The Political Economy of Exchange Rate Regimes: Evidence from Hong Kong and Taiwan*

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This paper investigates whether the macroeconomic performance of a small–open economy depends on the choice of exchange rate regimes. Hong Kong and Taiwan – two economies with many similar macroeconomic characteristics, but different in their choices of exchange rate regimes – provide a good setting to study the relation between the choice of exchange rate regime and macroeconomic performance. We examine the basic facts of growth and inflation and the coefficients' stability of their vector autoregression (VAR), as well as cyclical characters of other aggregate variables in Hong Kong and Taiwan. Our empiric finding indicates that macroeconomic performance is not systematically related to exchange rate regimes.

Keywords: exchange rate regime, monetary institution arrangement.

JEL classification codes: E52, E58, F33.

I. Introduction

Hong Kong and Taiwan share similarities not only in their geographies and culture, but also in their macroeconomic characteristics such as: (i) high degree of openness, (ii) labor-market flexibility and (iii) fiscal discipline.[1] Between them

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1. The openness degree in terms of the ratio of exports plus imports to GDP is high for Taiwan and Hong Kong. It is about 95% for Taiwan and 200% for Hong Kong, while only 20% for Japan over the last three decades. In addition, as reported by World Bank (1993), labor markets in the high-performing Asian economies have been free from the interventions that restrict labor mobility or repress wages. On the other hand, neither Hong Kong or Taiwan borrow abroad and both countries keep public deficits within the limits they can absorb. In fact, data from the *Hong Kong*

lies an important difference in the choice of exchange rate regime. Hong Kong adopted the floating-exchange-rate system until the third quarter of 1983 and then switched to the fixed-exchange-rate system. Taiwan, however, had a pegged (but adjustable) exchange rate system before the fourth quarter of 1980 and a managed floating-exchange-rate system after that. Does the choice of exchange rate regime affect their performance such as inflation and growth?

Assuming a strong commitment mechanism, a fixed-exchange regime theoretically provides an automatic rule for the conduct of monetary policy, helps mitigate the time-inconsistency problem and avoids inflation bias. Several empiric studies have confirmed these kinds of models. McCarthy and Zanalda (1996) compared the macroeconomic performance of Caribbean countries to show that countries operating under a currency board system have lower inflation and higher economic growth. Ghosh et al. (1997) provided stylized facts and regression results covering 136 International Monetary Fund members between 1960 and 1990. They found that inflation was lower and more stable under a pegged exchange rate regime, although real volatility was higher.

Baxter and Stockman (1989) compared the post-war stylized facts of 49 countries – including industrialized countries and less developed countries – and found little evidence for systematic differences in the behavior of aggregate variables across alternative exchange rate regimes except for real exchange rates. Hutchison and Walsh (1992) concluded that Japanese output stability since the mid-1970s was not attributable to changes in the country's exchange rate regime. In addition, Ahmed et al. (1993) showed that there was no difference in international business cycles between the USA and its foreign partner – composed of 5 other countries in the Organization for Economic Cooperation and Development (OECD) – from a fixed-exchange-rate regime to a floating one.[2]

The countries examined in most empiric studies may have different structural characteristics. Furthermore, most industrial countries adopted floating-exchange rates at roughly the same time as the first oil price shock occurred. It is difficult to isolate the effect that the choice of exchange rate regimes had on macroeconomic performance from the effects of oil price shocks and other structural differences. In order to isolate differences due to the exchange rate regime, Hong Kong and Taiwan – two economies with many similar macroeconomic characteristics but different in their choices of exchange rate regimes – provide a unique setting to study the relation between the choice of exchange rate regime and macroeconomic performance.

The remainder of this paper is organized as follows. Section 2 follows Edwards' (1999) model, which focuses on the trade-off between commitment

Monthly Digest of Statistics and the *Taiwan Financial Statistics Monthly* indicate that there is budget surplus for the two economies over the last two decades.

2. Taylor (1993) simulated the economic performance of the Group of 7 (G-7) countries under several monetary policy rules and found that the performance of output fluctuations and inflation were better with the flexible exchange-rate system than with the fixed-rate system.

and flexibility in selecting an exchange rate regime. The model is used to illustrate a common view about monetary policy: that discretionary policy (managed float) has flexibility, but that its inflation performance is biased relative to a rule (fixed-exchange rate). While a policy rule must be accompanied by a commitment mechanism to obtain credibility in theory, monetary institutions must be properly designed to achieve the economy's optimal performance in practice. Section 3 therefore reviews the monetary authorities and exchange rate history of Hong Kong and Taiwan. Section 4 examines the two countries' macroeconomic performance in the sample period from the first quarter of 1975 until the fourth quarter of 2000. Section 5 concludes the paper and provides an issue on monetary institutional arrangement in forming a commitment mechanism to a specific policy rule for future research.

II. Fixed or Flexible? A Model of Small–Open Economies

Whether or not the choice of exchange rate regimes matters for the control of inflation and the smoothing out of aggregate fluctuations is quite interesting for discussion. Theoretically, there is an active or contingent optimal rule that is superior to other policy rules under a stochastic environment, but subject to dynamic inconsistency. However, in practice no Central Bank follows such an exchange-rate-targeting rule (Svensson, 1999). This section therefore focuses on two types of practical exchange rate systems: (i) a fixed-(or pegged-)rate and (ii) a discretionary managed float.

Let the growth rate of a small–open economy's aggregate output (or employment rate) at time t, y_t, equal its natural rate y^n plus a term that depends positively on the unexpected inflation rate and an exogenous shock:

$$y_t = y^n + \alpha[\pi_t - E_{t-1}(\pi_t)] + \varepsilon_t. \tag{1}$$

Here ε_t is a white noise exogenous shock with mean zero and variance σ_ε^2. The operator E_t is defined by $E_t X \equiv E[X \mid \Omega_t]$, where X is a random variable, E is the mathematical expectation operator, and Ω_t is an information set available at time t.

For a small–open economy, the inflation rate (π_t) is the weighted average of domestic currency devaluation (d_t) and a change in the nominal wage rate (w_t) : $\pi_t = \theta d_t + (1 - \theta) w_t$, in which the weight ($\theta$) is between zero and one. The presence of nominal stickiness implies that the expected increase in the nominal wage rate is determined by private agents' expectation of inflation at the previous period: $w_t = E_{t-1}(\pi_t)$. It is clear from the definition of π_t that

$$w_t = E_{t-1}(d_t).$$

When a monetary authority selects an exchange rate regime, it sets a sequence of the domestic currency depreciation rate $\{d_t, t \geq 0\}$. The authority looks ahead of the inter-temporal loss function conditioned on the information set at the time it makes the decision (period 0):

$$L = E_0(1 - \beta)[Z_0 + \beta Z_1 + \beta^2 Z_2 + \ldots], \quad (2)$$

subject to equation 1.[3] Here β is the constant discount factor with $0 < \beta < 1$, and the temporal loss function at time t (Z_t) is given by

$$Z_t = a(y_t - ky^n)^2 + \pi_t^2,$$

in which a characterizes the monetary authority's preferences over the stabilization objective of output growth, and $k \geq 1$ implies that the natural rate of output growth (or full-employment rate) is too low due to tax distortion and externalities. In the limit $\beta \to 1$, the value of the inter-temporal loss function (2) will approach the unconditional mean of the period loss function,

$$L = EZ_t,$$

as in Edwards (1999).[4] Finally, assume that the monetary authority and agents in the private sector form their expectations rationally.

II.1 Fixed-exchange-rate system

Suppose the economy has precommitment technology so that the 'permanent' fixed-exchange-rate system is a feasible choice. Under the fixed-exchange-rate system, domestic currency depreciation by definition equals zero in each period (i.e. $d_t = 0$) and thus $\pi_t = 0$ and $y_t = y^n + \varepsilon_t$. The unconditional means of the inflation rates and output growth rates are zero and the natural rate, respectively. Let $\sigma_y^2 = (k-1)^2(y^n)^2$. It is easy to see that the unconditional expected value of the monetary authority's loss function is given by

$$E[L^F] = a[\sigma_y^2 + \sigma_\varepsilon^2].$$

Although we assume that the monetary authority adopting a fixed-exchange rate will always follow this policy rule, at every moment the authority has an incentive to make a surprise devaluation to increase output. What kind of monetary institutional arrangement can install a binding commitment under a fixed-exchange-rate regime? According to Hanke and Walters (1992), a typical currency board contains two essential characteristics that inherit precommitment technology: (i) it stands ready to exchange domestic currency for foreign reserve currency on demand at a pre-specified and fixed rate and (ii) the domestic currency is issued based upon at least 100% reserves of securities, denominated mainly in the foreign reserve currency. Once there is no resort to the printing press to pursue policy objectives such as low unemployment and extraction of seigniorage revenues, adopting currency board adds fundamental

3. We simplify the analysis by assuming that the economy, as with Hong Kong and Taiwan, does not bother with the balance of payments constraints.

4. Edwards (1999) is one of a few that has attempted to empirically identify the determinants behind the choice of a fixed-exchange-rate regime.

credibility to the fixed-exchange-rate system. However, even a currency board can severely limit the monetary authority in conducting a discretionary policy and can make its decisions more credible – the currency board can be abandoned just as the fixed-exchange-rate system can be.

II.2 Discretionary managed float

A policy is discretionary when it is conducted on a period-by-period basis. Minimizing the loss function under discretion is potentially closer to the practice and decision framework of monetary authorities. Since $E_{t-1}(\pi_t)$ is given and ε_t is realized at time t, a discretionary monetary authority chooses the optimal current devaluation rate as:

$$d_t = -\frac{\alpha a(1-k)y^n + \alpha a\varepsilon_t - [\alpha^2 a\theta - (1-\theta)][E_{t-1}(\pi_t)]}{\theta(\alpha^2 a + 1)}. \tag{3}$$

If the private agents form their expectations rationally, then their expectations of d_t must be consistent with equation (3). A consistent discretionary equilibrium is:

$$d_t = -\alpha a(1-k)y^n - \frac{\alpha a}{\theta(\alpha^2 a + 1)}\varepsilon_t,$$

and the equilibrium inflation rate becomes

$$\pi_t = \alpha a(k-1)y^n - \frac{\alpha a}{\alpha^2 a + 1}\varepsilon_t.$$

Clearly, the average inflation rate is above its zero target value, due to the monetary authority's output stabilization objective with $k > 1$. Furthermore, the volatility of inflation rates is also greater than its zero counterpart under a fixed-exchange-rate regime.

Under this discretionary managed floating-exchange-rate system, the unconditional mean of the objective function is given by $E[L^D]$:

$$E[L^D] = a\left[(\alpha^2 a + 1)\sigma_y^2 + \frac{\sigma_\varepsilon^2}{\alpha^2 a + 1}\right].$$

It is thus easy to show that

$$E[L^F] - E[L^D] = \frac{\alpha^2 a^2}{\alpha^2 a + 1}[\sigma_\varepsilon^2 - (\alpha^2 a + 1)\sigma_y^2].$$

When $E[L^F] > E[L^D]$, the managed floating-exchange-rate regime shall be chosen by the monetary authority. For example, when either the monetary authority's ambition of the output target measured by $(k-1)y^n$ is small

enough, or the variance of the exogenous shock (σ_ε^2) is large enough, the managed floating-exchange-rate regime is preferred over the fixed-exchange-rate regime.

Since an optimal rule under a managed floating-rate system is not practical in the real world, we focus on the comparison between a fixed-exchange rate and a discretionary managed float. Our simple model gives us the common impression that inflation rates under a managed-float regime are biased and have a higher volatility than those under a fixed-exchange-rate regime. However, the overall performance (evaluated on the objective function of monetary authorities) is ambiguous between the two exchange rate regimes.

Before moving to the next section, there is one thing worth mentioning. Given a chosen exchange rate system, a monetary institution should be properly designed to achieve the economy's optimal performance. For example, a currency board can install a binding commitment under a fixed-exchange-rate regime, but a discretionary Central Bank can not.[5] Both Hong Kong and Taiwan have experienced high growth and low inflation in the past four decades. It appears that, for most of the time, Hong Kong and Taiwan's monetary institutional arrangements have been proper for the exchange rate regime they have chosen.

III. Hong Kong and Taiwan's Monetary Institutions and Exchange Rates History

Hong Kong's government established the Exchange Fund under the Currency Ordinance in December 1935. This monetary arrangement had all the features of a currency board, with the exception that legal tenders were issued by authorized private banks rather than directly by the board. Unlike the Central Bank, the Exchange Fund does not have suitable policy instruments for monetary targeting; however, there have been several adjustments in the currency board. In 1988 the Exchange Fund established 'Accounting Arrangements' to conduct open market operations. Since March 1990, the Exchange Fund has been permitted to issue several kinds of Exchange Fund Bills, which are similar to Treasury Bills. In 1992 a discount window was opened to provide liquidity to banks. The Hong Kong Monetary Authority was then established in December 1992 to take over the power of the Exchange Fund Office and the Commissioner of Banking.

Taiwan's Central Bank resumed its operations on July 1, 1961. According to current Central Bank law, maintenance of the external and internal purchasing power of its currency is not the sole objective for the Central Bank. Both the

5. Ghosh et al. (1998) find that the inflationary performance of International Monetary Fund (IMF) members under a currency board system is better than under other fixed-exchange-rate regimes.

Minister of Finance and the Minister of Economic Affairs are mandatory Government representatives on the board, and the appointment of other directors is controlled by the Government. Parliament is not permitted to influence the formulation and conduct of monetary and exchange rate policies, and the Central Bank is not required to hold regular public hearings or reveal the record of the board meeting. This puts the Central Bank under the control of the Executive Branch of the Central Government.

Hong Kong and Taiwan had different choices of exchange rate regimes after the first oil price shock. Following a violent speculative attack against the US Dollar, Hong Kong abandoned the fixed-exchange-rate system on November 24, 1974. The performance of the Exchange Fund was traumatic during its floating-rate period (November 26, 1974 to October 17, 1983). According to the official policy, the Exchange Fund passively supplied any amount of certificates of indebtedness denominated in US dollars (requested by the private banks in exchange for foreign currencies) at market rates of exchange. In 1982, the governments of Britain and China began to negotiate over the future of Hong Kong, and political uncertainty led to a series of financial crises. On October 17, 1983, Hong Kong returned to the full currency board. The exchange rate has been fixed at 7.8 HK dollars to one US dollar ever since then.

On the other hand, Taiwan established its first currency market on February 1, 1979. During its first year of operation, the Central Bank and five designated banks determined the buying and selling rate of the exchange rate on a daily basis. Before that the Central Bank pegged the exchange rate and the Taiwan Dollar seemed to be devaluated. The pegged exchange rate and huge trade surpluses led to a rapid accumulation of foreign reserves. After the Central Bank withdrew from its daily process in the first quarter of 1981, the exchange rate system in Taiwan became a managed floating-exchange-rate system.

The predominant view in the sizeable literature on exchange rate regimes is that pegged exchange rates can be an important anti-inflation tool. Knowing that Hong Kong and Taiwan have the monetary institutional arrangement compatible with their respective exchange rate regimes, the preconditions for the best performance under a specific exchange rate regime are satisfied. We can therefore examine whether the two countries' macro performance is consistent with the theoretical implications in Section 2.

IV. The Exchange Rate Regime and Macroeconomic Performance

This section provides basic facts about Hong Kong and Taiwan in order to examine whether the relation between choice of exchange rate regimes and macroeconomic performance in terms of inflation and growth is consistent with the implications of the model in Section 2. Apart from the evidence of the simple statistics, regression results of a two-variable VAR are also investigated. Finally, cyclical characters of other aggregate variables under different exchange rate regimes are also compared.

IV.1 Basic facts of inflation and gross domestic product growth rates

Our sample consists of quarterly per capita gross domestic product (GDP) and consumer price index (CPI) data from the first quarter of 1975 until the fourth quarter of 2000. The second sub-sample period for Hong Kong (from the fourth quarter of 1983 until the fourth quarter of 2000) and the first sub-sample period for Taiwan (from the first quarter of 1975 until the fourth quarter of 1980) were treated as fixed-exchange-rate regime observations. The first sub-sample period for Hong Kong (from the first quarter of 1975 until the third quarter of 1983) and the second sub-sample period for Taiwan (from the first quarter of 1981 until the fourth quarter of 2000) were treated as flexible-exchange-rate observations. All data series were seasonally adjusted before estimation.[6]

Table 1 reports the means and standard deviations of GDP growth rates and inflation rates for Hong Kong and Taiwan in the full sample period as well as in different exchange rate regimes. The population means and standard deviations

Table 1 Statistical Properties of Growth Rates of GDP and CPI

Variable	*Mean (%)*			*Standard Deviation (%)*		
		I. Hong Kong				
	1975 : 1–2000 : 4	*Fixed*	*Floating*	*1975 : 1–2000 : 4*	*Fixed*	*Floating*
GDP	1.13	0.87	1.64	2.13	1.71	2.68
growth rate		(0.25)	(0.36)		(0.24)	(0.34)
		[0.303]	[0.179]		[0.070]	[0.177]
Inflation rate	1.62	1.39	2.08	1.26	1.21	1.22
		(0.31)	(0.26)		(0.20)	(0.12)
		[0.476]	[0.127]		[0.775]	[0.742]
		II. Taiwan				
	1975 : 1–2000 : 4	*Fixed*	*Floating*	*1975 : 1–2000 : 4*	*Fixed*	*Floating*
GDP	1.56	1.98	1.43	1.13	1.52	0.94
growth rate		(0.19)	(0.14)		(0.39)	(0.10)
		[0.065]	[0.355]		[0.414]	[0.042]
Inflation rate	0.94	2.08	0.60	1.41	2.01	0.93
		(0.67)	(0.09)		(0.36)	(0.05)
		[0.058]	[0.003]		[0.444]	[0.000]

Notes: Hong Kong's fixed-rate period is 1983 : 4–2000 : 4; its floating-rate period is 1975 : 1–1983 : 3. Taiwan's fixed-rate period is 1975 : 1–1980 : 4 and its floating-rate period is 1981 : 1–2000 : 4.

Means and deviations are estimated by generalized method of moments (GMM) estimation. Numbers in parentheses are standard errors. Values in brackets are the *P*-values of the $\chi^2(1)$ statistics for testing the null that the statistic under a specific exchange rate regime equals the corresponding full sample moment.

6. Data for Hong Kong are from the Census and Statistics Department, Hong Kong Administrative Region, while data for Taiwan are from its Central Bank and Directorate-General of Budget, Accounting and Statistics, Executive Yuan.

(with their standard errors in parentheses) in the sub-sample period are estimated as generalized method of moments (GMM) estimators using Hansen–Heaton–Ogaki GAUSS program estimator. The standard errors are robust to both heteroskedasticity and auto-correlation of the residuals. Values in brackets are $\chi^2(1)$ statistics' P-values for testing the null that the statistic estimated in the specific exchange rate regime equals the corresponding value for the data in the full sample period.

The statistics in Table 1 reveal that the fixed-exchange-rate regime does not have a better inflationary performance than the floating-exchange-rate regime. The statistics for Hong Kong's inflation are not significantly different from their full-sample counterparts. However, the mean and variance of Taiwan's inflation rates are lower than average at a 1% significance level in the floating-rate period, while the mean of its rates is higher at a 10% level in the fixed-rate period. These results indicate that inflationary performance improved over time for Taiwan. This is contrary to our model's predictions and inconsistent with the findings in both Ghosh et al. (1997) and Ghosh et al. (1998). On the other hand, the average annual growth rate of Taiwan's real GDP in the fixed-rate period is higher at a 10% level than its full-sample counterpart and the average annual growth rate of Hong Kong's real GDP in the floating-rate period is also higher (although insignificant) than its full-sample counterpart. In addition, Taiwan's real GDP is less volatile than average in the floating-rate period at a 5% level, while Hong Kong's real GDP is less volatile than average in the fixed-rate period at a 10% level. These time-series properties appear to suggest that the oil price shock (rather than the choice of exchange rate regime) was the important determinant of macroeconomic performance for Hong Kong and Taiwan.

IV.2 A VAR analysis

The theoretical model in Section 2 does not provide a testable structural econometric model for the output growth rate and inflation rate. Nevertheless, if we suppose that the reduced-form VAR system is an adequate description of the GDP growth rate (y_t) and inflation rate (π_t) : $C + A(L)X_t = U_t$ in which C is the 2×1 constant vector, $A(L) \equiv I + A_1L + A_2L^2 + \ldots + A_pL^p$, $X_t = [y_t \ \pi_t]'$ is a vector of stationary variables, and $U_t = [u_{1t} \ u_{2t}]'$ is a vector of serially uncorrelated normal-distributed shocks.[7] Here L is the lag operator with $L^q x_t = x_{t-q}$, I is a 2×2 identity matrix, and A_i is a 2×2 matrix coefficient, for $i = 1, 2, 3, \ldots p$. The lag order in the VAR model (which is decided by the likelihood ratio test) is 4 for Hong Kong and 2 for Taiwan.

According to the theoretical predictions in Section 2 and previous empiric studies (i.e. Ahmed et al., 1993), the most likely structural changes in the VAR

7. Phillips and Perron's $\hat{Z}_\alpha$ test shows that these variables are non-stationary in levels and stationary in growth rates.

system of X_t are volatility shift and regression parameter instability.[8] To detect the regression parameter instability, we can investigate whether the coefficients in $A(L)$ change across alternative exchange rate regimes. If the coefficients do indeed change, then the dynamic responses are not the same for the two exchange rate regimes.

This paper first tests for the constancy of the variances, as this logically precedes the test for the constancy of the regression parameters. Given the normality and independence assumptions, the ratio of the estimated variances in the managed float-rate period to those in the fixed-exchange-rate period is an F statistic.[9] The F-test statistics for testing constant variances across the two exchange rate regimes are distributed with degrees of freedom $N_1 - 1$ and $N_2 - 1$, where N_1 is the number of observations in the floating-rates regime, and N_2 is the number of observation in the fixed-rate regime. The F-test statistics for the constant variance of u_{1t} and u_{2t} across the two exchange rate regimes are 2.08 and 1.26 for Hong Kong and 0.43 and 0.24 for Taiwan, respectively. The null hypothesis of the constant variances of U_t for Hong Kong and for Taiwan is rejected at the 1% significance level, except for Hong Kong's u_{2t}.

According to F-test statistics, Hong Kong had a higher volatility of U_t under the floating-exchange-rate regime, while Taiwan had a higher volatility of U_t under the fixed-exchange-rate regime. Since Hong Kong and Taiwan adopted different exchange rate regimes in their first sub-sample periods, a higher volatility of U_t in the first sub-sample period indicates that the volatility patterns of the two aggregate variables cannot be systematically related to the exchange rate regime. Moreover, this evidence is consistent with the higher volatility of oil price changes in the 1970s.

We then investigate whether the exchange rate regime change induced other structural shifts, leading to instability in the regression parameters. Due to the differences in the volatility of shocks, we adopt a weighted-least-squares estimation, so that the parameter-instability test is conditioned on a non-constant variance across regimes. This amounts to testing for the significance of the slope dummies associated with A_1. The likelihood ratio statistics for this hypothesis – which are asymptotically distributed as $\chi^2_{(16)}$ for Hong Kong and $\chi^2_{(8)}$ for Taiwan – are 18.73 and 13.31, respectively. Both statistics are less than the 5% critical values. Thus, the dynamic interactions among inflation and GDP growth rate have been the same across exchange rate regimes for both Hong Kong and Taiwan. This result is consistent with Ahmed et al. (1993), who found no differences in the transmission properties of economic disturbances across exchange rate regimes.

8. Both the slopes and intercepts' dummy variables for observations corresponding to the flexible exchange rate period are added when estimating the VAR system by ordinary least squares.

9. Diagnostic tests in regression by Godfrey's Lagrange Multiplier tests indicate that the error terms are serially uncorrelated.

IV.3 Other macroeconomic performances

This paper also examines whether the cyclical behaviors of aggregate variables in Hong Kong and Taiwan – such as GDP, consumption, investment, exports, imports, and real exchange rate – are systematically related to the choice of exchange rate regime.[10] To compare our results with those in Baxter and Stockman (1989), we use their trend-removing procedures to induce the stationarity of relevant aggregate variables: (i) seasonal-difference the logarithm of the variable, and (ii) remove a segmented linear trend fitted to the logarithm of a seasonally adjusted variable.[11] All quantity variables are real and are measured on a *per capita* basis.

One would expect that the choice of exchange rate regime would have important effects on trade variables such as exports, imports, and real exchange rate. When using the first-differencing procedure, it is clear from Table 2 that the real exchange rate's volatility is high in the floating-rate period, although the difference is not statistically significant. This is surprising, because the real exchange rate's volatility is commonly associated with the floating-exchange-rate regime. While changes in import volatility are also insignificant, the volatility of Taiwan's exports is a distinct exception. The latter is significantly more stable in the floating-rate period at a 1% level, independent of the two trend-removing procedures, as displayed in Table 2.

According to Baxter and Stockman (1989), all OECD countries except Italy experienced an increase in export volatility; however, only three out of twenty-three non-OECD countries experienced the increase in the post-1973 floating-rate period. Our finding also provides weak support for the theory that changes in real trade variability depend on the choice of exchange rate regimes.

Table 2 also gives the average annual growth rates and volatility measures of GDP, consumption, and investment. The mean and standard deviation of consumption, just as the statistics of the real exchange rate, increase insignificantly under a floating-exchange-rate regime.[12] On the other hand, investment, as well as GDP, has a higher growth rate and lower volatility in a floating-exchange-rate regime for Hong Kong.[13] Investment, as well as GDP, has a lower growth rate and volatility in a floating-exchange-rate regime for Taiwan. Of the two, Taiwan's GDP volatility with a linear detrending process is significantly higher in the fixed-rate period and lower in the floating-rate period. These results appear to

10. Data source for Hong Kong is Whaton Econometric Forecasting Associates, Census and Statistics Department, Hong Kong Special Administrative Region, and International Financial Statistics (IFS), IMF. Data source for Taiwan is Financial Statistics, and National Income Accounts, Taiwan district, Republic of China. Data source for USA is IFS, IMF.

11. The breaking point in the linear trend is first quarter of 1986. Seasonal factors are removed by dummy variables.

12. Hong Kong experienced increases in the floating-rate period only with the first-differencing procedure.

13. Its GDP volatility only experienced increases with the first-differencing procedure.

Table 2 Statistical Properties of Aggregate Variables

Variable	*Seasonal Differencing*						*Linear Detrending Standard Deviation (%)*		
	Annual Growth Rate (%)			*Standard Deviation (%)*					
				I. Hong Kong					
	1975 : 1–2000 : 4	*Fixed*	*Floating*	*1975 : 1–2000 : 4*	*Fixed*	*Floating*	*1975 : 1–2000 : 4*	*Fixed*	*Floating*
GDP	4.39	3.65	5.85	4.89	4.60	5.04	5.06	5.20	4.66
		(2.58)	(1.28)		(1.43)	(0.49)		(1.29)	(0.77)
Consumption	4.62	3.52	6.79	5.20	4.51	5.60	6.88	7.19	6.04
		(2.00)	(1.37)		(2.30)	(0.86)		(1.04)	(0.76)
Investment	4.71	3.50	7.07	9.31	9.14	9.05	12.02	11.82	11.12
		(3.07)	(5.17)		(3.29)	(2.16)		(1.96)	(1.94)
Exports	8.86	9.56	7.48	8.58	8.21	8.99	10.25	11.89	5.33
		(4.71)	(3.58)		(1.71)	(1.78)		(2.48)	(0.60)
Imports	9.62	9.86	9.17	9.49	9.14	10.02	12.34	14.03	7.73
		(5.60)	(4.41)		(2.51)	(1.41)		(2.57)	(1.42)
Real exchange rate	0.09	−1.85	3.37	5.56	4.61	5.59	6.09	6.38	4.93
		(4.10)	(3.26)		(1.68)	(1.02)		(3.54)	(3.77)
				II. Taiwan					
	1975 : 1–2000 : 4	*Fixed*	*Floating*	*1975 : 1–2000 : 4*	*Fixed*	*Floating*	*1975 : 1–2000 : 4*	*Fixed*	*Floating*
GDP	6.13	7.26	5.79	2.96	4.15	2.38	2.97	4.28*	2.31[a]
		(1.31)	(1.14)		(0.52)	(0.73)		(0.40)	(0.47)
Consumption	6.23	5.84	6.35	2.49	2.37	2.49	3.41	2.58	3.57
		(1.00)	(0.91)		(0.30)	(0.43)		(0.46)	(1.04)
Investment	6.88	9.67	6.04	7.73	9.18	6.97	9.38	9.35	9.03
		(3.48)	(2.10)		(2.28)	(0.74)		(1.18)	(0.99)
Exports	8.87	11.20	8.17	10.40	16.63	7.35**	7.05	11.23*	5.03**
		(4.77)	(2.11)		(2.37)	(1.16)		(1.80)	(0.50)
Imports	8.09	7.86	8.16	10.31	14.54	8.57	8.20	10.10	7.41
		(5.09)	(2.28)		(3.25)	(1.08)		(2.26)	(1.46)
Real exchange rate	0.12	−0.11	0.19	6.85	3.34	7.56	8.83	3.53	9.81
		(2.27)	(3.95)		(4.21)	(1.90)		(1.15)	(2.73)

Notes: Hong Kong's fixed-rate period is 1983 : 4–2000 : 4; its floating-rate period is 1975 : 1–1983 : 3. Taiwan's fixed-rate period is 1975 : 1–1980 : 4 and its floating-rate period is 1981 : 1–2000 : 4.

Means and deviations are estimated by generalized method of moments (GMM) estimation. Numbers in parentheses are standard errors. Terms [a], *, and ** indicate the $\chi^2(1)$ statistics for testing the null that the statistic under a specific exchange rate regime equals the corresponding full sample moment is significant at the 10, 5, and 1% level, respectively.

Table 3 Cross-Correlations with GDP

	Correlation of X_{t-j} with GDP_t						
Variable (X_t) j:	*–4*	*–2*	*–1*	*0*	*1*	*2*	*4*
	I. Hong Kong: Seasonal Differencing (Fixed/Floating)						
Consumption	0.23/0.50	0.55/0.38	0.70/0.48	0.75/0.37	0.68/0.30	0.53/0.18	0.10/–0.19
Investment	0.40/0.39	0.63/0.48	0.60/0.60	0.46/0.60	0.22/0.54	–0.02/0.47	–0.34/–0.11
Exports	0.30/–0.53*	0.76/–0.14	0.86/0.20*	0.88/0.62	0.73/0.57	0.53/0.51	0.06/0.01
Imports	0.33/–0.22*	0.73/–0.03	0.82/0.24[a]	0.82/0.45	0.67/0.61	0.46/0.52	0.02/0.16
US GDP	–0.01/0.00	0.11/0.20	0.17/0.34	0.18/0.53	0.14/0.57	0.01/0.51	–0.25/0.02
	II. Hong Kong: Linear Detrending (Fixed/Floating)						
Consumption	0.71/0.53	0.83/0.58*	0.87/0.71	0.86/0.49[a]	0.84/0.59	0.75/0.43	0.55/0.10
Investment	0.66/0.74	0.69/0.65	0.67/0.70	0.65/0.77	0.57/0.69	0.49/0.50	0.32/0.18
Exports	0.72/–0.13	0.89/0.13	0.90/0.30*	0.91/0.66	0.81/0.52	0.71/0.56	0.48/0.43
Imports	0.75/0.40	0.89/0.39	0.90/0.45[a]	0.91/0.65	0.83/0.67	0.73/0.55	0.530/0.38
US GDP	–0.60/0.05	–0.57/0.32	–0.57/0.40	–0.57/0.52	–0.57/0.59	–0.59/0.63	–0.56/0.55
	III. Taiwan: Seasonal Differencing (Fixed/Floating)						
Consumption	0.01/0.49	0.42/0.65	0.67/0.66	0.67/0.63	0.34/0.44	–0.01/0.28	–0.75/–0.05
Investment	–0.36[a]/0.31	–0.52/0.61	–0.39/0.62	–0.32/0.56	0.03/0.33	0.33/0.16	0.26/–0.26
Exports	–0.58/–0.33	0.21/0.26	0.57/0.52	0.91/0.73	0.76/0.68	0.21/0.53	–0.41[a]/0.10
Imports	–0.44/0.15	0.25/0.62	0.68/0.75	0.74/0.75	0.49/0.55	0.02/0.38	–0.53/–0.05
US GDP	–0.11/0.11	0.57/0.34	0.79/0.40	0.78/0.40	0.60/0.31	0.16/0.17	–0.33/–0.15
	IV. Taiwan: Linear Detrending (Fixed/Floating)						
Consumption	0.73/0.63	0.77/0.77	0.77/0.72	0.83/0.78	0.65/0.60	0.65/0.57	0.56/0.35
Investment	0.45/0.54	0.15/0.56	0.36/0.58	0.37/0.69	0.35/0.62	0.21/0.52	0.21/0.39
Exports	0.24*/–0.43	0.70*/–0.11*	0.74/0.15[a]	0.86*/0.26	0.82/0.21	0.78[a]/0.19	0.62[a]/0.15
Imports	0.57/0.31	0.73/0.58	0.80/0.76	0.76/0.74	0.74/0.68	0.63/0.55	0.45/0.30
US GDP	0.48/–0.35	0.75/–0.20	0.83/–0.17	0.85/–0.18	0.86/–0.20	0.84/–0.26	0.75/–0.34

Notes: Hong Kong's fixed-rate period is 1983 : 4–2000 : 4; its floating-rate period is 1975 : 1–1983 : 3. Taiwan's fixed-rate period is 1975 : 1–1980 : 4 and its floating-rate period is 1981 : 1–2000 : 4.
Means and deviations are estimated by generalized method of moments (GMM) estimation. Numbers in parentheses are standard errors. Terms [a], *, and ** indicate the $\chi^2(1)$ statistics for testing the null that the statistic under a specific exchange rate regime equals the corresponding full sample moment is significant at the 10, 5, and 1% level, respectively.

suggest that the statistical properties of GDP may be related to the stage of economic development rather than to the choice of exchange rate regime.

The business cycle phenomenon also consists of a common pattern of correlation between different aggregate variables and Table 3 presents the cross-correlation statistics. We turn to consumption and investment and their cross-correlation with GDP. The first observation is the rise in the correlation between consumption and GDP in the fixed-rate period, except for Taiwan with a differencing procedure. Some of the statistics in Hong Kong are significant. As for the correlation of investment and GDP, the estimate of Taiwan with a differencing procedure is imprecise and many of these statistics even indicate a countercyclical investment. For the rest of the estimated correlation of investment and GDP, there is no significant difference across exchange rate regimes. For real

exports and imports, the strong pro-cyclical character in the fixed-rate period was not generally applied to the floating-rate period and many of these correlation coefficients are significantly different.[14]

As the USA is the most important trade partner for Hong Kong and Taiwan, we also examine whether the two countries' output cross-correlation with the USA differs across alternative exchange rate regimes. It can be seen in Table 3 that the output correlation with the USA generally loses its pro-cyclical character in the second sample period for both Hong Kong and Taiwan. However, the standard errors for the estimates of correlation coefficients are large and none of the changes is significant.[15] In general, the changes in the casual structure between GDP and other aggregate variables appear to be independent of the choice of exchange rate regime.

V. Concluding Remarks

The choice of exchange rate regimes has long been one of the most fundamental issues in international finance. In order to isolate differences that are due only to the exchange rate regime and not due to a 'post-1973' effect, this paper studies two episodes of countries that share many similar macroeconomic characteristics, but that changed their exchange rate regime at different times – Hong Kong and Taiwan. Our empiric study, either documented by simple statistics or a VAR analysis of inflation and growth, indicates that macroeconomic performance is not systematically related to the choice of exchange rate regimes.

However, it is well known that the effect of an announcement depends on the extent to which the public itself believes that announcement. Today's giant global capital markets easily magnify any weaknesses in a country's commitment to targeting an exchange rate and leave little room for maneuver. A proper monetary institutional arrangement could be important for building the commitment mechanism. The 1997 Asian financial crisis – a time when many countries announced a target for their exchange rate – provides a good episode for examination. For Taiwan, the problem may be that there are too many competing objectives for the Central Bank. A Central Bank, as a lender of last-resort pledging that it will indefinitely ignore all side-effects to defend the exchange rate, is not likely to be credible. Alternatively, the transparency and accountability of Hong Kong's monetary policy enabled it to beat back (or avoid altogether) the speculative attacks in the fall of 1997 while still retaining an open capital market. Currency stability is the overriding goal in the currency board system. The practical arrangement of monetary institutions is therefore an interesting issue and worthy of further research.

14. There are more phase-shifts with the seasonal differencing procedure for Taiwan.

15. One possible interpretation of these results is that business cycles in the second sample period were more country-specific than in the first sample period.

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