dutch Disease'.[1] Examples of this idea include van Wijnbergen (1984), Salehi-Esfahani (1988), Sachs and Warner (1995), Gylafson *et al*. (1997), Elbadawi (1999) and Adam and O'Connell (2004).

In fact, in the basic Dutch Disease model, the nature of the exchange rate regime makes little difference to the effects of an increase in foreign exchange income. Suppose for example that two goods (traded and nontraded) are produced by a single factor of production (labour). There will be two domestic market equilibrium conditions (for nontraded goods and for labour), and a Balance of Payments equilibrium condition, with only two endogenous relative prices: that of nontraded goods relative to traded goods and that of labour relative to traded goods. General equilibrium can only be attained through adjustment of real money balances, and in a basic model it does not matter whether this is achieved by nominal exchange rate adjustment or by an adjustment of foreign exchange reserves under a fixed nominal exchange rate.

The most interesting extensions to this basic framework explore the dynamics of a model in which some of the increased expenditure is on capital goods, as in Adam and Bevan (2006). Now, increased productivity in the nontraded goods sector can offset the standard relative price effect, at least in the steady state, and investment in the traded goods sector can

[1] The term was originally applied to the consequences of a natural resource discovery in the Netherlands.

offset any remaining contractionary effect there. It remains an empirical question how long it takes to reach the steady state, how much real exchange rate appreciation there is before the steady state is attained, and how much of a productivity loss there is during the transition period. Moreover, with sticky domestic prices, the nature of the exchange rate regime is likely to matter to the transition process. A flexible exchange rate – either a floating rate or an adjustable peg – is likely to facilitate faster relative price adjustment and a shorter transition period. *If* there are productivity losses during transition, then a fixed exchange rate is likely to entail some overall welfare loss.

In this paper we use time series data to explore the evidence for Dutch Disease effects from increased aid inflows in ten small open economies in the South Pacific. These countries display a substantial degree of economic heterogeneity, and we see a corresponding level of heterogeneity in their response to aid inflows. Before describing our econometric model, we briefly review existing evidence from other parts of the world.

2. Existing Evidence on Aid and Dutch Disease

Work on Dutch Disease in developing countries is hampered by a lack of data. All researchers face a choice between an econometric model that eschews much of the detail of the existing theory, and a more detailed model with parameters that are 'calibrated' rather than estimated. Time series and panel econometric studies mostly find a link between the real exchange rate and the volume of aid inflows. However, the elasticity of the real exchange rate with respect to aid varies substantially from one study to another. Adenauer and Vagassky (1998) find substantial real exchange rate appreciation effects in the countries of the West African Economic and Monetary Union. Similar results appear in the work of White and Wignaraja (1992) on Sri Lanka, and of Prati and Tressel (2006), who use a large cross-country panel. Here, estimates of the elasticity of the real exchange rate with respect to aid inflows range up to 30%. Bourdet and Falck (2006) find that aid inflows in the Cape Verde Islands also cause some real exchange rate appreciation, although the effect is relatively small, with an elasticity of less than 10%. In contrast, Nyomi (1998) and Sackey (2001) find that aid inflows lead to real exchange rate *depreciation* in Tanzania and Ghana, respectively. There is some depreciation even in the short run (i.e., within one year of an increase in aid). This suggests that in some countries the offsetting productivity effects kick in very quickly indeed, or that the standard Dutch Disease model is in some way inappropriate. In this regard, Atingi-Ego (2005) suggests that there is excess capacity in the nontraded goods sector of some African countries, so increases in demand are not likely to cause any substantial price increase.

Results from CGE models of the effect of aid inflows are similarly mixed. The work of Bandara (1995), Jemio and Jansen (1993), Jemio and Vos (1993) and Vos (1998) suggests that in some countries there is likely to be enough investment by firms in the traded goods sector to ensure that this sector expands as a result of an increase in aid inflows. Examples of this case include Mexico, Sri Lanka and Thailand. However, in other countries, such as Pakistan and the Philippines, there are more conventional Dutch Disease effects, with an appreciating real exchange rate and a contracting traded goods sector. The dynamic CGE model presented in Adam and Bevan (2004), which is calibrated to data from Uganda, indicates that the response of the real exchange rate and traded good production to an aid inflow is very sensitive to variations in the composition of aid expenditure. Nevertheless, substantial real exchange rate appreciation is much less likely in the steady state than it is in the short run. This result also appears in Laplange *et al*. (2001), one of very few papers to attempt to model the economies of the South Pacific. Calibrating a CGE model to data from the Cook Islands, where labour is internationally mobile, and Kiribati, where labour is mostly not internationally mobile, they find substantial real exchange rate appreciation in the short run, with aid elasticities of 25% and 10% respectively. However, steady state elasticities are very close to zero.

The existing evidence on the macroeconomic effects of aid inflows gives the overwhelming impression that there are few, if any, generalisations to be made across different developing countries. We should not expect to see uniformity in the macroeconomic response of different South Pacific economies to an increase in aid. As we will see, these countries do exhibit a great deal of macroeconomic heterogeneity; nevertheless, certain patterns do emerge.

3. Modelling the Macroeconomic Impact of Aid in the South Pacific

The developing economies of the South Pacific have received almost no attention in the macroeconomic literature. However, they account for a substantial fraction of the foreign aid budgets of Australia and New Zealand. The different Pacific islands encompass a wide variety of economies, and we explore the effect of official development assistance (ODA) in these islands as a representative case study of the impact of aid in small open developing economies.

Table 1 indicates some basic economic characteristics of the economies we will be looking at. Both Table 1 and our econometric analysis exclude those Pacific territories with a population of under ten thousand, and also those, such as Papua New Guinea, with a population of over one million. The largest is Fiji, with a population of close to one million, and a current level of PPP-adjusted *per capita* GDP of over five billion US Dollars. The smallest is Tuvalu, with a population of twelve thousand and a GDP of just over fifteen million Dollars. The different economies listed in Table 1 represent a wide range of *per capita* income levels. The French territories (French Polynesia and New Caledonia) are in the high middle-income range, with annual *per capita* income levels well in excess of ten thousand Dollars. At the other extreme, Tonga, Tuvalu and the Marshall Islands have annual *per capita* income levels of only around two thousand Dollars. There is even more variance in the levels of aid dependency. Over the past three decades, ODA to Fiji has amounted to only around 3% of GDP, while aid to Tuvalu has amounted to over 80%.

Table 2 shows the variation in economic structure for those ten territories for which adequate data are available from the UN National Accounts statistics database. The table includes figures for the share of GDP accounted for by value added in three broad aggregates of (potentially) traded goods: agriculture, forestry and fishing; mining and manufacturing; hotels, restaurants and retail trade. It can be seen that the relative sizes of these components, and of the residual (mostly publicly provided services) vary considerably from one island to another. The table also shows that the same is true of export performance. Four economies have a reasonably high level of export performance: in Fiji, Kiribati, the Solomon Islands and Vanuatu, the ratio of exports to GDP generally exceeds 50%. However, there are also two – the Cook Islands and French Polynesia – in which the ratio is typically below 10%.

[Tables 1-2 here]

Given this degree of macroeconomic heterogeneity, we should allow for substantial variation in the response of different territories to aid inflows. This suggests that cross-country panel data analysis is inappropriate in our case. However, macroeconomic data on these territories are very limited, with few economies in which many variables are recorded for a substantial length of time. For this reason, we will fit a very simple time-series model to the available data for our ten territories. The model we will use for territories with flexible nominal exchange rates is:

$$B(L)\begin{bmatrix}\ln(y_t)\\ \ln(e_t)\\ \pi_t\end{bmatrix} = c(L)aid_t + \begin{bmatrix}u_t^1\\ u_t^2\\ u_t^3\end{bmatrix} \qquad (1)$$

where y_t is real GDP in year t, e_t is the real exchange rate and π_t is the rate of growth of the GDP deflator. u_t^i is a reduced form regression residual for the i^{th} dependent variable. $B(L)$ is a 3×3 matrix of lag polynominals indicating the interaction of the three dependent variables, and $c(L)$ is a 1×3 matrix of lag polynomials indicating the impact on the system of our aid variable, aid_t. This is defined as the ratio of ODA in year t to nominal GDP in year t-1. (The use of lagged GDP makes more plausible the assumption that our aid variable is weakly exogenous.) In the absence of convincing data on the relative price of traded and nontraded goods in each territory,[2] the real exchange rate is defined as the ratio of the territory's GDP deflator to the Australian GDP deflator, making a currency conversion at the prevailing official nominal exchange rate. We note in passing that the use of a PPP proxy for the real exchange rate introduces some measurement error in one of our dependent variables, and hence entails some efficiency loss in our estimator, relative to the (infeasible) option of using measured prices of traded and nontraded goods. See Palermo (2002) for a fuller discussion of alternative real exchange rate definitions.

Equation (1) allows for the *possibility* that the real exchange rate and domestic inflation can evolve separately. This reflects the fact that some of the ten territories use a national currency, as indicated in Table 1. In these cases, the nominal exchange rate regime is usually an adjustable (sometimes undeclared) peg to a basket of foreign currencies, or else a dirty float. There is no commitment to a hard peg, and the nominal exchange rate can adjust in response to external shocks. For a given real exchange rate, some domestic inflation is possible, through proportional growth in both the domestic price index and the domestic currency price of the Australian Dollar. However, there are also some territories without any national currency; these territories use instead the Australian or New Zealand Dollar, or the CFP Franc. In these cases, domestic inflation cannot evolve separately from the real exchange rate, so the fitted VAR is:

$$B(L)\begin{bmatrix}\ln(y_t)\\ \ln(e_t)\end{bmatrix} = c(L)aid_t + \begin{bmatrix}u_t^1\\ u_t^2\end{bmatrix} \qquad (2)$$

omitting the inflation equation.

[2] Some territories report deflators for some components of GDP in some years. Even if the data were available for many countries for a substantial length of time, using these data would require some heroic assumptions about which sectors' output was internationally tradable.

The data we use are for 1970-2003. Annual real and nominal GDP figures (and hence the GDP deflator) are taken from the UN National Accounts statistics database, as are the relevant nominal exchange rates. ODA figures are taken from the OECD DAC.[3] One should note as a *caveat* that private capital flows are omitted from our model. Data on such flows are incomplete for many of the territories in our sample. However, what data do exist suggest that in most cases private flows have been very small relative to official flows, at least in the twentieth century.

The lag orders in $B(L)$ and $c(L)$ are determined empirically, using the Akaike Criterion as a guide. In all cases except that of Tuvalu two lags in $B(L)$ and one in $c(L)$ suffice; in Tuvalu two lags in $c(L)$ are necessary.

We cannot assume that the variables appearing in equations (1-2) are stationary. Generally, it is not possible to reject the null that they are I(1) in a sample as small as ours. However, it would be silly to try to apply the Johansen cointegration test in such a small sample, and other cointrgration tests assume the existence of a single cointegrating vector, an assumption that we have no good reason to make. Moreover, our main interest is in determining the size and sign of the impact of aid on the variables in our system, and we have no particular need to identify the parameters of a structural model from the reduced form parameters in $B(L)$ and $c(L)$. Our only real problem is in finding appropriate critical values for the t ratios on the reduced form parameters, particularly those in $c(L)$. If some of the variables are I(1), then the t ratios will not have the standard student's t distribution. We address this problem by bootstrapping our own t distributions from 100,000 replications of the fitted model.[4] In the null data generating process, the dependent variables are independent of aid, but otherwise with the properties of the fitted model. The model of aid under the null is $\Delta aid_t = \alpha + \varepsilon_t$ with the values of α and of the residual variance $V(\varepsilon)$ estimated from the data.

Table 3 provides summary statistics for the dependent variables in our ten territories. Average real growth rates over the last three decades vary from 1% in Kiribati to over 4% in Tonga and French Polynesia. However, in all cases the variance is very high relative to the mean. This is also true of growth in the real exchange rate and of the rate of domestic inflation. There is some trend in the real exchange rate in most territories, but one that is small relative to the year-on-year variation. The effects of aid discussed below should be seen in the

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[3] The figures also correspond to official development assistance data appearing in the World Bank *World Development Indicators*.

[4] The model is fitted using Pc-Give 10.0, and the replications are performed using Pc-Naive 2.0.

context of a region in which the typical economy is often being subjected to large real and nominal shocks.

[Table 3 here]

Tables 4-5 present the results of fitting the VAR model to the data for our ten territories. Table 5 reports all of the fitted coefficients, along with t ratios some descriptive and diagnostic statistics for the regression equations. The "Test 1" figures at the bottom of Table 5 are p-values for an LM autocorrelation test on the residual vector; the "Test 2" figures are p-values for a normality test on the residual vector. Note that in many cases there is a single outlier in the distribution of regression residuals, and so many of the VARs contain a single dummy for that outlier, in order to ensure that the residual distribution is approximately normal. Inclusion of the dummies does not make a substantial difference to the sizes and significance levels of the estimated coefficients. It turns out that aid has a statistically significant impact on output and/or inflation in four out of the ten cases: in the Cook Islands, Tuvalu, Tonga and Vanuatu. This should not be taken to imply that aid has no effect in the other six, but rather that with the limited data available we are able to reject the null that it is inconsequential in only the four cases. Table 4 reports just the aid coefficients and corresponding t ratios in the four territories, but also includes the simulated 5% critical values. Note that the coefficients in Table 4 are derived by fitting equation (1) to data from Tonga and Vanuatu, and fitting equation (2) to data from the Cook Islands and Tuvalu.

[Tables 4-5 here]

As Tables 1-3 show, the four territories appearing in Table 4 embody a substantial degree of macroeconomic heterogeneity. However, the one factor that they share is that they are the four smallest economies in our sample, measured by total GDP (Table 1, column 2). The strongest evidence for an aid effect is evident in the smallest territories. The size of average aid inflows relative to GDP is unusually high in one of them (Tuvalu), but not in the other three, at least in comparison with the six economies registering no significant aid effect (Table 1, column 3).

In three of the four territories (the Cook Islands, Tuvalu and Vanuatu), aid appears to be inflationary. Of these three territories, the two without a flexible nominal exchange rate regime (the Cook Islands and Tuvalu) register a significant real exchange rate appreciation, while the other (Vanuatu) registers significant domestic inflation without any significant change in the real exchange rate. One interpretation of these results is that in Vanuatu large aid inflows have been matched by a nominal exchange rate depreciation, which has prevented any real exchange rate appreciation. In the Cook Islands and Tuvalu, similar pressures cannot be released through nominal exchange rate adjustment: the Cook Islands use the New Zealand Dollar and Tuvalu the Australian Dollar. If the nominal exchange rate regime makes a difference here, then we are outside the bounds of a basic Dutch Disease model, as explained in the introduction. The importance of the nominal exchange rate regime suggests that there is some nominal rigidity at work. Nominal wage inertia is one possible explanation, although we do not have the data to test this hypothesis directly.

In Tonga, there is a significant but temporary real exchange rate *depreciation* in response to an aid inflow. As noted in the introduction, this is not the first country where such a result has been recorded; nevertheless, the reasons for the difference between Tonga and other small Pacific states warrant further investigation. Tonga is not an outlier along any of the dimensions featured in Tables 1-3.

The magnitude of the inflationary effects recorded in Table 4 is depicted in Figures 1-4. The figures show the response of real GDP and the real exchange rate (or, in Vanuatu, the rate of domestic inflation), with an increase in aid inflows equivalent to one year's GDP at t = 0. That is, the variable aid_t increases by one unit. This is a much larger change in aid inflows than is typical in any of our countries; it represents and extreme scenario in which there is a very large innovation in donor policy. But remember that in our linear model the patterns in the figure would be the same if the innovation were smaller; only the scaling would change. The hypothetical increase in aid is temporary, lasting for a single year, and for the purposes of the figures we assume that aid is strongly exogenous to the variables of interest.[5]

The figures for the Cook Islands and Tuvalu (Figures 1-2) look very similar, except for the scaling. The effects of a unit increase in aid_t in Tuvalu are very much smaller. However, average aid inflows in Tuvalu are very much larger as a fraction of GDP (Table 1, column 3), and a typical increase or decrease in aid there is much larger than in the Cook Islands. In both places, there is a substantial real exchange rate appreciation within the first two years following the innovation; the growth in the real exchange rate is around 30% in the Cook Islands and 6% in Tuvalu. Thereafter, the real exchange rate depreciates again, and by year 4 is close to its original level. The appreciation causes a dip in GDP (by around 15% in the Cook Islands and 3% in Tuvalu), although we can see from the GDP equation in Table 5

[5] Whether aid is in fact strongly exogenous is not relevant to the point of the exercise, which is to illustrate the effect of a purely hypothetical innovation in donor policy. Remember that the consistency of the regression estimates on which the figures are based depends only on the weak exogeneity of aid.

that this effect is only marginally significant. Thereafter, GDP quickly adjusts to it original level. In the unrestricted VAR that we have fitted, the final level of GDP is slightly higher than the initial level. This is consistent with aid improving productivity in the long run; however, this long-run effect is not statistically significant.

The response of GDP in Vanuatu (Figure 3) also looks quite similar, although adjustment back to the initial level of income is faster: GDP is very close to its initial level by year 3. This is consistent with the conjecture that nominal exchange rate adjustment in Vanuatu mitigates the inflationary effects of an increase in aid inflows, when otherwise nominal wage inertia may result in falling output. There is a short, sharp inflationary period with a 30% drop in GDP, but the economy soon returns to its initial state.

In Tonga (Figure 4), there is a short, sharp depreciation in the real exchange rate by about 30%. This is alongside an increase in GDP of a little over 10%. While the real exchange quickly returns to its initial level, the increase in GDP is persistent. With so little data, this permanent effect is on the edge of statistical significance. However, Tonga is the one country where there is at least some evidence that aid improves productivity in the long run.

[Figures 1-4 here]

4. Conclusion

We have fitted a simple conditional VAR to time-series data for ten Pacific economies in order to establish whether there is any evidence for the conjecture that aid inflows lead to real exchange rate appreciation and worsening competititveness. Our results are as mixed as those in the existing literature on aid and Dutch Disease in other parts of the world. We find significant effects only in a minority of our economies, and in one of these the effect is in the opposite direction to that normally assumed. However, there is clear evidence that the real exchange rate responds to changes in aid inflows in all of the smallest economies, suggesting that this is an issue at least partly related to size.

When aid does have an impact on the real exchange rate, it usually leads to an appreciation and loss of competitiveness. It can also lead to a temporary reduction in GDP. Possibly, these effects are more persistent in territories with no currency of their own, without the facility of nominal exchange rate adjustment. Certainly, the macroeconomic management of aid inflows is a serious challenge in very small island economies.

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Table 1: Pacific States and Territories with Populations of 10,000-1,000,000

State or Territory (own currency)	*Population (thousands)*[6]	*PPP Adjusted GDP (billions of USD)*[2]	*ODA 1970-2003 (% GDP)*[7]
Cook Islands (no)	21	0.11	26.7
Fiji (yes)	906	5.38	2.9
French Polynesia (no)	276	4.58	11.3
Kiribati (no)	105	0.79	39.7
New Caledonia (no)	219	3.16	12.7
Samoa (yes)	177	1.00	15.6
Solomon Islands (yes)	552	0.80	20.8
Tonga (yes)	115	0.24	19.3
Tuvalu (no)	12	0.02	81.9
Vanuatu (yes)	209	0.58	21.8
Without adequate data			
F.S. Micronesia (no)	108	0.28	
Marshall Islands (no)	60	0.12	
Nauru (no)	13	0.06	

Table 2: Main Identifiable Components of Sectoral Value Added and Exports as a Percentage of GDP, 1970-2003

	agriculture forestry fishing	mining manufacturing utilities	trade restaurants hotels	transport storage commun-ication	*exports*
Cook Islands	11.4	5.5	31.6	12.5	*6.8*
Fiji	17.3	15.7	14.9	11.1	*56.2*
French Polynesia	4.0	9.0	23.4	6.6	*9.1*
Kiribati	24.6	2.8	15.4	13.9	*58.1*
New Caledonia	2.0	19.1	23.0	5.5	*22.2*
Samoa	17.3	21.2	16.8	10.9	*26.2*
Solomon Islands	43.5	6.6	8.6	4.1	*57.9*
Tonga	28.3	6.5	12.6	6.9	*21.6*
Tuvalu	19.2	7.4	16.2	6.0	*15.9*
Vanuatu	22.6	6.5	32.9	7.7	*52.8*

[6] Source: CIA *World Factbook*.

[7] Source: OECD DAC.

Table 3: Annual Percentage Growth Rates, 1970-2003

	GDP		**real exch. rate**		**GDP deflator**	
	mean	*std. dev.*	mean	*std. dev.*	mean	*std. dev.*
Cook Islands	1.06	*5.39*	2.16	*9.20*	8.56	*6.45*
Fiji	3.17	*4.69*	-0.46	*9.14*	6.31	*6.00*
French Polynesia	4.33	*4.57*	0.43	*11.94*	4.98	*6.05*
Kiribati	0.95	*15.58*	-0.70	*6.31*	5.37	*5.90*
New Caledonia	2.42	*7.29*	0.01	*12.85*	4.56	*7.10*
Samoa	1.62	*3.62*	-0.95	*7.87*	7.76	*8.87*
Solomon Islands	3.29	*7.70*	-1.53	*11.40*	9.33	*7.47*
Tonga	4.28	*7.07*	-1.07	*11.05*	5.99	*11.45*
Tuvalu	3.05	*8.81*	1.24	*8.70*	7.31	*8.98*
Vanuatu	3.88	*7.70*	-2.24	*13.18*	2.75	*7.37*

Table 4: Aid Coefficients for the Cook Islands, Tonga, Tuvalu and Vanuatu

			coeff.	t ratio	5% c.v.[8]
Cook Islands	*GDP equation (y)*	*current aid*	-0.030	-0.79	
		lagged aid	**-0.120**	**-3.26**	**-2.13**
	RER equation (e)	***current aid***	**0.168**	**5.17**	**2.06**
		lagged aid	**0.207**	**4.18**	**2.07**
Tonga	*GDP equation (y)*	*current aid*	0.048	0.53	
		lagged aid	0.103	1.54	
	RER equation (e)	***current aid***	**-0.304**	**-2.19**	**2.09**
		lagged aid	**0.283**	**3.27**	**2.09**
	inflation equation (π)	*current aid*	-0.319	-1.53	
		lagged aid	0.223	2.10	
Tuvalu	*GDP equation (y)*	*current aid*	-0.009	-0.90	
		lagged aid	-0.010	-1.11	
		lagged aid (2)	**-0.026**	**-2.37**	**-2.00**
	RER equation (e)	***current aid***	**0.033**	**2.02**	**2.00**
		lagged aid	**0.026**	**2.17**	**2.00**
		lagged aid (2)	**0.029**	**2.29**	**1.99**
Vanuatu	*GDP equation (y)*	*current aid*	-0.090	-1.14	
		lagged aid	-0.365	-1.68	
	RER equation (e)	*current aid*	-0.129	-0.96	
		lagged aid	0.014	0.07	
	inflation equation (π)	***current aid***	**0.306**	**3.37**	**2.08**
		lagged aid	**0.316**	**3.76**	**2.09**

[8] Critical values are simulated from 100,000 replications using Pc-Naive 2.0. In the null DGP, the dependent variables are independent of aid, but otherwise with the properties of the fitted model. The model of aid under the null is $\Delta aid_t = \alpha + \varepsilon_t$ with values of α and $V(\varepsilon)$ estimated from the data.

Table 5: Fitted VAR Coefficients

	Cook Islands		Fiji		Fr. Polynesia		Kiribati		N. Caledonia		Samoa		Solomon Is.		Tonga		Tuvalu		Vanuatu	
ln(*y*) eq.	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***
$\ln(y)_{-1}$	1.36	*16.00*	0.18	*0.82*	0.62	*4.14*	0.90	*10.3*	0.87	*11.2*	0.99	*17.7*	0.94	*4.9*	1.12	*6.91*	0.97	*4.22*	0.56	*4.24*
$\ln(y)_{-2}$	-0.59	*-5.93*	0.12	*0.56*	0.33	*2.34*	-0.12	*-1.12*	-0.07	*-1.20*			-0.03	*-0.19*	-0.09	*-0.62*	-0.24	*-1.11*	0.23	*1.99*
$\ln(e)_{-1}$	0.12	*1.92*	-0.04	*-0.36*	0.02	*0.32*	0.59	*1.59*	0.25	*3.29*	0.03	*0.56*	-0.29	*-1.68*	-0.34	*-1.88*	0.16	*0.94*	-0.35	*-3.82*
$\ln(e)_{-2}$	-0.03	*-0.42*	-0.05	*-0.61*	0.02	*0.28*	-0.71	*-2.1*	0.19	*2.74*			0.14	*0.71*	0.47	*2.3*	0.03	*0.21*	0.01	*0.06*
π_{-1}			0.02	*0.14*							-0.06	*-1.54*	-0.01	*-0.04*	0.40	*1.73*			0.12	*0.65*
π_{-2}			-0.13	*-0.79*									0.14	*0.87*	-0.09	*-1.01*			0.20	*1.23*
aid	-0.03	*-0.79*	0.85	*1.34*	-0.34	*-0.64*	-0.10	*-0.80*	-0.78	*-1.84*	-0.17	*-1.19*	-0.40	*-1.68*	0.05	*0.53*	-0.01	*-0.90*	-0.09	*-1.14*
aid_{-1}	-0.12	*-3.26*	-1.50	*-1.19*	0.77	*1.47*	-0.10	*-0.60*	1.08	*2.58*	0.00	*0.02*	0.31	*1.47*	0.10	*1.54*	-0.01	*-1.11*	-0.36	*-1.68*
aid_{-2}																	-0.03	*-2.37*		
intercept	4.39	*3.27*	13.72	*3.35*	1.24	*2.06*	4.04	*1.97*	5.14	*5.18*	0.16	*0.14*	1.94	*2.16*	-0.66	*-1.11*	4.52	*2.78*	5.25	*2.66*
σ	0.03		0.04		0.04		0.07		0.05		0.04		0.07		0.04		0.09		0.04	
ln(*e*) eq.	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***
$\ln(y)_{-1}$	0.96	*5.89*	0.47	*1.24*	1.06	*5.21*	0.02	*0.30*	0.49	*1.66*	0.02	*0.24*	-0.08	*-0.3*	-0.90	*-2.81*	0.08	*0.43*	1.03	*3.22*
$\ln(y)_{-2}$	-0.48	*-2.43*	0.28	*0.61*	-0.93	*-4.21*	0.05	*1.30*	-0.24	*-0.80*			-0.02	*-0.08*	0.71	*2.42*	0.24	*2.05*	-1.01	*-3.50*
$\ln(e)_{-1}$	0.81	*10.9*	0.73	*4.20*	0.70	*4.00*	0.58	*4.68*	0.62	*2.43*	0.65	*6.00*	0.90	*3.01*	1.26	*3.59*	0.45	*2.41*	1.06	*8.62*
$\ln(e)_{-2}$	0.01	*0.17*	-0.28	*-1.80*	-0.47	*-2.67*	-0.04	*-0.32*	-0.37	*-1.58*			-0.66	*-1.57*	-0.77	*-2.34*	0.37	*2.28*	-0.14	*-1.23*
π_{-1}			-0.13	*-0.36*							-0.20	*-1.83*	-0.94	*-2.2*	-0.81	*-2.90*			-0.01	*-0.04*
π_{-2}			-0.10	*-0.65*									-0.44	*-3.47*	0.00	*-0.02*			-0.11	*-0.72*
aid	0.17	*5.17*	0.22	*0.14*	-0.95	*-0.84*	0.04	*0.56*	0.52	*0.56*	0.20	*1.08*	-0.27	*-1.01*	-0.30	*-2.19*	0.03	*2.02*	-0.13	*-0.96*
aid_{-1}	0.21	*4.18*	-4.38	*-1.70*	-0.69	*-0.97*	-0.08	*-0.84*	-0.54	*-0.54*	-0.56	*-1.86*	-0.43	*-1.97*	0.28	*3.27*	0.03	*2.17*	0.01	*0.07*
aid_{-2}																	0.03	*2.29*		
intercept	-8.98	*-5.56*	-13.05	*-1.54*	-3.05	*-1.54*	-1.17	*-1.46*	-6.42	*-3.22*	-0.33	*-0.19*	2.41	*2.03*	3.72	*4.63*	-5.31	*-2.87*	-0.46	*-0.32*
σ	0.05		0.08		0.09		0.06		0.11		0.07		0.10		0.07		0.06		0.06	
***π* eq.**			**coeff.**	***t ratio***							**coeff.**	***t ratio***	**coeff.**	***t ratio***	**coeff.**	***t ratio***			**coeff.**	***t ratio***
$\ln(y)_{-1}$			0.38	*1.32*							-0.15	*-1.28*	-0.10	*-0.51*	-0.84	*-2.53*			0.25	*1.93*
$\ln(y)_{-2}$			-0.27	*-0.79*									0.05	*0.32*	0.62	*2.12*			-0.16	*-1.52*
$\ln(e)_{-1}$			-0.20	*-1.50*							-0.24	*-1.56*	-0.27	*-1.19*	-0.26	*-0.60*			0.18	*2.12*
$\ln(e)_{-2}$			0.11	*1.30*									-0.10	*-0.54*	-0.25	*-0.56*			-0.05	*-0.57*
π_{-1}			0.57	*1.94*							0.07	*0.52*	-0.65	*-2.50*	-0.23	*-0.56*			-0.44	*-2.57*
π_{-2}			-0.33	*-1.81*									-0.26	*-2.24*	-0.01	*-0.07*			-0.04	*-0.44*
aid			-1.33	*-1.44*							-0.14	*-0.41*	-0.12	*-0.62*	-0.32	*-1.53*			0.31	*3.37*
aid_{-1}			-0.14	*-0.10*							-0.28	*-0.75*	-0.14	*-0.63*	0.23	*2.10*			0.32	*3.76*
intercept			-1.69	*-0.41*							3.24	*1.33*	1.34	*1.12*	4.14	*2.98*			-2.20	*-2.69*
σ			0.05								0.10		0.06		0.07				0.03	
test 1 (p)	0.25		0.07		0.92		0.17		0.61		0.85		0.44		0.96		0.87		0.06	
test 2 (p)	0.22		0.57		0.15		0.17		0.55		0.15		0.39		0.89		0.39		0.73	
additional effects	1976 dummy		trend				1980 dummy		1981 dummy						1984 dummy		1986 dummy		1983 dummy	

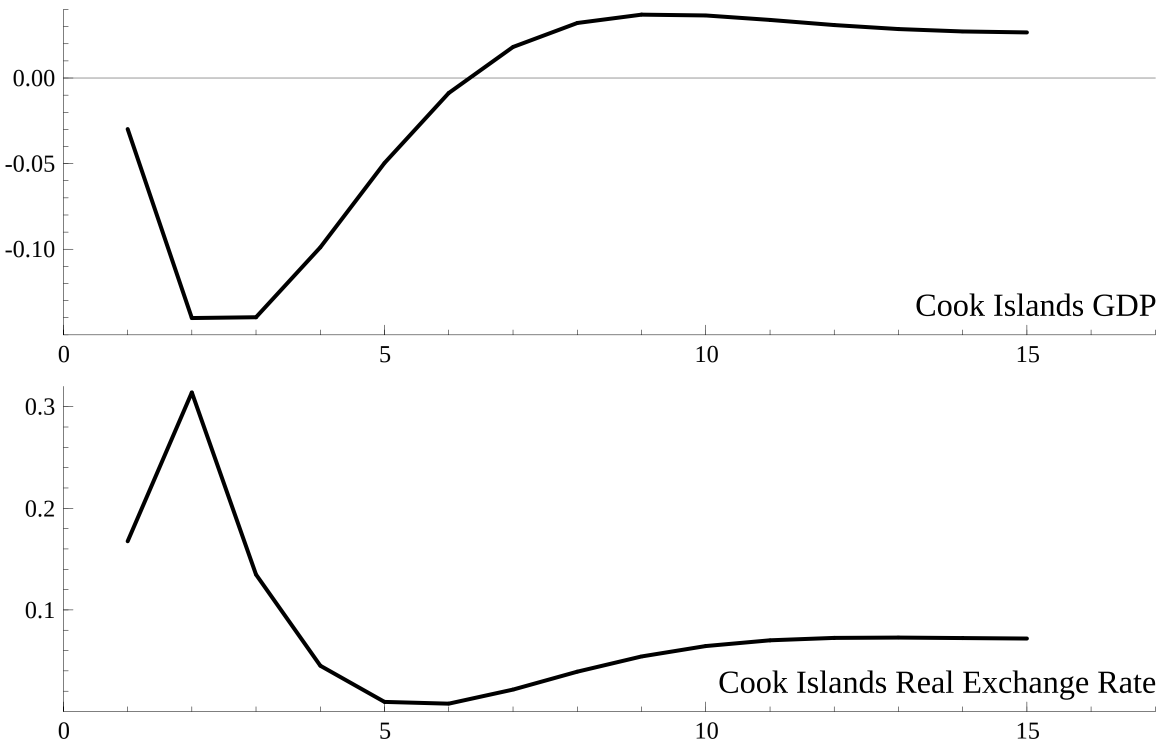

Figure 1: Unit Impulse Responses, Cook Islands

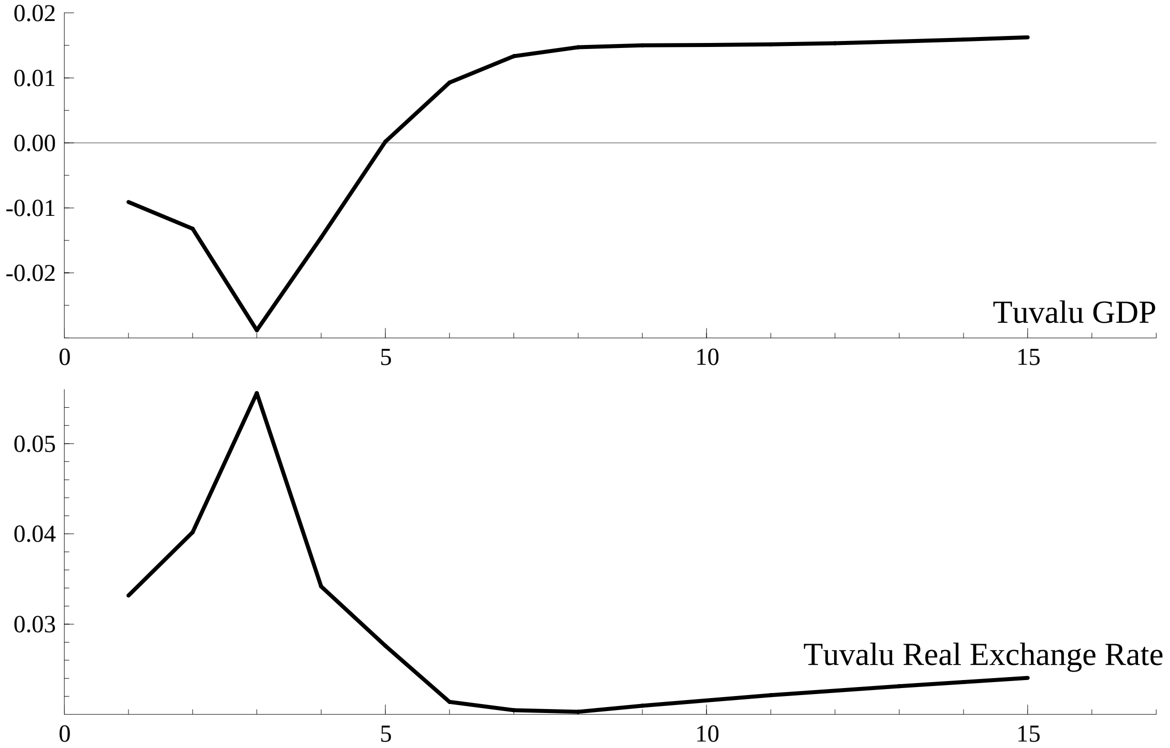

Figure 2: Unit Impulse Responses, Tuvalu

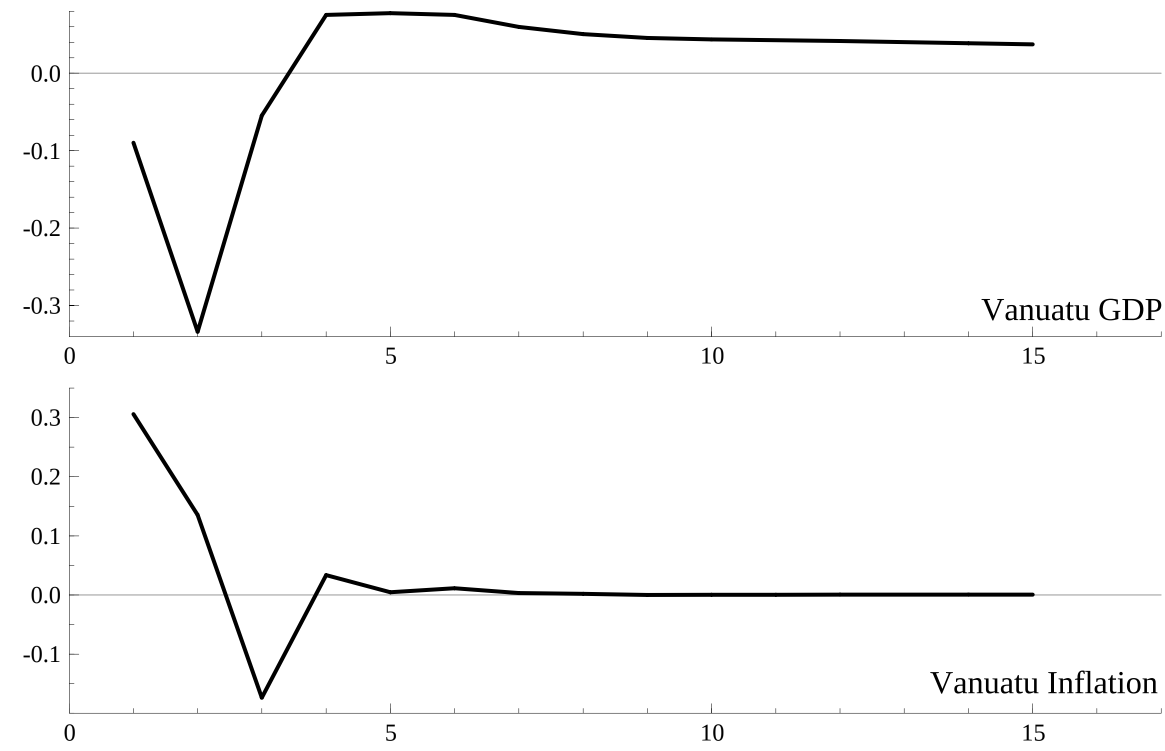

Figure 3: Unit Impulse Responses, Vanuatu

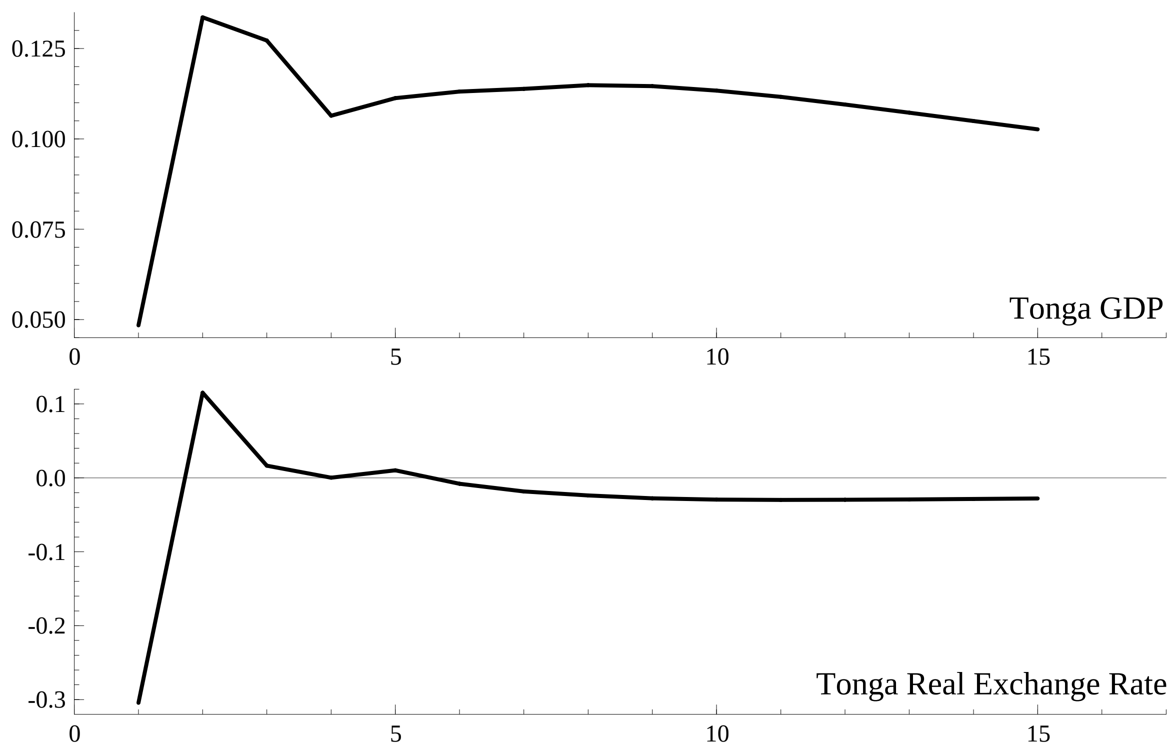

Figure 4: Unit Impulse Responses, Tonga