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BUSINESS CYCLE CORRELATIONS IN ASIA-PACIFIC

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Abstract

In this paper business cycle correlations between countries in the Asia-Pacific region are examined. A number of authors have suggested that trade intensity between pairs of countries increases business cycle synchronisation, though theoretically it is not clear that this should be the case. In this paper trade intensity and a number of other macroeconomic and structural variables are used to try and explain synchronisation. Our findings suggest that trade does not explain correlations in the Asia-Pacific region.

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1. Introduction

Of key importance to policymakers is the reaction of the domestic economy to disturbances in economies in close geographic proximity, or to larger but perhaps more distant economies such as the United States. Many countries fear that a prolonged recession in the U.S., for example, will have serious adverse effects on home country growth and employment. In this paper I try to understand these relationships. I focus on countries in the Asia-Pacific region, and attempt to explain correlations between GDP since 1970. The variables used to explain business cycle synchronisation include trade linkages, the similarity of monetary policy, and structural variables such as the size of the manufacturing sector.

One might expect that closer trade links would lead to more closely synchronised business cycles, but theoretically this relationship is ambiguous. Ricardian analysis would suggest that more trade would lead to more specialisation. With more specialisation the structural differences between economies would become larger, and sector specific shocks in one economy would be less likely to affect other economies. On the other hand, closer trade linkages will lead to stronger demand linkages across countries - as one economy moves into recession, the demand for other countries' exports will fall, inducing a fall in other countries' output.[1]

While there are a number of papers that explore business cycle synchronisation among OECD economies, there are few papers that explore this issue in other countries. In this paper the focus is on countries in the Asia-Pacific region.[2] The sample includes countries that are very open to trade, such as Hong Kong, Singapore, and Malaysia, which all have trade to GDP ratios of over 100 per cent. In addition, countries such as Australia and Singapore are very closely synchronised with cycles in the United States. Finally, the Asian crisis experience generated data that is useful in understanding what factors may explain simultaneous recession experiences. It is hoped that this variability in the sample will help identify the factors that explain business cycle synchronisation.

The paper is structured as follows. The next section reviews related work, and describes the data and methodology. Section 3 describes the results, and the final section offers conclusions. The findings can be summarised as follows. Firstly, business cycle synchronisation is difficult to explain. The explanatory power of the regressions is small both in absolute value and relative to similar regressions in related studies on OECD economies. Secondly, there is not strong evidence that business cycles are synchronised through trade, a channel often emphasised in the literature. Finally, the most statistically significant variables in the regressions are those that capture structural features of an economy such as the similarity of the level of technological know-how or manufacturing structure.

1 For a more thorough review of models of the transmission mechanisms that link business cycles see Backus, Kehoe, and Kydland (1995).

2 The countries in the sample are Australia, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan, Thailand, and the United States.

2. Methodology and Related Work

The recent surge of research in the area of optimal currency areas has led to a number of papers that seek to explain cross-country business cycle correlations. The desirability of a currency union depends in part on the extent to which participating countries' economies are synchronised. As a result, much effort has gone into trying to explain synchronisation, and also into trying to predict the impact that changes such as the formation of a currency union and greater trade integration have on business cycle synchronisation. Frankel and Rose (1998) argue that countries that have closer trade linkages tend to have more closely synchronised business cycles. On this basis they argue that steps that enhance economic and trade integration between countries are likely to lead to more synchronised cycles and, therefore, make currency unions more desirable. Similarly, Clark and van Wincoop find that states within the United States are much more closely synchronised than countries within Europe, a result that they attribute mostly to closer trade linkages within the U.S. as compared with European countries. Rose and Engel (2000) also find that currency union countries trade more, and have more highly synchronised business cycles than countries not in currency unions.

While the above papers suggest that trade is an important determinant of business cycle synchronisation, a number of authors have suggested that, once other determinants of synchronisation are properly controlled for, this effect is quite small. Imbs (2000) argues that it is the extent to which economies are structurally similar that explains synchronisation. Using a measure of similarity that depends on the shares of employment in each sector of the economy in each country, Imbs finds that structural similarity is able to explain much more of the cross country variability in business cycle synchronisation than trade. He also estimates that the rise in trade between 1963 and 1990 has caused a small increase in synchronisation, but this has been more than offset by an increase in specialisation that has led to lower synchronisation.

Otto, Voss and Willard (2001) include both trade and a structural variable, and measures of financial and monetary policy linkages in their model of synchronisation. They argue that most of the alternative transmission channels considered act as proxies for trade, though they do find some evidence that similarity of exchange rate behaviour can help explain synchronisation. However, they also argue that there is evidence that their basic model (and likely also the models discussed above) is mis-specified. In addition to trade, they find that country characteristics such as similarity of technological development, and language and legal structures are important explanators of synchronisation. While there is debate over the statistical significance of trade in explaining synchronisation, it should be said that all of these studies find that trade is able to explain very little of the variability in business cycle correlations - R^2s typically are around 0.2, and never above 0.4 in the many models encompassed by the above papers.

In this paper I examine the evidence on GDP correlations in 13 countries in the Asia-Pacific region. The sample includes countries that are very large traders, such as Singapore and Hong Kong, and more moderate trading nations such as Australia, Japan, and the United States. There is also a wide range of structural characteristics among these economies, with roughly eight high income and five low income countries in the sample.

The estimation approach follows that employed in most of the papers cited above. The dependent variable in the regression models is simply the bivariate correlation between filtered GDP. With a sample of thirteen countries, there are 78 such correlations. Before computing correlations, GDP is filtered using either first differencing or the Hodrick-Prescott filter.[3] Because of a lack of quarterly data for some of the countries over much of the sample, annual data from IFS is used to compute the correlations. The main sample is 1980-99, though I check for robustness using data that also includes the 1970s, and also using data only from 1980-95 (thus excluding the Asian crisis).

While both the filtering method and the sample period are likely to affect the results (see Canova and Dellas 1993, and Canova 1998 for a discussion of relevant filtering issues) it is found that the general conclusions of this paper are robust to the filtering methods and subsamples that are considered. Figure 1 plots the HP filtered and the first differenced correlations for the 1980-99 sample. It is clear that the two series are highly correlated, though correlations between GDP growth rates tend to be lower. Figure 2 shows the impact of adding four years data to the correlations (the figure shows the differenced data). Clearly the Asian crisis does affect the correlations for many countries in our sample. Finally, Figure 3 shows the correlations with the United States for all of the countries in our sample. Once again it is clear that the Asian crisis reduced correlations with the U.S. for countries in Asia, though the Australia and New Zealand correlations do not change. This figure also illustrates that the common wisdom that the United States is the locomotive driving most of the economies of the world is not clear from a careful examination of the data. For some Asian countries, and also for New Zealand, cycles are *negatively* correlated with cycles in the U.S..

If we denote the correlation between filtered GDP in country i with filtered GDP in country j as $\rho_{i,j}$ then the regression models estimated are of the form

$$\rho_{i,j} = \beta_1 + \beta_2 T_{i,j} + \sum_k \beta_k Z^k_{i,j} \qquad (1)$$

where $T_{i,j}$ is a measure of trade between countries i and j, and the Zs are other measures that may explain the GDP correlations such as the similarity of monetary policy or measures of the differences between economic structure in different economies. The measure of trade, $T_{i,j}$ is the maximum of the two export plus import to GDP ratios for i and j; *i.e.*

$$\max\left\{ \frac{\overline{X}_{i,j} + \overline{M}_{i,j}}{\overline{Y}_i}, \frac{\overline{X}_{j,i} + \overline{M}_{j,i}}{\overline{Y}_j} \right\}. \qquad (2)$$

This ratio captures the idea that the GDP correlations between two countries will depend on the size of the trade linkages, and on the importance of trade in GDP. It is the maximum that is important since a high ratio for Singapore in bilateral trade intensity with the U.S., for example, will lead to Singapore's GDP being more correlated with the U.S. whether or not the U.S.-Singapore ratio is high (this of course assumes that higher trade intensity increases synchronisation). Bilateral trade data is available from the IMF Direction of Trade Statistics. This data is supplemented with data from the NAPES database from the ANU, which includes data on bilateral trade for Taiwan.

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3 The results reported in the paper are constructed using λ =400. Experimentation with a band pass filter that more precisely extracts the cyclical components of the data yielded very similar results to those reported in the paper.

The other variables that are included in the model include two measures that capture the similarity of monetary policy. These are the average of real short interest rate spreads (using money market rates from IFS or interbank rates from CEIC to compute real rates) and the standard deviation of the bilateral exchange rate over the sample. In addition, three measures that try to capture structural similarity between countries are employed. The first measure is the absolute value of the difference between the share of the economy devoted to manufacturing in two economies. Secondly, I use a measure of the difference between technological development between countries. Here the thirteen countries are ranked according to PCs per thousand persons, internet hosts per thousand persons, and mobile phones per thousand persons. I then take the sum of the three ranks and use the absolute value of the difference between these sums as a dependent variable (all data is available from the World Bank Development Report). A final measure of structural similarity is the absolute value of the difference between the "Freedom Index" between countries. The Heritage Foundation measures this index based on a number of measures of barriers to economic freedoms and trade in different countries, and it is therefore hoped that this measure is indeed picking up differences in structure between economies that might help explain synchronisation.

Three other variables that may pick up similarity in structure between economies are also used as regressors. Firstly, it has often been found that distance between economies is very important in explaining trade between countries (see Feenstra, Markusen, and Rose 2001 for example), and a distance variable is included in the model with the idea that geographic proximity may also proxy for structural similarity.[4] A similar variable is geographic adjacency, which is measured using a simple 0,1 dummy variable. Finally, common language is used as an explanator of business cycle correlations, where all official languages are included in the choice of language for each country. Once again a 0,1 dummy variable is utilised, equal to 1 if the two countries share a common language.

Table 1 presents summary statistics for all of the variables, while Table 2 presents the trade data used in the regressions. It is noteworthy that the mean GDP correlations are quite small in value, and never more than one standard deviation from zero. It is also noted that the correlations between potential explanatory variables are in general quite low, so that multicolinearity is unlikely to be problematic in the regressions. Table 2 illustrates that the measures of trade intensity are very persistent across different samples. The implication of this is that it will not be changes in the behaviour of trade across various periods that is causing any lack of robustness in the results (the correlations between the trade intensity measures in the three subsamples that are considered are all above 0.99).

4 Distance is often used as an instrument for trade in many of the papers cited above. Frankel and Rose argue that greater trade integration can lead countries toward currency unions, which in turn lead to higher correlations between GDP through the synchronisation of monetary and fiscal policy that results. Hence, OLS estimates of the impact of trade on synchronisation will not be able to uncover the role played by trade versus the role played by common policies. It is not felt that this is an issue for this paper, however. Only Hong Kong and the United States have a common currency arrangement, compared with the large number of OECD countries in Europe that have linked policies through the ERM. I note that I have checked the robustness of the results to IV estimation, and the general conclusions are not affected. A final remark on this is that the quality of standard instruments for trade is generally poor for the sample of countries used in this paper.

3. Results

As a further way of summarising the data Table 3 presents the results of simple OLS regressions where each of the main explanatory variables is considered in turn, for both the 1980-99 and 1980-95 sample periods.[5] The first point to note is that trade is never significantly different from zero, and negative in sign. In all of the studies cited above, trade is positively associated with the correlation measures. For this sample of countries the sign of the coefficient does vary across specifications, but the statistical insignificance of trade appears to be very robust.

One should expect to see the measures of monetary policy similarity having a negative sign - two countries that have less similar interest rate policy or more variance in exchange rates should have less synchronised cycles. In the 1980-95 sample these variables have the anticipated sign in three of the four regressions, and exchange rate volatility is different from zero at conventional significance levels when the data has been first differenced. However, adding the final four years of data before computing the correlations leads to a reversal of the signs and insignificance of these coefficients. This is interpreted as indicating that the monetary variables do not have a robust relationship with the correlations, another conclusion that is robust across different specifications.

The final three variables for which we report results are the "structural" variables. Here it is expected that more similarity of manufacturing shares or technology would lead to more synchronised cycles, which would result in negative coefficients on these variables as they have been measured. While the freedom variable is not significantly different from zero, it is found that the coefficients on the technology and the manufacturing variable are negative and statistically different from zero. Again, this conclusion is robust to different specifications. However, the R^2 indicates that the regressions are able to explain relatively little of the variability in the correlation measures. Again, this is the case in all of the specifications. The regressions are never able to explain as much of the variability as can be explained in similar equations for the OECD, though as noted above the explanatory power in the OECD equations is also not high.

Table 4 presents results where combinations of the variables are included in the regression model. Obviously there are many possible specifications, and results are reported that always include the trade variable, along with other explanatory variables. It is noted that I have explored many combinations of the variables in addition to those reported, as well as examining subsamples of the countries and allowing for separate intercepts for large and small trading countries. The results appear to be very robust to such modifications. The first regression results reported include all of our variables, including the distance and adjacency measures that were also tried as instruments for trade. This specification can explain just more than one-fifth of the variation in the correlations, and the proxy for technology is significantly different from zero. As insignificant variables are dropped from the regression, technology and distance

5 One potential issue with the regressions is that the dependent variable lies between [-1,1]. The regressions utilise the transformation $f(x)=\ln(x)+1/(\ln(1-(x)))$, where x is the correlation measure, in order to map the dependent variable from $[-1,1] \rightarrow \Re$.

are the only variables that remain significant. It is not clear whether distance is proxying for similarity in economic structure, or for trade, or some other linkage between economies; however, dropping distance from the regressions does not make the trade variable become significant. The main conclusions that can be drawn from Table 4 are, first, that the regressions are still explaining very little of the variability around the mean in the correlations. Secondly, trade is not statistically different from zero in any of our specifications. There is, however, some evidence that the extent to which economies are similar in structure, measured using the technology and manufacturing share variables, do have a statistically significant impact on synchronisation.

4. Conclusions

This paper aims to explain business cycle correlations in a sample of Asia-Pacific countries. The results can be summarised as follows. Firstly, trade does not appear to be very strongly associated with higher correlations between filtered GDP. Either the trade to GDP synchronisation link is specific to OECD economies or, alternately, this linkage is not very robust. Secondly, consistent with the findings of Imbs (2000) for the OECD we find some evidence that measures of the structural similarity between countries are positively associated with the business cycle correlations. However, it is noted that very little of the variability in the bilateral correlations is explained by any of the models estimated.

The results indicate that a good deal more work needs to be done in order to properly understand business cycle synchronisation. The link from trade to synchronisation would not appear to be a robust stylised fact at this stage, while the evidence on structure and synchronisation appears mixed. One fruitful avenue for further research is to build a more structural model of these correlations that more carefully models and measures the different kinds of shocks that impact on different countries, and estimates how these shocks affect business cycle correlations. A limitation to doing so, however, is the paucity of time series data for the sample of countries that are considered in this paper.

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Table 1. Summary Statistics

	Correlations												
	$\sigma_{HP,1}$	$\sigma_{\Delta,1}$	$\sigma_{HP,2}$	$\sigma_{\Delta,2}$	$\sigma_{HP,3}$	$\sigma_{\Delta,3}$	Trade	Spread	Exch.	Mfg.	Tech.	Adj.	Dist.
$\sigma_{HP,1}$													
$\sigma_{\Delta,1}$	0.81												
$\sigma_{HP,2}$	0.85	0.53											
$\sigma_{\Delta,2}$	0.67	0.48	0.88										
$\sigma_{HP,3}$	0.92	0.66	0.91	0.71									
$\sigma_{\Delta,3}$	0.73	0.79	0.61	0.57	0.78								
Trade	0.11	0.14	0.00	0.02	-0.02	-0.08							
Spread	-0.01	-0.17	0.14	0.14	-0.01	-0.16	-0.33						
Exch.	-0.16	-0.33	0.06	0.04	-0.07	-0.21	-0.41	0.78					
Mfg.	-0.30	-0.42	-0.15	-0.17	-0.17	-0.22	-0.11	0.14	0.30				
Tech.	-0.25	-0.18	-0.20	-0.12	-0.20	-0.07	-0.01	0.11	0.23	0.16			
Adj.	0.01	-0.08	0.04	0.07	0.01	-0.00	0.27	-0.03	-0.05	-0.01	0.03		
Dist.	-0.08	0.13	-0.34	-0.34	-0.16	0.03	0.13	-0.20	-0.18	0.09	0.06	-0.29	
	Sample means and standard deviations												
$\overline{X}$	0.15	0.23	0.16	0.21	0.12	0.14	7.83	7.45	14.21	0.08	12.82	0.06	5775
σ_x	0.34	0.25	0.41	0.31	0.43	0.30	10.33	4.53	4.45	0.06	8.49	0.25	4290

Notes: The first subscript on the sigmas denotes whether the HP filtered or first differenced data were used to compute the bivariate correlations. The second subscript denotes the time period; period 1 is 1970-95, period 2 is 1980-99 and period 3 is 1980-95.

Table 2a. Bilateral trade as a fraction of GDP (average for 1970-99)

	Aus	China	HK	Indon	Japan	Korea	Mal	NZ	Phi	Sing	Tai	Thai	USA
Aus		0.64	2.66	1.12	0.71	1.21	4.20	7.77	1.34	7.76	1.98	1.14	0.22
China	0.79		31.72	0.87	0.78	1.98	3.26	0.79	0.98	8.10	3.07	1.57	0.31
HK	0.51	5.38		0.63	0.46	1.62	3.19	0.67	1.84	13.06	5.43	1.93	0.27
Indon	0.45	0.25	0.88		0.66	1.09	1.69	0.46	0.81	10.85	1.50	0.82	0.15
Japan	6.33	6.27	20.33	14.46		13.69	27.72	6.53	12.38	39.79	16.71	15.75	2.13
Korea	0.79	0.92	3.87	1.39	0.77		3.81	0.77	1.43	5.27	1.39	1.20	0.41
Mal	0.49	0.38	1.67	0.47	0.43	1.02		0.53	1.26	41.87	1.37	2.25	0.15
NZ	1.14	0.09	0.50	0.16	0.11	0.18	0.75		0.29	1.42	0.22	0.19	0.05
Phi	0.19	0.14	0.86	0.33	0.24	0.42	1.58	0.27		2.76	0.74	0.41	0.13
Sing	0.63	0.76	5.76	3.76	0.40	0.88	22.37	0.77	1.68		1.91	4.37	0.23
Tai	0.77	1.56	8.13	1.27	0.67	0.93	4.05	0.69	1.76	8.34		2.02	0.49
Thai	0.24	0.25	1.73	0.44	0.34	0.43	3.96	0.25	0.60	10.14	1.08		0.10
USA	4.20	2.82	24.87	6.97	4.50	14.85	21.44	6.40	15.35	45.35	23.80	9.43	

Notes: Each cell value represents the ratio of total trade (imports plus exports) between pairs of countries to the GDP of each column country.

Table 2b. Bilateral trade as a fraction of GDP (average for 1980-99)

	Aus	China	HK	Indon	Japan	Korea	Mal	NZ	Phi	Sing	Tai	Thai	USA
Aus		0.56	1.99	1.29	0.60	1.35	3.65	8.33	1.27	6.46	1.94	1.14	0.21
China	0.99		40.51	1.13	0.93	1.98	3.08	1.04	1.18	8.67	3.07	1.95	0.46
HK	0.55	6.93		0.72	0.52	1.92	3.81	0.70	2.45	13.92	6.29	1.92	0.29
Indon	0.58	0.29	0.89		0.63	1.12	1.72	0.61	0.84	10.38	1.26	0.72	0.15
Japan	6.18	6.46	20.12	13.62		11.33	29.03	7.03	11.05	39.74	15.31	14.67	2.34
Korea	1.07	0.92	4.75	1.81	0.83		4.99	1.05	1.95	6.67	1.59	1.58	0.51
Mal	0.55	0.32	1.77	0.58	0.42	1.13		0.61	1.55	42.28	1.58	2.58	0.19
NZ	1.20	0.09	0.37	0.20	0.10	0.19	0.65		0.27	1.23	0.25	0.18	0.05
Phi	0.20	0.15	0.95	0.33	0.20	0.45	1.81	0.28		3.24	0.72	0.45	0.13
Sing	0.73	0.81	6.10	3.88	0.45	1.13	24.51	0.87	2.36		2.22	5.31	0.29
Tai	0.98	1.56	9.40	1.39	0.75	0.93	5.07	0.94	2.26	10.07		2.08	0.60
Thai	0.31	0.32	1.65	0.48	0.37	0.53	4.47	0.31	0.79	11.42	1.06		0.14
USA	4.36	4.03	21.77	6.42	4.58	14.08	24.20	6.68	15.63	48.69	23.20	10.41	

Table 3a. Simple Regression Results

	Sample: 1980-99. $\rho_{i,j} = \beta_1 + \beta_2 X_{i,j} + \varepsilon_{i,j}$											
	HP Filtered data						Differenced Data					
Trade	-0.16						-0.02					
	(0.86)						(0.97)					
Spread		3.01						2.36				
		(0.16)						(0.18)				
Exchange			1.22						0.62			
			(0.58)						(0.73)			
Tech.				-2.59						-1.09		
				(0.03)						(0.21)		
Mfg.					-2.74						-2.18	
					(0.10)						**(0.08)**	
Freedom						0.73						4.51
						(0.97)						(0.75)
R^2	0.00	0.02	0.00	0.05	0.03	0.00	0.00	0.02	0.00	0.02	0.03	0.00

Table 3b. Simple Regression Results

	Sample: 1980-95. $\rho_{i,j} = \beta_1 + \beta_2 X_{i,j} + \varepsilon_{i,j}$											
	HP Filtered data						Differenced Data					
Trade	-0.19						-0.44					
	(0.84)						(0.52)					
Spread		0.14						-2.52				
		(0.95)						(0.12)				
Exchange			-1.50						-3.38			
			(0.51)						**(0.03)**			
Tech.				-2.74						-7.42		
				(0.04)						(0.38)		
Mfg.					-3.42						-2.56	
					(0.09)						**(0.08)**	
Freedom						-0.10						-0.08
						(0.56)						(0.48)
R^2	0.00	0.00	0.00	0.05	0.04	0.00	0.00	0.03	0.05	0.01	0.05	0.01

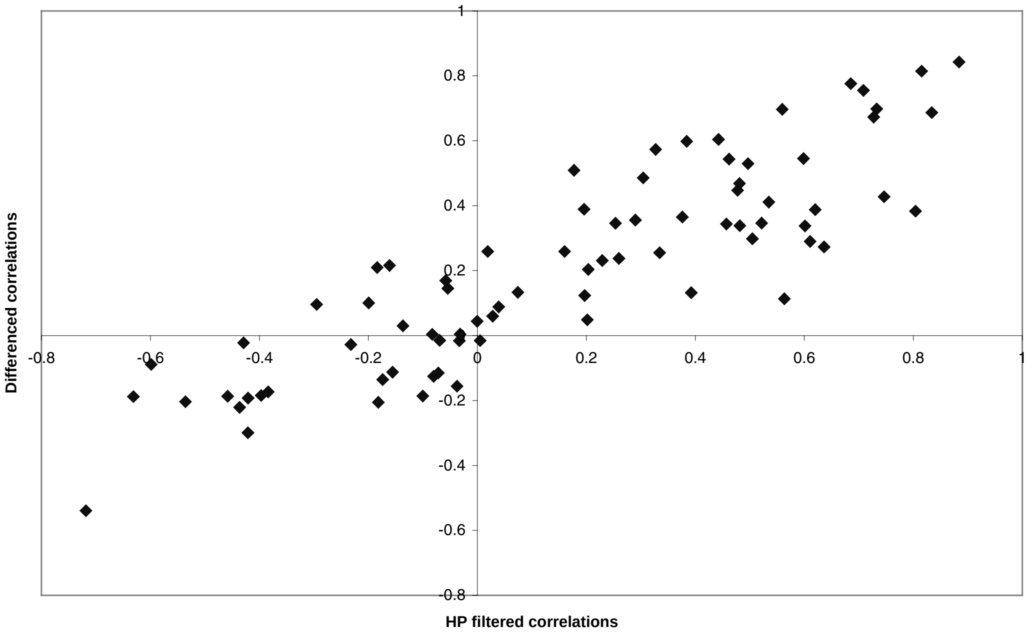
Notes: p-values in parentheses.

Table 4. More Regression Results

	Sample: 1980-99. $\rho_{i,j} = \beta_1 + \beta_2 X_{i,j} + \varepsilon_{i,j}$									
	HP Filtered data					Differenced Data				
Trade	0.48	0.29	0.50	0.51	0.33	0.38	0.23	0.40	0.41	0.27
	(0.63)	(0.47)	(0.58)	(0.58)	(0.69)	(0.59)	(0.39)	(0.51)	(0.52)	(0.61)
Tech.	-4.90	-0.88	-2.43	-2.56	-2.93	-1.97	-0.31	-0.86	-0.97	-1.26
	(0.03)	(0.11)	**(0.06)**	**(0.04)**	**(0.03)**	(0.16)	(0.41)	(0.32)	(0.25)	(0.14)
Mfg.	-2.49	-6.80	-2.25			-1.87	-6.28	-1.87		
	(0.17)	(0.36)	(0.21)			(0.16)	(0.25)	(0.15)		
Spread	2.91	1.24				3.32	1.37			
	(0.35)	(0.36)				(0.17)	(0.20)			
Exchange	-0.63	-0.01	2.57	1.62	2.83	-1.82	-5.90	1.28	0.50	1.44
	(0.86)	(0.99)	(0.30)	(0.50)	(0.28)	(0.52)	(0.62)	(0.52)	(0.79)	(0.47)
Freedom	0.49					0.23				
	(0.10)					(0.25)				
Distance	-0.50	-0.28	-0.66	-0.70		-0.42	-0.22	-0.51	-0.55	
	(0.13)	**(0.02)**	**(0.02)**	**(0.01)**		**(0.09)**	**(0.01)**	**(0.01)**	**(0.01)**	
Adjacent	-0.14					-0.36				
	(0.80)					(0.93)				
R^2	0.21	0.17	0.17	0.15	0.06	0.17	0.16	0.14	0.12	0.02

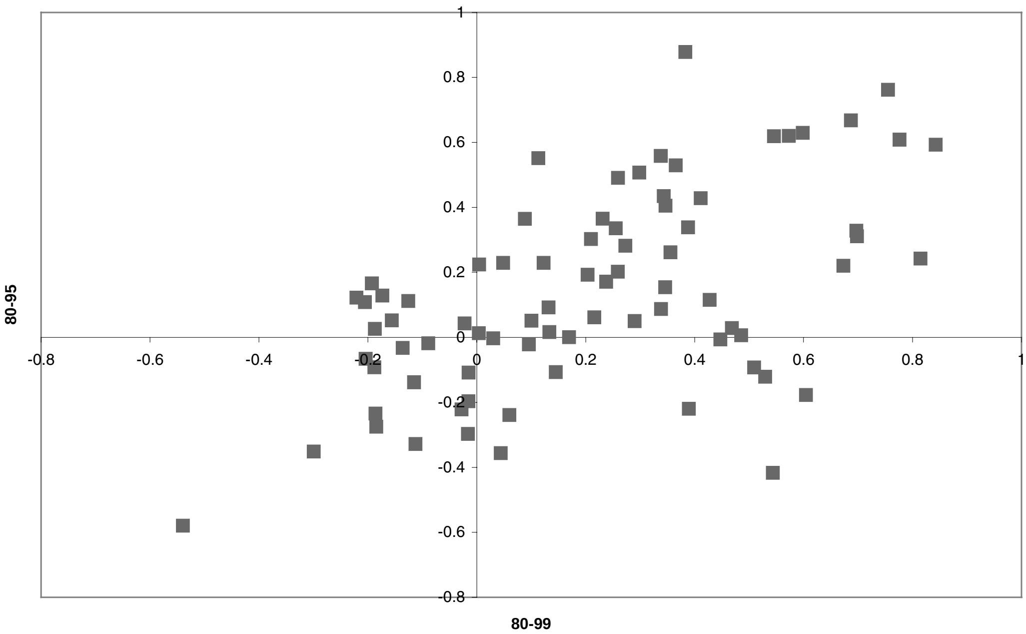
Notes: p-values in parentheses.

Figure 1. Bivariate Correlations: HP Filtered and Differenced Data,1980-99



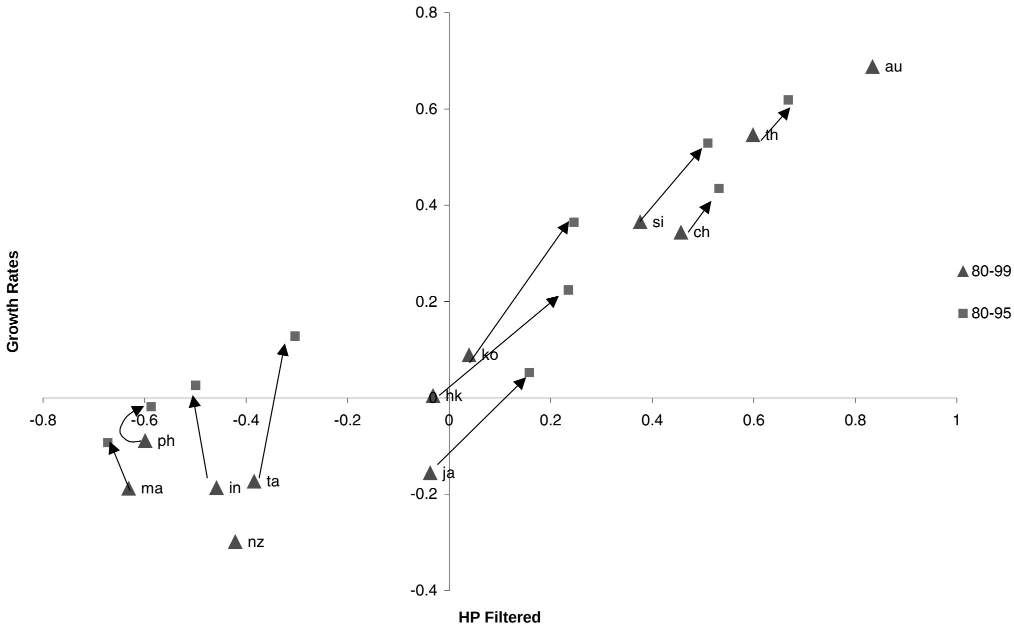
The method of filtering is important, though the correlation between the correlations is quite high. It is also notable that the correlations between the differenced GDP series tend to be lower.

Figure 2. How the Asian Crisis Affects the Correlations? 80-95 vs 80-99, differenced data.



The addition of four years data does affect the GDP correlations. This is more marked in the correlations between the differenced data, where the correlation between the correlations is only .31 in the samples beginning from the 1980s.

Figure 3. The Asian Crisis and Correlations with the U.S.



With the exception of Australia and New Zealand, correlations do change with the inclusion of post Asian crisis data. In most cases exclusion of the Asian crisis period leads to higher correlations of GDP with the U.S., indicated by the arrows generally pointing to the north-east.