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Is there a yen optimum currency area? Evidence from 18 Asian and Pacific economies

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Abstract

This paper examines the macroeconomic costs and benefits of adopting a common currency (the yen) for 18 Asian and Pacific countries. Economic theory suggests that the main benefit is enhanced price stability, while the main cost is higher business-cycle volatility if the adopting country's output is not sufficiently correlated with that of Japan. Using data from 1960–2001, the paper finds that the estimated cost and benefit measures exhibit substantial variability across the countries and are often positively correlated: countries (such as Bangladesh or Nepal) that have a lot to gain from adopting the yen, also have a lot to lose from it; while other economies (such as Singapore, Thailand, or Taiwan) that have little to lose by adopting the yen, have also little to gain by it. The empirical results can be also used to compare net benefits for individual countries, showing, for example, that Korea is a more promising candidate for adopting the yen than Pakistan or Malaysia.

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1. Introduction

Despite the fact that the economic importance of East Asia for the world economy is universally acknowledged to be huge (and still growing), the prospect of a common currency for the economies of the area has been much less extensively researched than the euro project for the European Union or the prospect of dollarization for the Americas.[1] Such research, however, is even more urgently needed after the events of the 1997–1998 Asian crisis which had a very strong currency component.[2] Would a common currency for the Asian economies have prevented or mitigated the crisis? How large would the benefits have been? And at what cost in terms of business-cycle volatility?

This paper examines the main macroeconomic costs and benefits of adopting a common currency (the yen) for a number of Asian countries. Economic theory suggests that, under certain conditions, the main benefit for a country joining a yen-based monetary union is enhanced price and exchange-rate stability, and thus a lower steady-state inflation rate. At the same time, adopting the yen rules out the possibility of independent monetary policy, and so it may contribute to business-cycle volatility if the adopting country's output is not sufficiently correlated with that of Japan.

Annual data from the 1960–2001 period are used to estimate various measures of these costs and benefits for 18 countries of the region (including Japan). The paper finds that these cost and benefit factors vary substantially across the countries considered. Furthermore, costs and benefits are often positively related, making net benefits very difficult to compute. In a nutshell, countries (such as Bangladesh or Nepal) that have a lot to gain from adopting the yen, also have a lot to lose from it; while other economies (such as Singapore, Thailand or Taiwan) that have little to lose by adopting the yen, have also little to gain by it. The empirical results can also be used to compare between countries, pointing out, for example, that Korea is a more promising candidate for adopting the yen than Pakistan or Malaysia.

The rest of the paper is organized as follows. Section 2 uses a recent model of monetary policy in order to illustrate the theoretical derivation of costs and benefits from adopting the yen. Section 3 describes the empirical methodology and the data. Section 4 presents and discusses the empirical results, and Section 5 concludes.

2. Theoretical background

The theoretical framework follows the ''New Keynesian'' monetary policy model of Clarida et al. (1999).[3] Suppose there are N economies indexed by i ($i = 1, 2, \ldots, N$). The loss

[1] Two exceptions are Eichengreen and Bayoumi (1996) who investigate a very similar set of questions using a different methodology, and Alesina et al. (2002) who examine the pros and cons for several countries from adopting the yen (as well as the euro or the dollar).

[2] The literature on the Asian crisis is vast. See Corsetti et al. (1999) for a thorough account of the causes and related policies.

[3] Also see Karras (2003). Very similar results can be derived from the (older) monetary policy model based on the work by Kydland and Prescott (1977), Barro and Gordon (1983), and Rogoff (1985), and used to evaluate the effects of monetary integration by Alesina and Grilli (1992), DeGrauwe (1994), and Alesina and Wacziarg (1999). The main differences between these models and the present formulation is a more modern aggregate supply specification and a richer dynamic structure.

function of each economy's monetary authority takes the form

$$L_i = \frac{1}{2} E_t \left\{ \sum_{j=0}^{\infty} \beta^j [a_i (y_{i,t+j} - k_i)^2 + \pi_{i,t+j}^2] \right\}, \tag{1}$$

where y denotes output (in deviations from trend), π the inflation rate, a the relative weight on output deviations ($a > 0$), β the discount factor, E denotes mathematical expectation, and k is the output target. As usual, it is assumed that $k \geq 0$ because of distortions such as imperfect competition or taxes.

For each economy, aggregate supply is given by a "New Keynesian" expectations-augmented Phillips curve

$$\pi_{i,t} = \lambda_i y_{i,t} + E_t \pi_{i,t+1} + u_{i,t}, \tag{2}$$

where $\lambda_i > 0$, $u_{i,t} = \phi_i u_{i,t-1} + z_{i,t}$, $0 < \phi_i < 1$, and $z_{i,t} \sim iid(0, \tau_i^2)$. This can also be written in aggregate-supply form as

$$y_{i,t} = \vartheta_i (\pi_{i,t} - E_t \pi_{i,t+1}) + v_{i,t}, \tag{3}$$

where $\vartheta_i = 1/\lambda_i$ and $v_{i,t} = -u_{i,t}/\lambda_i$.[4] Note that this implies $v_{i,t} = \phi_i v_{i,t-1} - \lambda_i^{-1} z_{i,t}$, and define

$$\sigma_i^2 \equiv \mathrm{Var}(v_{i,t}) = \tau_i^2 [\lambda_i^2 (1 - \phi_i^2)]^{-1}.$$

2.1. Independent monetary policy

Without monetary integration, each economy's central bank can pursue an independent monetary policy, minimizing (1) subject to (2). This leads to the following outcome ("discretion"):

$$\pi_{i,t}^{\mathrm{IND}} = a_i q_i u_{i,t} + \frac{a_i}{\lambda_i} k_i = -a_i q_i \lambda_i v_{i,t} + \frac{a_i}{\lambda_i} k_i, \tag{4}$$

and

$$y_{i,t}^{\mathrm{IND}} = -\lambda_i q_i u_{i,t} = \lambda_i^2 q_i v_{i,t} \tag{5}$$

where the IND superscript denotes outcomes under independent monetary policy, and $q_i = [\lambda_i^2 + a_i (1 - \beta \phi_i)]^{-1}$. The macroeconomic performance of the economy will be characterized by average ("trend") inflation equal to

$$\overline{\pi}_i^{\mathrm{IND}} = \frac{a_i k_i}{\lambda_i} \tag{6}$$

and output ("business-cycle") volatility

$$\mathrm{Var}(y_i^{\mathrm{IND}}) = \lambda_i^4 [\lambda_i^2 + a_i (1 - \beta \phi_i)]^{-2} \sigma_i^2 \tag{7}$$

[4] This specification of the Phillips curve goes back to Calvo (1983). For more recent examples see Rotemberg (1987), Roberts (1995), and Gali and Gertler (1999).

As expected, the inflation bias is increasing with the weight on output (a), the output target (k), and the slope of the aggregate supply ($\vartheta = 1/\lambda$). It is also apparent that there is a trade-off between average inflation and output variability:[5] if a is very low (so that the central bank is very "conservative" in the sense of assigning a higher relative weight to inflation than to output), average inflation will be very low, but output very unstable.

2.2. Adopting the yen as common currency

Next, assume the N economies form a monetary union, monetary authority is delegated to Japan ($i = 1$), and the yen is adopted by all N economies.[6] Then, at equilibrium, $\pi_{i,t}^{\text{YEN}} = \pi_{1,t}^{\text{YEN}} = \pi_{1,t}^{\text{IND}}, \forall i$, where $\pi_{1,t}^{\text{IND}}$ is given by (4). Substituting into (3), we get

$$y_{i,t}^{\text{YEN}} = -a_1 q_1 (1 - \phi_1) v_{1,t} + v_{i,t}, \tag{8}$$

where the YEN superscript refers to outcomes under monetary integration. Note that, with adopting the yen, economy i's output is affected not just by its own output shock, $v_{i,t}$, but also by the Japanese shock, $v_{1,t}$. The reason, of course, is that the Japanese shock is "exported" to the other countries via the conduct of monetary policy by the Bank of Japan.

How does the macroeconomy perform if the yen is adopted? Average inflation will be given by

$$\overline{\pi}_i^{\text{YEN}} = \frac{a_1 k_1}{\lambda_1} \tag{9}$$

and business-cycle volatility by

$$\text{Var}(y_i^{\text{YEN}}) = a_1^2 q_1^2 (1 - \phi_1)^2 \sigma_1^2 + \sigma_i^2 - 2 a_1 q_1 (1 - \phi_1) \rho_{i,1} \sigma_i \sigma_1, \tag{10}$$

where $\rho_{i,1} \equiv \text{corr}(v_{i,t}, v_{1,t})$. Costs and benefits of membership of adopting the yen can now be identified.

The main macroeconomic *benefit* of adopting the yen can be seen if we compare Eqs. (6) and (9). From these two equations, it is apparent that participation in the monetary union will reduce a country's average inflation rate, provided Japan has a more "conservative" monetary authority ($a_1 < a_i$ and $K_1 < K_i$) and a less tempting aggregate supply ($\vartheta_1 < \vartheta_i$): $\overline{\pi}_i^{\text{YEN}} < \overline{\pi}_i^{\text{IND}}$.

At the same time, however, comparing Eqs. (7) and (10) shows that adopting the yen may very well increase output volatility: this is the macroeconomic *cost* of membership in

[5] As first pointed out by Taylor (1979), there is also a trade-off between output variability and inflation variability, given here by $\text{Var}(\pi_i^{\text{IND}}) = a_i^2 \lambda_i^2 [\lambda_i^2 + a_i (1 - \beta \phi_i)]^{-2} \sigma_i^2$: a low a reduces the volatility of inflation but raises that of output. See Fuhrer (1997).

[6] Note that adopting the yen is different from forming a monetary union that would introduce a new but common currency. The former can be thought of as "yen-ization" (and theoretically resemble the effects of dollarization) while the latter would be more similar to the creation of the euro for 12 of the 15 EU countries. While the similarities between the two are many, the differences are also important. For example, analysis of a euro-type monetary union would require (i) an investigation of each economy's correlations with the entire monetary area rather than solely with Japan, (ii) resolving how seignorage would be shared, (iii) assigning weights to each country in the policy decision process. Partly for these reasons, we concentrate here on the simpler question of the effects of adopting the yen.

the yen area. From (10), this cost will be smaller, the closer $\rho_{i,1}$ is to unity. Intuitively, if business cycles in Indonesia and Japan are very highly correlated, countercyclical monetary policy conducted by the Bank of Japan will be a very close substitute for monetary policy conducted by Indonesia's central bank. In this case, Indonesia's adoption of the yen, even though it means giving up independent monetary policy, will not be very costly. If, on the other hand, Indonesian output is negatively correlated with Japan's, so that expansions in one of the two countries tend to coincide with recessions in the other, surrendering monetary policy to Japan will destabilize Indonesia by amplifying its business cycle.

3. Data and empirical methodology

Two data sets are used in order to quantify the costs and benefits outlined above. *Data Set I* (PWT 6.1) uses real GDP and nominal exchange rates from the Penn World Tables, Mark 6.1, documented in Heston et al. (2001; see also Summers and Heston, 1991). Real GDP is expressed in PPP-adjusted constant 1996 prices (chain method). The data set includes 18 economies for which both series are available annually from 1960 to 2000: Australia, Bangladesh, China, Hong-Kong, Indonesia, India, Japan, Korea, Sri Lanka, Malaysia, Nepal, New Zealand, Pakistan, the Philippines, Papua New Guinea, Singapore, Thailand, and Taiwan.[7] *Data Set II* (IFS) uses annual real GDP, in 1990 prices, and annual CPI data from the IMF's International Financial Statistics on CD-ROM. The period covered is from 1960 to 2001, but the full data are now available for a smaller number of economies. Real GDP, for example, is only available for Australia, Indonesia, India, Japan, Korea, Nepal, New Zealand, Pakistan, the Philippines, Singapore, and Thailand (11 of the original 18 economies).

The construction of inflation and depreciation rates is straightforward (see also Table 1), but the derivation of cyclical output warrants some additional discussion. Three different methods are used to detrend the output series of each country and estimate its cyclical component. The first is simple differencing, using $(\mathrm{GDP}_{i,t} - \mathrm{GDP}_{i,t-1})/\mathrm{GDP}_{i,t-1}$ as the growth rate of real GDP.

The second method is the Hodrick–Prescott (HP) filter, proposed by Hodrick and Prescott (1980) and extensively used in the business-cycle literature. Letting $y_{i,t} = \ln(\mathrm{GDP}_{i,t})$, the HP filter defines the trend component $\overline{y}_{i,t}$ as the one that minimizes

$$\sum_{t=1}^{T}(y_{i,t} - \overline{y}_{i,t})^2 + \ell \sum_{t=2}^{T-1}[(\overline{y}_{i,t+1} - \overline{y}_{i,t}) - (\overline{y}_{i,t} - \overline{y}_{i,t-1})]$$

for $\ell > 0$. The cyclical component is simply $y_{i,t} - \overline{y}_{i,t}$. Here, we selected $\ell = 100$, the value recommended by Kydland and Prescott (1989) for annual data.

The third method makes use of the recently very popular Band–Pass (BP) filter proposed by Baxter and King (1995) and evaluated by Stock and Watson (1998) and Christiano and Fitzgerald (1999), who also compare its properties to those of the HP filter. The low pass

[7] Country selection has been dictated by data availability only. Data for Papua New Guinea, Singapore, and Thailand extend over 1960–1997.

Table 1
Average annual depreciation and inflation rates

i	Data set I: PWT 6.1 (1960–2000)		Data set II: IFS (1960–2001)	
	$\overline{\Delta e}$	$\sqrt{\mathrm{Var}(\Delta e)}$	$\overline{\pi}$	$\sqrt{\mathrm{Var}(\pi)}$
Australia	1.92	7.56	5.74	4.12
Bangladesh	5.57	9.46	10.44[a]	12.41[a]
China	3.61	11.30	–	–
Hong-Kong	0.88	4.70	–	–
Indonesia	78.49	285.24	60.95	179.36
India	6.07	8.36	7.86	5.61
Japan	−2.55	8.98	4.30	4.38
Korea	8.92	20.31	9.54[b]	7.19[b]
Sri Lanka	7.75	12.40	8.38	6.15
Malaysia	0.79	7.58	3.30	3.31
Nepal	6.02	7.28	8.27[b]	5.67[b]
New Zealand	3.27	9.51	6.97	5.46
Pakistan	6.88	13.63	7.90	5.52
Philippines	9.18	17.99	10.48	8.76
Papua New Guinea	1.55[a]	7.28[a]	7.47[c]	4.52[c]
Singapore	−1.88[a]	3.56[a]	2.91	4.63
Thailand	1.81	6.96	5.08	5.15
Taiwan	−0.54[a]	4.44[a]	–	–

Note: $\Delta e_{i,t} = 100 \times (e_{i,t} - e_{i,t-1})/e_{i,t-1}$, and $\pi_{i,t} = 100 \times (\mathrm{CPI}_{i,t} - \mathrm{CPI}_{i,t-1})/\mathrm{CPI}_{i,t-1}$, where $e_{i,t}$ is the nominal exchange rate (units of country i's national currency per US dollar at time t). Averages, $\overline{\Delta e}$ and $\overline{\pi}$, and standard deviations are computed over the whole time period unless otherwise indicated.

[a] PWT data for Papua New Guinea, Singapore, and Taiwan, and IFS data for Bangladesh are for 1960–1997.

[b] Korea's and Nepal's inflation numbers are for the 1967–1997 period.

[c] Papua New Guinea's inflation numbers are for the 1972–1997 period.

(LP) filter $\alpha(L)$, which forms the basis for the band pass filter, selects a finite number of moving average weights α_h to minimize

$$Q = \int_{-\pi}^{\pi} |\delta(\omega)|^2 \, \mathrm{d}\omega$$

where $\alpha(L) = \sum_{h=-K}^{K} \alpha_h L^h$ and $\alpha_K(\omega) = \sum_{h=-K}^{K} \alpha_h \, \mathrm{e}^{-\mathrm{i}\omega h}$. The LP filter uses $\alpha_K(\omega)$ to approximate the infinite MA filter $\beta(\omega)$. Define $\delta(\omega) \equiv \beta(\omega) - \alpha(\omega)$. Minimizing Q minimizes the discrepancy between the ideal LP filter$\beta(\omega)$ and its finite representation $\alpha_K(\omega)$ at frequency ω. The main objective of the BP filter as implemented by Baxter and King (1995) is to remove both the high frequency and low frequency component of a series, leaving the business-cycle frequencies. This is formed by subtracting the weights of two low pass filters. We define ω_L and ω_H, the lower and upper frequencies of two low pass filters as 8 and 2, respectively. We therefore remove all fluctuations shorter than two or longer than eight years. The frequency representation of the band pass weights becomes $\alpha_K(\omega_H) - \alpha_K(\omega_L)$, and forms the basis of the Baxter–King filter which provides an alternative estimate of the trend component $\overline{y}_{i,t}$, and the cyclical $y_{i,t} - \overline{y}_{i,t}$.

While minor differences among the results obtained by the three filters are not difficult to detect (for example, differencing generally produces the most volatile series, while the

BP filter the smoothest), the main characteristics are remarkably similar. This robustness will be formally confirmed by the findings of the next section.

4. Empirical results

4.1. Benefits

As discussed in Section 2, an economy stands to benefit from adopting the yen by having a lower average inflation rate and reduced inflation variability, provided the Bank of Japan is less prone to inflation bias than the domestic monetary authorities. By definition, adopting the yen will also eliminate variability of the exchange rate with respect to the yen, making depreciation (or devaluation) of the currency against the Japanese currency impossible.[8] Therefore, the economy's exchange rate movements with respect to other currencies, such as the US dollar or the euro, will exactly follow the pattern set by the Japanese yen. How important would such a benefit be in practice for the countries in our sample?

Table 1 provides an answer to this question by looking at average exchange-rate depreciation and inflation rates, over 1960–2000, for each of the 18 countries in the sample. It is apparent that the extent of the inflation bias has varied substantially across these countries. Focusing first on exchange rates, the average annual depreciation rate against the US dollar over 1960–2000 has ranged from −2.55% for the Japanese yen to 78.49% for the Indonesian rupiah. Exchange-rate volatility, measured by the standard deviation of the depreciation rate, has been the smallest for Singapore and the largest (again) for Indonesia. Among the rest of the countries, Korea, the Philippines, and, to a lesser extent, Pakistan and Sri Lanka, have also labored under unstable currencies, but not nearly as much as Indonesia. It is clear then that, in terms of exchange-rate stability, Indonesia has by far the most to gain from adopting the yen, while the benefits can also be sizable for the Philippines, Korea, Pakistan, and Sri Lanka. On the contrary, such benefits will be negligible for Singapore, Taiwan, or Hong-Kong.

A similar picture emerges if one looks at price stability. Again looking at Table 1, the average annual inflation rate over 1960–2000 has ranged from 2.91% in Singapore to 60.95% in Indonesia. Inflation variability, measured by its standard deviation, exhibits virtually the same ranking, being the lowest in Malaysia and the highest in Indonesia. Fig. 1 shows that, consistent with the long-run Purchasing Power Parity hypothesis, the relationship between the average depreciation rate and the average inflation rate has been almost exactly one-to-one. This of course justifies our treatment of price and exchange-rate stability as the same policy goal. Fig. 2 produces a scatter plot of the same two variables excluding the observation for Indonesia, to demonstrate that the PPP relationship is not due to the outlier but also holds for the moderate- and low-inflation countries.[9] Once more, the inflation bias has been most pronounced in Indonesia, but also in the Philippines,

[8] Theoretically, of course, and especially in the long-run, there is no difference between the inflation and the exchange-rate results, as can be seen by combining the Purchasing Power Parity and Quantity Theory of Money relationships. See Figs. 1 and 2 below for empirical evidence on the present sample of economies.

[9] The correlation coefficient for the average depreciation and average inflation rates for the full sample is 0.995, while for the sample excluding Indonesia 0.863.

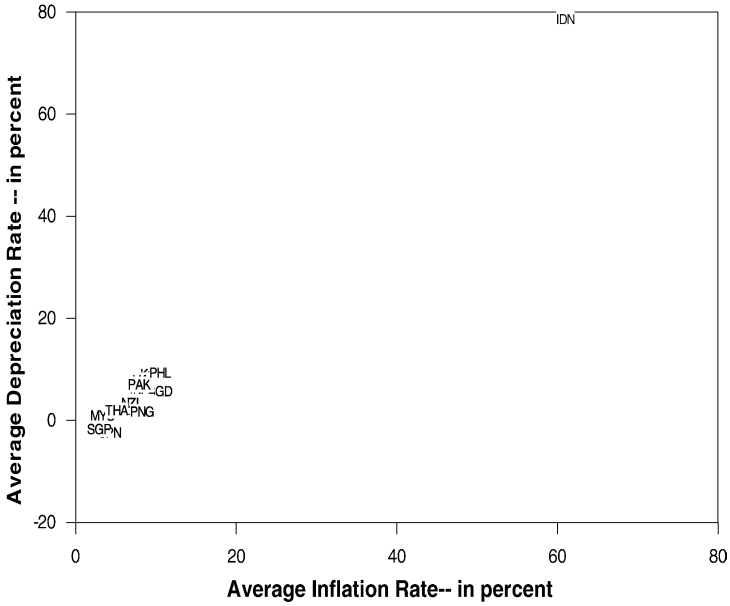

Fig. 1. Depreciation and inflation.

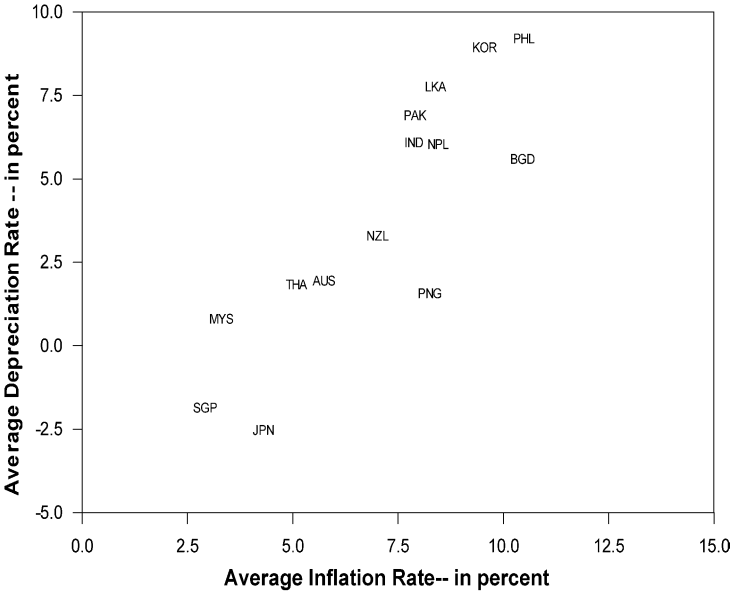

Fig. 2. Depreciation and inflation, excluding Indonesia.

Bangladesh, and Korea. It follows that these are the economies that have most to gain from adopting the yen. Instead, the gains for Singapore or Taiwan will be very small. The rest of the countries can be easily ranked in terms of likely benefits on the basis of their inflation and depreciation performance. For example, Pakistan would stand to gain more than Australia, but less than Korea.

4.2. Costs

If there were no costs, the evidence of Table 1 would suggest that adopting the yen would be beneficial for most of the countries considered, even though the extent of the benefit would differ by country. Adopting the yen, however, is costly because the adopting country, by giving up independent monetary policy, loses some of the ability to respond to output shocks and thus to smooth the domestic business cycle. As shown in Section 2, the size of the cost will depend on the correlation between Japan's and the member economy's cyclical output.

Table 2 reports the correlation coefficient of each country's cyclical output component with that of Japan, for the three methods outlined in Section 3 (differencing, the Hodrick–Prescott filter, and the Band–Pass filter) and the two data sets used. Note that the correlations are broadly similar across the three filtering methods, but somewhat less so between the two data sets. Pakistan seems to be the only country where the two data sets strongly disagree, the PWT giving a much more positive picture than the IFS. Taiwan, Singapore, Thailand, Australia, and Korea seem to be the most consistently and highly

Table 2
Cyclical correlations with Japan

i	Data set I: PWT 6.1 (1960–2000)			Data set II: IFS (1960–2001)		
	$\rho^{\mathrm{DIFF}}_{i,\mathrm{JPN}}$	$\rho^{\mathrm{HP}}_{i,\mathrm{JPN}}$	$\rho^{\mathrm{BP}}_{i,\mathrm{JPN}}$	$\rho^{\mathrm{DIFF}}_{i,\mathrm{JPN}}$	$\rho^{\mathrm{HP}}_{i,\mathrm{JPN}}$	$\rho^{\mathrm{BP}}_{i,\mathrm{JPN}}$
Australia	0.35	0.38	0.33	0.27	0.38	0.30
Bangladesh	−0.33	−0.24	−0.21	–	–	–
China	−0.37	−0.22	−0.21	–	–	–
Hong Kong	0.34	−0.08	0.22	–	–	–
Indonesia	0.12	0.26	0.43	0.22	0.29	0.32
India	−0.04	0.28	0.21	0.05	0.31	0.33
Japan	1.00	1.00	1.00	1.00	1.00	1.00
Korea	0.33	0.40	0.35	0.35	0.36	0.27
Sri Lanka	−0.00	0.10	0.08	–	–	–
Malaysia	−0.04	−0.07	0.27	–	–	–
Nepal	−0.25	−0.24	−0.13	−0.23	−0.14	−0.14
New Zealand	0.05	−0.31	−0.16	0.02	−0.22	−0.15
Pakistan	0.37	0.45	0.32	−0.10	−0.29	0.02
Philippines	0.29	0.03	0.24	0.25	0.05	0.18
Papua New Guinea	0.38[a]	0.01[a]	−0.13[a]	–	–	–
Singapore	0.33[a]	0.16[a]	0.34[a]	0.32	0.48	0.28
Thailand	0.40	0.35	0.43	0.38	0.31	0.29
Taiwan	0.40[a]	0.40[a]	0.33[a]	–	–	–

Note: $\rho_{i,\mathrm{JPN}}$ is the correlation of country i's cyclical component with Japan's cyclical component. DIFF refers to differencing; HP to the Hodrick–Prescott filter, using $\ell = 100$; BP to the Band–Pass filter, implemented as in Baxter and King (1995) using $K = 2$ lags. See the text for details.

[a] PWT correlations with Japan for Papua New Guinea, Singapore, and Taiwan are over 1960–1997.

positively correlated with Japan, while the correlations are also mostly positive for India, Indonesia, and the Philippines. Sri Lanka and Malaysia appear to be effectively uncorrelated with the Japanese economy, while Bangladesh, China, Nepal, and (to a lesser extent) New Zealand have a preponderance of negative correlations with Japan.

Table 2 suggests that the stabilization cost of adopting the yen will be the lowest for Taiwan, Singapore, Thailand, Australia, and Korea: their cyclical outputs are highly correlated with Japan's, so that monetary policy conducted by the Bank of Japan may be an acceptable substitute for that of their own independent monetary authorities. On the other hand, the costs of giving up their currencies in favor of the yen will be the highest for Bangladesh, China, and Nepal, and considerable for New Zealand, Sri Lanka, and Malaysia: their cycles are negatively correlated or uncorrelated with that of Japan, so that delegating monetary policy to the Bank of Japan can be *de*stabilizing for these economies.

4.3. Relationship between costs and benefits

Assessing whether adopting the yen would be beneficial requires joint evaluation of costs and benefits. This is accomplished by comparing the estimates of Table 1 with those of Table 2 for the countries in question. Unfortunately, for many of the countries in our sample, there is a strong positive relationship between costs and benefits of adopting the yen: high benefits, as a consequence of high inflation or depreciation rates, tend to be associated with high costs, in the form of low (or negative) cyclical correlations with Japan; while low benefits often correspond with low costs. This makes the cost-benefit calculation difficult to implement because it implies that some countries for which the price-stability benefits will be high are also those for which the stabilization costs are likely to be high; while countries for which adopting the yen will have small costs will also experience small benefits. Put differently, some countries (such as Bangladesh or Nepal) that have a lot to gain from adopting the yen, also have a lot to lose from it; while other economies (such as Singapore, Thailand or Taiwan) that have little to lose by adopting the yen, have also little to gain by it.

It is still possible, however, to make statements about *individual* countries, and compare them to others in terms of the cost-benefit calculus. Both data sets, for example, suggest that Korea is a better candidate for adopting the yen than Pakistan or Malaysia. Korea has more to gain, because Korea's inflation bias has been bigger than Pakistan's or Malaysia's, *and* less to lose, as its cyclical correlation with Japan is higher than Pakistan's and Malaysia's. Even more clear-cut is the case for Indonesia. Indeed, Indonesia's inflation bias is by far the largest in the sample, while its output has some strong positive correlations with Japan, making Indonesia a very promising candidate.

4.4. Costs and benefits over time

Another interesting question is how the estimated volatilities and correlations have evolved over time. In addition to providing some predictive information, such an exercise may shed light on the endogeneity issue discussed below. This section examines the issue

Table 3
Average annual depreciation and inflation rates, by period

i	Data set I: PWT 6.1.		Data set II: IFS	
	$\overline{\Delta e}$(1960–1980)	$\overline{\Delta e}$ (1981–2000)	$\overline{\pi}$ (1960–1980)	$\overline{\pi}$ (1981–2001)
Australia	0.06	3.52	6.34	5.36
Bangladesh	4.75	6.07	–	–
China	−2.37	8.96	–	–
Hong-Kong	−0.64	2.25	–	–
Indonesia	137.09	18.98	110.48	11.72
India	2.85	8.70	7.00	8.83
Japan	−2.05	−2.73	7.25	1.64
Korea	13.99	4.88	–	–
Sri Lanka	7.44	7.97	5.58	11.87
Malaysia	−1.61	3.01	3.29	3.45
Nepal	2.56	9.03	–	–
New Zealand	2.14	4.43	7.80	6.64
Pakistan	4.72	8.61	7.91	8.06
Philippines	8.28	9.69	10.06	11.22
Papua New Guinea	–	–	–	–
Singapore	–	–	–	–
Thailand	−0.17	3.63	5.81	5.05
Taiwan	–	–	–	–

Note: See Table 1.

by splitting the full 1960–2000 (2001 for the IFS data) period in two equal subperiods: 1960–1980 and 1981–2000 (2001 for the IFS).[10]

Tables 3 and 4 present the results for the two subperiods. Table 3 reports the average values only (the standard deviations are omitted) and Table 4 presents the correlations of only the differenced and HP-filtered series (the BP-filtered series are omitted). The rest of the results, not reported to preserve space, lead to the same conclusions discussed below (all results are available on request).

Comparing the average inflation and depreciation rates first, the evidence of Table 3 indicates that while the inflation bias has increased in some countries (such as China, Nepal, India, and Pakistan), it has decreased in others (such as Indonesia and Korea). Interestingly, however, the differences in average depreciation and inflation rates between the two periods appear to be small, with the obvious exception of Indonesia, where the more recent period has been characterized by substantially less severe price instability.

Moving on to the estimated correlations, the numbers of Table 4 suggest a somewhat greater instability over time for more of the countries in the sample. First of all, the direction of change is generally consistent between the two data sets. An exception is Nepal, for which the PWT estimates suggest that correlation has changed from negative in the early period to positive in the latter period, whereas the IFS estimates indicate the opposite. For the rest of the countries, the two data sets imply similar changes. Cyclical correlations with Japan have increased for Hong Kong, Korea, Malaysia, Pakistan, the Philippines, and Thailand, while they have decreased for Australia, China, India,

[10] I am grateful to an anonymous referee for suggesting this.

Table 4
Cyclical correlations with Japan, by period

i	Data set I: PWT 6.1				Data set II: IFS			
	1960–1980		1981–2000		1960–1980		1981–2001	
	$\rho_{i,\mathrm{JPN}}^{\mathrm{DIFF}}$	$\rho_{i,\mathrm{JPN}}^{\mathrm{HP}}$	$\rho_{i,\mathrm{JPN}}^{\mathrm{DIFF}}$	$\rho_{i,\mathrm{JPN}}^{\mathrm{HP}}$	$\rho_{i,\mathrm{JPN}}^{\mathrm{DIFF}}$	$\rho_{i,\mathrm{JPN}}^{\mathrm{HP}}$	$\rho_{i,\mathrm{JPN}}^{\mathrm{DIFF}}$	$\rho_{i,\mathrm{JPN}}^{\mathrm{HP}}$
Australia	0.55	0.66	−0.16	0.05	0.30	0.57	0.01	0.15
Bangladesh	−0.21	−0.16	−0.14	−0.62	–	–	–	–
China	−0.15	0.07	−0.35	−0.61	–	–	–	–
Hong Kong	0.02	−0.20	0.35	0.22	–	–	–	–
Indonesia	−0.14	0.32	0.50	0.24	0.06	0.43	0.48	0.23
India	0.24	0.37	−0.06	0.08	0.32	0.33	0.08	0.22
Japan	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Korea	0.28	0.28	0.51	0.57	0.32	0.30	0.54	0.52
Sri Lanka	0.38	0.53	−0.02	−0.31	–	–	–	–
Malaysia	−0.23	−0.33	0.24	0.09	–	–	–	–
Nepal	−0.12	−0.41	0.17	0.25	−0.06	−0.28	0.11	0.12
New Zealand	0.17	−0.17	−0.45	−0.64	0.04	−0.26	−0.15	−0.19
Pakistan	0.34	0.46	0.51	0.56	−0.16	−0.41	0.53	0.29
Philippines	−0.10	−0.32	0.10	0.26	−0.07	−0.21	0.08	0.30
Papua New Guinea	–	–	–	–	–	–	–	–
Singapore	–	–	–	–	0.23	0.69	0.29	0.11
Thailand	0.32	0.28	0.62	0.50	0.28	0.22	0.65	0.53
Taiwan	–	–	–	–	–	–	–	–

Note: See Table 2.

Sri Lanka, and New Zealand. No obvious pattern emerges for Bangladesh or Indonesia.

The estimates of Tables 3 and 4 soften some of the conclusions drawn earlier, while they reinforce others in straightforward ways. For example, the fact that Indonesia's inflation bias is overestimated when one examines the entire period, means that Table 1 exaggerates Indonesia's benefits of adopting the yen. On the other hand, the fact that Korea's (Australia's) cyclical economic activity is more (less) strongly correlated with Japan in the more recent period, makes Korea's (Australia's) costs of adopting the yen even lower (higher).

Finally, it would be extremely interesting to investigate some of the reasons behind the changes in these correlations in future research. In particular, it would be valuable to know the extent to which these changes can be attributed to changing trade patterns, in which case they could shed light on the endogeneity argument discussed below.

5. Conclusions

This paper examined the macroeconomic costs and benefits of membership in a yen-based monetary union. Economic theory suggests that the main benefit of adopting the yen depends on the size of a country's inflation bias, while the stabilization cost depends on the cyclical correlation between the member country and Japan. Using two sets of data over the 1960–1997 period, and three methods of calculating the cyclical

component of output, measures of these costs and benefits were estimated for 18 Asian and Pacific economies.

The empirical results show that the estimated costs and benefits, while varying substantially across the countries in the sample, are often positively related: several of the countries which stand to benefit the most from adopting the yen in terms of price stability, also tend to be the countries for which the stabilization costs of delegating monetary policy to Japan will be the highest. In other words, countries (such as Bangladesh or Nepal) that have a lot to gain from adopting the yen, also have a lot to lose from it; while other economies (such as Singapore, Thailand or Taiwan) that have little to lose by adopting the yen, have also little to gain by it. This means that the net benefits of adopting the yen are difficult to compute and compare. Despite this, however, it is still possible to make statements about individual countries. The results of this paper, for example, point out that Korea is a more promising candidate for membership in a yen-based monetary union than Pakistan or Malaysia. Moreover, Indonesia appears to be a perfect candidate for ''yen-ization'' as it combines a high (though declining) inflation bias and high cyclical correlation with Japan.

The implications of these results for the 1997–1998 Asian crisis is obvious: adopting the yen would have helped only those countries with high positive correlations with Japan. For the rest, it would not have been helpful, in the sense that it wouldn(t have eased the trade-off many of these countries faced between maintaining a stable currency and preventing an even deeper and more prolonged downturn. Had such a country adopted the yen, the country's low or negative correlation with Japanese cyclical output would have meant that Japanese monetary policy would have been a very poor substitute for monetary independence and thus very costly in stabilization terms.

However, the above conclusions should be qualified for at least two reasons. First, adopting the yen by itself may enhance the structural similarities of the economies involved and raise some of the low or negative cyclical correlations estimated here. This is the argument made by Frankel and Rose (1998) about the ''endogeneity'' of optimum currency area criteria (but see also Krugman, 1993). Indeed, a similar argument has been made in defense of the European Monetary Union and dollarization. The extent to which this is likely to happen, and therefore the extent to which the business-cycle costs measured here may be exaggerated, is a promising area for future research.

Finally, it needs to be acknowledged that adopting the yen is, at least partly, a political process, involving more than strictly economic decisions. This is almost always the case with similar international arrangements, other examples of which are NAFTA, the accession of China to the WTO, dollarization, and membership in the EU and the *euro* for various European countries. The fact that political issues are highly important, however, does not change the economic parts of the equation. If political criteria are more prominent than economic ones, an economy may adopt the yen when costs exceed benefits, or may be prevented from adopting it when the net benefit is positive. In this case, the economic criteria may not be a good predictor of actual participation in a yen-based monetary union. However, the economic effects will always depend on these criteria. Thus, whether adopting the yen will benefit or harm a country's economy depends on the economic criteria only.

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