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Monetary Policy in a Small Open Economy: The Case of Singapore

During the past quarter century, Singapore has combined the fastest growth with the lowest inflation of any industrial economy.¹ This record has been accompanied by conservative monetary and fiscal policies, as well as free trade and unrestricted capital flows, reminiscent of nineteenth-century liberalism. The primary concern of this article is Singapore's monetary policy, which is interesting and perhaps instructive in several ways. First, Singapore is the best available example of the small open economy that occupies a central place in international trade theory; it has few protective tariffs or exchange controls and is too small to influence the prices of internationally traded goods. Second, the constancy with which the Singapore monetary authorities have pursued price stability for 170 years, as a colony and as an independent state, may be unique. Third, because Singapore's monetary officials have been forthright in articulating their methods and objectives, we are provided with a rare opportunity to evaluate the success, or otherwise, of the policies of a central bank.

A country's economic policies are political variables subject to many influences and cannot be understood without knowledge of their history and the institutional framework within which they are conducted. The first section of this article traces the history of Singapore's monetary institutions and policies from its establishment as a British trading post in 1819. These institutions and policies have changed less than in most countries, and the present commitment to stable prices may be attributed to the belief that past economic successes have in large part been due to Singapore's record of price stability. The second section presents the structure of the economy and government wage, fiscal, and trade

policies—the *real* background that sets the requirements and limitations of monetary policy. We will see that the Singapore monetary authority has been spared most of the internal constraints, such as government deficits and aggressive unions, that have plagued central banks in other countries, giving it the freedom as well as the desire to pursue price stability.

Singapore's recent monetary policy is examined in the third section. The authorities have continued to adapt to changes in world monetary conditions. As a colony and during the first few years after independence from Great Britain in 1963, Singapore aimed at price stability and a stable exchange rate

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¹ Between 1965 and 1990, the average annual growth rate of Singapore's per capita real gross national product (GNP) was 7.2 percent, compared with 6.7 percent and 6.4 percent for South Korea and Taiwan, Singapore's closest competitors. Singapore's average rate of consumer price inflation was 3.6 percent, compared with 4.2 percent for West Germany, which had the second-lowest inflation, 5.6 percent for the United States, and 6.7 percent for Organization for Economic Cooperation and Development (OECD) countries (based on data from World Bank Development Report 1990, International Financial Statistics, and Financial Statistics: Taiwan District, The Republic of China).

by tying its currency to that of a larger country on the gold standard—the United Kingdom until its devaluation in 1967 and then the United States until it left gold in the early 1970s. Since then, Singapore has continued to achieve low inflation through close control of its money stock and letting its exchange rate rise relative to most of the inflationary outside world. Some possible lessons of the Singapore experience are considered in the last section.

The evolution of monetary attitudes and institutions

What made Singapore different in the 1960s from most other countries of Southeast Asia was that she had no xenophobic hang-over from colonialism. The statue of the founder of Singapore, Sir Stamford Raffles, still stands in the heart of the city to remind Singaporeans of his vision in 1819 of Singapore becoming, on the basis of free competition, the emporium of the East, on the route between India and China. There were then 120 people on the island. They lived by fishing. Within five years of its founding, there were 5,000 traders, British, Arab, Chinese, Indian, and others drawn in by this principle of free and equal competition.

Had the Dutch who governed the then Netherlands East Indies accorded these same ground rules for trade and commerce in the Indonesian Archipelago, Singapore might never have got started. These were our origins. So we have never suffered from any inhibitions in borrowing capital, know-how, managers, engineers, and marketing capabilities.

—Prime Minister K. Y. Lee (1978)

Singapore's colonial heritage also includes the determination to select the monetary institutions most conducive to price stability. The development

of those institutions and their relationship to the present framework are discussed below.

The silver standard and the Currency Board system. In 1819, the island of Singapore, *lion of the sea*, at the tip of the Malay peninsula (see *the map*) was acquired by the British East India Company from a local sultan. Singapore was joined with two ports on the west coast of Malaya, Pinang and Malacca, in a single administrative unit called the *Straits Settlements*. The liberal economic environment extended to acceptance of the competitive, full-bodied currency then in general use in the East—Spanish and Mexican silver dollars. More than 2 billion of these coins were minted by the Spanish from Mexican silver between 1535 and 1821, and 1.5 billion were minted by the Mexican government during the remainder of the nineteenth century. They “were the most widely circulated coins in history, [perhaps] closer than any other to being a truly international currency” (Chiang 1967, 1–2).²

Government monetary involvement was limited to minting subsidiary coins until 1899, when private note issues were terminated and a Board of Commissioners of Currency was established to issue paper currency in exchange for silver coin and to redeem this currency in coin on request. The operations of the Currency Board were patterned after boards established in other British and French colonies. Fifty percent of the value of its notes were held in silver and the remainder was invested in British government securities, the income from which defrayed the expenses of the Board and supplemented the reserve until it attained 110 percent of the note issue. Additional sums were paid into the general revenues of the colony. The reliance on sterling was finally broken by the British devaluation of 1967, but Singapore's currency continues to be more than fully backed by gold and foreign exchange (there was a shift from a silver to a gold standard in 1906).

Straits Settlements notes came to be widely used in British Borneo, Sumatra, the independent sultanate of Brunei, and the Malay peninsula, which had come under British control although administered separately from the Straits Settlements. In 1938, the Settlements joined the nine Malay States and Brunei in a currency union, the Straits dollar became the Malayan dollar, and the Currency Board distributed its profits in line with currency use in the various parts of the union.

² Dollar is a variation of the German word thaler, a sixteenth-century coin struck from Bohemian silver. Thaler and its variations came to be generally applied to silver coins. The Spanish peso, or piece of eight, was known in the English-speaking world as the dollar, and the name was extended to the similar U.S. silver coin minted in 1792.



The gold exchange standard. Germany, the United States, and several other countries adopted the gold standard in the last third of the nineteenth century, and these increases in the demand for gold, combined with silver discoveries, caused a depreciation of silver relative to gold. The value of the Straits silver dollar in the London market fell from 60 pence (a quarter of a pound sterling, which was fixed to gold and until decimalization in 1971 had 20 shillings of 12 pence each) in 1872 to 31 pence in 1893.³ The Indian silver rupee

³ Britain had been on the gold standard since the early eighteenth century. The gold standard was based on the willingness of banks and governments to exchange their note and deposit liabilities for fixed amounts of gold; for example, the Bank Charter Act of 1844 required the Bank of England to purchase with notes all gold offered for 3 8875 per ounce of standard gold and to sell gold for 3 89375 per standard ounce.

suffered similarly. India and the Straits Settlements traded predominantly with gold standard countries, and both were liable for substantial payments to London fixed in gold. Foreign investment was discouraged, inflation instigated labor disputes, and the resulting agitation for the gold standard eventually overcame the opposition of those who argued that a depreciating currency stimulated exports.

India was first to develop what came to be called the *gold exchange standard*. Silver coins continued to circulate, and the local currency was not easily redeemable in gold, but gold was “available for payments of international indebtedness at an approximately constant rate [that is, within the *gold points*] in terms of the national currency” (Keynes 1913, 30). The reserve was kept abroad, partly in gold but mainly in British government securities. The system benefited India and Great Britain. India earned interest by investing resources that otherwise would have been circulating as full value gold or silver coin, and the market for British securities was enlarged. Because the reserve was held principally in British securities, the system was referred to as the *sterling exchange standard*. A similar system established by the United States in the Philippines in 1903 was called the *dollar exchange standard*. In addition to maintaining an adequate gold reserve, the local government’s main tasks were to insure that silver and other subsidiary coins were worth less melted down than their nominal values so that they would remain in existence and that the quantities of notes and coin in circulation were such that their value in the foreign exchange markets did not fluctuate. The Indian system was extended to the Straits Settlements in 1906 at the rate of one Straits silver dollar to 28 pence, which was maintained by Singapore until it left the pound to keep parity with gold and the U.S. dollar when Britain devalued in 1967.

Currency Board or central bank? The Federation of Malaya became independent in 1957, and Singapore gained internal self-government in 1959. In 1959, Malaya established a central bank that performed various regulatory functions and served as the government’s banker. But the central bank

did not issue currency. That remained the responsibility of the Currency Board. Singapore and British Borneo joined Malaya to form Malaysia in 1963, and in 1965 Singapore left Malaysia, but the currency union continued until 1967. Currency boards were widely admired by the colonial peoples for whom they had been established:

From this history of monetary developments one point stands out, namely the overriding importance of commercial relations with the outside world. It was through international trade that modern money came to Malaya. It was the safeguarding of international trade and investment which motivated the currency reformers and provided Malaya with a monetary system which was simple, inexpensive and “ideally suited to a period of colonial expansion and capital migration.”⁴

However, Malaysia felt the time had come for a more active monetary policy. In correspondence with the Singapore Ministry of Finance, the Malaysian central bank agreed that “the Currency Board system has not restrained orderly development so far” but expressed concern that its continuation might interfere with desirable monetary actions in the future.

[S]hould the economy deteriorate and should the Malaysian and Singapore Governments be obliged to maintain levels of expenditure in spite of deteriorating revenues, the Currency Board system will certainly be a serious restraining factor in the orderly development of Malaysia and Singapore because of the rigidities of the system which prevents the use of foreign exchange reserves other than for backing the currency....

The Board cannot in any way influence the money supply and, even in normal times, it is powerless to make credit available to meet the growing needs of an expanding economy, nor can it influence the cost of credit in the country. The system cannot in any way influence the country’s economy when it is subjected to pressures due to swings in the country’s balance of payments. Its rigidity imposes an undue hardship on the economy in periods of crisis. A defla-

⁴ Drake (1969, 27), with a quotation from Gunaskera (1954).

tionary situation caused by a deficit in the balance of payments...can be accentuated by a contraction in the supply of money at a time when the proper remedy for such a situation would be an increase in the money supply and a lowering of the cost of credit in the country.⁵

The Singapore Minister of Finance responded,

[I]t must be remembered that the present stability of the Malaysian dollar...is due in quite large measure to the in-built financial discipline which a Currency Board system imposes. The main point to ask is whether the Currency Board system has restrained orderly development in Malaysia and Singapore to date....The point [of our earlier letter] is that taking into account the effects of sudden separation of Singapore from Malaysia, it may be more prudent for both our countries to continue with a known trusted existing currency system, rather than to introduce structural changes now.⁶

These differences could not be bridged, and in 1967 Malaysia and Singapore began to issue separate currencies. The old currency board was extinguished, and Singapore and Brunei established a new one. Currency boards had existed in nearly fifty British, French, and American colonies. But by 1970, among those gaining independence only Singapore had elected to keep that system.⁷ Perhaps Singapore's decision to preserve its monetary constitution was as much as anything a signal of its continued commitment to price and exchange rate stability.⁸ However, the simultaneous achievement of these goals is possible only as long as other countries pursue the same ends. Growing world inflation, the increasing frequency of exchange rate realignments, and finally, in the early 1970s, the end of the Bretton Woods system rendered Singapore's 1967 decision obsolete. Henceforth, Singapore would have to choose between the conflicting goals of price and exchange rate stability.

The Monetary Authority of Singapore (MAS). The Currency Board still exists, but effectively as a department of the MAS, which was established in 1971 with all the formal powers and responsibilities possessed by modern central banks.⁹ In

practice, however, purchases and sales of foreign exchange are its only significant instrument of monetary policy. Open market operations in government securities on a significant scale have not been possible because of the absence of a good secondary market.¹⁰ Most government securities are held by the Central Provident Fund (the government pension fund) and other institutions that tend to hold them to maturity. There is no active discount rate policy because it is believed that interest rates are determined externally. Of the three traditional instruments of monetary policy, this leaves the reserve requirement ratio on bank deposits, which in the face of large capital inflows was raised in 1973 from 5 percent to 9 percent and then lowered during 1974–75 to 6 percent, where it has remained.

Figure 1 shows that most MAS actions are purchases of foreign exchange to offset drains caused by government surpluses.¹¹ In the third section, the exchange rate and the money stock are sometimes treated, for convenience, as alternative instruments of monetary policy. But the exchange rate and money are only proximate instruments; some might call them *intermediate targets*. The immediate instrument is always operations in foreign exchange.

⁵ From letters of January 10, 1966, and April 8, 1966, reproduced in Annexes A 6 and B 4 to Republic of Singapore, White Paper on Currency (1967).

⁶ Republic of Singapore, White Paper on Currency (1967), Annex B.3, March 21, 1966.

⁷ The only other currency board still in existence is that of Hong Kong, which is still a colony.

⁸ It should be noted that Malaysia's inflation rate since 1965 has been almost as low as Singapore's.

⁹ The chairman of the MAS is normally also the chairman of the Board of Commissioners of Currency.

¹⁰ However, the government has encouraged greater activity in the Treasury bill market since 1986. See Emery (1991, 226).

¹¹ Also see Moreno's (1988) Chart 1, "Sources of Reserve Money."

The economic framework: the real background to monetary policy

In Singapore, we found that the best fiscal and monetary policy to underpin a major investment promotion effort is to turn a deaf ear to the seductive appeals of the New Economics, which preaches that economic growth can be achieved by over-spending and manipulating the supply of money... [W]e have found that the old-fashioned conservative policy of balancing the government budget—in fact of budgeting for a substantial surplus on current account to finance development expenditure—produces the best results in the long run.

—Minister of Finance K. S. Goh (1973)

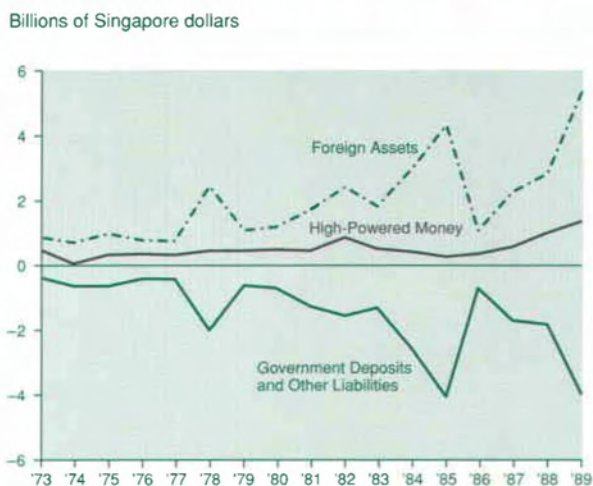
Singapore may be the world's most open economy.¹² There are few exchange controls or protective tariffs, and the government has sought to provide an attractive climate for foreign investment.¹³ It has one of the world's largest and busiest ports (the location of its massive deep-water port on the main sea lane between East Asia and the Middle East and Europe is its greatest natural advantage) and one of the largest refinery centers. It is a major financial center, trailing only London, New York, and Hong Kong in the number of commercial banks (135), and it is the center of the Asian Dollar Market, with 190 financial institutions soliciting nonresident deposits. Singapore's foreign trade in relation to the size of its economy leads the world (*Table 1*).

The continuation of the colonial free trade regime and commitment to monetary stability have undoubtedly been important factors in Singapore's economic success. Its leaders were educated in England shortly after World War II, but they

¹² Singapore is rivaled by only Hong Kong for this distinction.

¹³ Most exchange controls were dropped in 1978, but the authorities have retained the right to interfere in some cases. For example, banks intending to extend loans in Singapore dollars for more than S\$500,000 to nonresidents or residents for use outside Singapore must obtain the approval of the MAS. See Emery (1991, 211).

Figure 1
Sources of High-Powered Money:
MAS Purchases of Foreign Assets Less Changes
in Government Deposits and Other Liabilities



SOURCE: *International Financial Statistics*.

were unaffected by popular Keynesianism, believing that growth is best achieved by an open economy, foreign investment, domestic saving, and fiscal and monetary conservatism. However, Singapore is not a *laissez faire* state. The government sets economic goals and unhesitatingly interferes with market forces to achieve those goals. Some of those government activities and their implications for monetary policy are discussed below.

Land use and the pattern of production. Singapore has approximately the area and population of the city of Chicago, and government is most obvious in its regulation of land use. The space required for roads is limited by a 225 percent tax on new car purchases (recently supplemented by quotas), cremation is encouraged, outlying villages have been razed and their inhabitants moved to the high-rise housing blocks that dominate the Singapore landscape, and agriculture has been reduced. Cheap food is available from nearby agricultural economies, and "[r]ecognising that [Singapore's] comparative advantage lies in less land intensive activities like trade, manufacturing, and provision of services, the government has over the years steadily reduced both the number of farms and the area they occupy..." (Lim 1988,

Table 1
International Trade-GDP Ratios for Selected Countries, 1984

Country	Total Trade/GDP	Exports/GDP	Imports/GDP
Singapore	2.89	1.32	1.57
Malaysia	1.04	.56	.48
Indonesia	.44	.27	.17
Thailand	.43	.18	.25
Philippines	.36	.16	.19
Hong Kong	1.86	.93	.93
Taiwan	.92	.53	.39
South Korea	.72	.35	.37
Australia	.25	.12	.12
New Zealand	.50	.24	.26
Belgium	1.37	.66	.71
Denmark	.59	.28	.30
West Germany	.53	.28	.25
Japan	.24	.14	.11
United States	.15	.06	.09

NOTE: GDP is gross domestic product.

SOURCE: Lim (1988, 5).

96). Between 1965 and 1989 the share of agriculture and fishing in gross domestic product (GDP) fell from 3.1 percent to 0.3 percent. Nearly 80 percent of the land is government-owned, a substantial part of which is now vacant in anticipation of commercial and industrial development by high-tech foreign firms. Various tax incentives “promote the use of foreign technology,” and the government has provided a superb infrastructure and a “responsible trade union movement” (Lim 1988, 257), but otherwise firms receive little government protection or assistance. There is no room for activities, foreign-owned or Singaporean, that require tariff protection, subsidies, or help from the central bank in the form of low interest rates or other policies likely to cause inflation or a depreciating exchange rate. Even public utilities and other government enterprises earn profits.

Fiscal policy. The government enforces substantial private saving and manages a surplus on its own account.¹⁴ The most striking aspect of the top portion of Table 2 is the high rate of investment—more than 40 percent of GDP during the 1970s and 1980s. Saving also exceeds 40 percent of income. Most private saving is through the Central Provident Fund (CPF), a mandatory plan under which

employers and employees contribute specified proportions of wages for the future use of employees. Withdrawals are permitted only for home purchase (the main use), retirement income, home repair, and hospital expenses. Current contribution rates are 18 percent and 22 percent of wages for employers and employees, respectively.

Wage policy. The government’s attitude toward wages has been influenced by the conflicting desires for international competitiveness (by means of low wages), long-term growth (implying high wages to force out low-wage industries), and economic stability (calling for flexible wages). An example of the second influence was the “wage corrective policy” launched in 1979 in combination with an “industrial restructuring program...to promote skill-intensive, high-value-added industries” (Lim 1988, 140). Because reductions in unemployment and increases in labor-force participation had been exhausted as sources of growth, increased emphasis was placed on “qualitative improvement in

¹⁴ Figure 1 shows the effect of this surplus on bank reserves.

Table 2
Gross Domestic Product and Related Data
 (Millions of Current S\$, Unless Indicated Otherwise)

	1960	1970	1980	1989
Private consumption	1,922	3,920	12,911	25,781
Government consumption	162	693	2,447	5,901
Gross fixed capital formation				
Private	145	1,521	7,710	16,897
Government	60	367	2,493	3,708
Change in inventories	40	356	1,425	-1,036
Net exports of goods and services	-301	-1,179	-2,216	4,153
Gross domestic product	2,027	5,678	24,771	55,404
Gross domestic product (1985 prices)	4,907	11,826	28,466	53,076
Population at mid-year (thousands)	1,646	2,075	2,414	2,613
Per capita real GDP (thousands 1985 S\$)	2,981	5,699	11,792	16,407
Employment (thousands)	449	644	1,073	1,277
Unemployment rate (percent)	4.9	6.0	3.0	2.2
Area (square miles)*	225	226	239	242
Per capita GDP (US\$)				
United States	2,833	4,918	11,787	18,301
West Germany	1,300	3,039	13,217	18,305
Japan	458	1,953	9,071	19,463
South Korea	156	272	1,634	2,883
Singapore	431	916	4,706	7,623

* Increase due to landfills.

SOURCES: Singapore data are from *Economic Survey of Singapore*. Per capita GDP (US\$) data are from International Monetary Fund, *International Financial Statistics*.

labour and access to modern technology” (Lim 1988, 139).¹⁵ Tax incentives were introduced “to promote investments in more technologically sophisticated industries and to emphasise research and development” (Lim 1988, 257). The wage-corrective policy was an attempt by the government—as a large employer and regulator of CPF contributions and through its influence on private wage bargaining—to reinforce these incentives and “to phase out low quality labour intensive industries” by raising wages and other labor costs (Lim 1988, 257).

Some observers have argued that this policy was applied too vigorously, that the rise in real wages between 1979 and 1984 (8.7 percent per annum, compared with a productivity growth rate of 4.6 percent) was partly responsible for the 1985–86 recession, and since that time the government has stepped up efforts to make labor costs more flexible. Adjustments in employer CPF contributions have been an important part of this policy, being reduced from 25 percent to 10 percent in 1986 and gradually being raised in line with economic expansion. Furthermore, in recent years many companies have followed the National Wages Council’s recommended “flexible wage policy” by limiting wage increases to 2 percent to 4 percent but giving larger year-end bonuses linked to company performance (Daniel 1989). Table 3 compares wage supplements

¹⁵ Between 1970 and 1985, the labor-force participation rate rose from 55 percent to 66 percent, entirely due to the rise in female participation from 30 percent to 48 percent.

Table 3
**Average Hourly Compensation of Manufacturing
 Production Workers, 1985 (US\$)**

Country	Wage	Ratio of Additional Compensation to Wage	Total Compensation
United States	\$9.52	.362	\$12.97
Switzerland	\$7.11	.330	\$9.45
Japan	\$5.53	.168	\$6.45
United Kingdom	\$4.75	.321	\$6.27
Singapore	\$1.57	.550	\$2.44
Hong Kong	\$1.61	.110	\$1.78
Taiwan	\$1.38	.050	\$1.45
South Korea	\$1.17	.200	\$1.41

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, June 1986; reproduced in Lim (1988, 185).

in Singapore with those of other countries. The largest components of the 55-percent figure for 1985 were the employers' 25 percent CPF contribution and bonus and wage supplements totaling 13 percent. The former is now 18 percent, but the latter has probably grown. In 1989, government workers received a Christmas bonus equivalent to 2.75 months' salary, and many private-sector workers received much more.

The government continues to put pressure on low-wage industries. In addition to limiting the numbers of unskilled foreign workers that firms may employ, a *foreign workers levy* was introduced in 1987. The monthly levy is adjusted in response to economic conditions, but in 1990 it ranged from S\$250 to S\$300, depending on the industry (the Singapore dollar was worth about 55 U.S. cents).

Finally, it is worth pointing out that labor law and union cooperation are important contributors to wage flexibility. The Employment Act of 1968 "enjoins upon the labour movement more discipline, restraint in wage negotiation and, generally, a greater awareness of the social responsibility of organized labour in the larger framework of the national interest" (Goh 1972). The Industrial Relations Act of the same year reduced the scope of collective bargaining by giving "full discretionary powers to management in matters of promotion, transfer, recruitment, dismissal, reinstatement, assignment of

duties and termination of employment for reasons of reorganisation or redundancy." Disputes over other matters must be referred to the Industrial Arbitration Court, whose decisions are binding. There has been one strike since 1977, involving sixty-one workers for two days. In the midst of the labor disputes of the early 1960s, the finance minister complained that overseas industrialists hesitated to open factories in Singapore because of their fear of labor problems (Goh 1963). This impediment to foreign investment has been removed.

Some economists have recommended that wage policy be aimed at the target of employment stability (partly by maintaining export competitiveness) and that monetary policy be directed at price stability.¹⁶ Officials have not articulated a policy model, and their control over wages is not complete, but their behavior has been roughly consistent with this prescription.

Foreign investment. The quotation by Prime Minister K. Y. Lee at the beginning of the first section understates the government's desire for foreign investment, which in fact is preferred to domestic ownership. Officials view Singaporeans as traders and money lenders, with preferences for

¹⁶ For example, see Corden (1984) and Lim (1988, 314-19).

...short-term investment in Singapore and in diversification out of Singapore. This is a rational phenomenon, and deep in the instincts of the trader. The future is uncertain; Singapore's comparative advantages in the world change quickly; therefore, take short-term positions and don't put all your eggs in one basket.¹⁷

Hence, private long-term investment in Singapore must be undertaken by already diversified multinationals. Finance Minister Goh emphasized that large foreign firms bring know-how, established products with world repute, and markets, and Prime Minister Lee pointed out that "the bigger and more established a [multinational corporation] is in his field, the higher his success rate and the bigger his contribution to jobs and GNP" (Lee 1978). Wholly owned firms from the United States, Japan, and Europe had a failure rate of only 6 percent, compared with a 38 percent failure rate for wholly owned Singaporean enterprises (Goh 1963, 16, and

Lee 1978, 20). In 1984, foreign manufacturing firms made up 21 percent of establishments, 53 percent of workers, and 65 percent of value-added (Koh 1987). In recent years, about 80 percent of manufacturing investment commitments have come from foreign firms.¹⁸

Monetary policy

The gamut of Singapore's experience in the past four years, of severe imported inflation, mild recession and prompt recovery in the context of international economic and financial instability has strengthened the bases of domestic economic and financial policies. The economy avoided the excesses in fiscal, monetary and wage policies, and their accompanying economic costs, evident in a number of developed and developing countries today.

—Monetary Authority of Singapore,
Annual Report 1976/77, p. 2

Singapore's policymakers were slow to adjust to the new monetary environment following the breakdown of the Bretton Woods system and failed to insulate the economy from the monetary expansions undertaken by a large part of the world in response to the oil-price shock.¹⁹ But the experience redoubled their determination to find ways to achieve stability at home despite the instability around them. The MAS has repeatedly affirmed that "price stability [is] the prime objective, ...aimed at sustaining confidence in the domestic economy and mitigating external inflationary pressures, as well as safeguarding export competitiveness."²⁰ It has been able to pursue this objective with a single-mindedness that must be the envy of other central bankers because of a pliable labor force and a conservative fiscal policy and bolstered by the belief that the authorities' best contribution to growth is the maintenance of a stable environment for investment.

In this section, I examine the means by which Singapore has achieved price stability. I first consider exchange rate management because MAS officials state that since 1981 they have preserved stable prices by manipulating the value of the Singapore dollar to offset foreign inflation.²¹ However, such a policy would require the continuous

¹⁷ George Yeo (minister of state, finance, and foreign affairs), speech reported in *The Straits Times*, February 9, 1990.

¹⁸ Ministry of Trade and Industry, Republic of Singapore. *Economic Survey of Singapore, various issues*.

¹⁹ *Singapore's consumer prices rose 20 percent in 1973 and 22 percent in 1974. Average annual inflation since 1974 has been 2.7 percent.*

²⁰ MAS Annual Report 1981/82, p. 4, and Annual Report 1984/85, p. 1. *Similar statements have appeared in almost every Annual Report.*

²¹ *For example, the MAS Annual Report 1983/84 stated that "[g]iven the openness of the Singapore economy, especially the high integration of domestic and international financial markets, it is not possible to pursue an independent monetary policy, although there is some flexibility in influencing domestic conditions in the short run. Thus, the focus of the Authority's policy is on the exchange rate rather than on movements of monetary aggregates" (p. 4). Similar statements may be found in every Annual Report since 1981–82. Lee (1987) and Moreno (1988) also have argued that Singapore operates with an exchange rate target rather than money or interest rate targets. The MAS's statement will surprise those who believe that a flexible exchange rate increases a country's control of its money stock.*

Table 4

Model of a Small Open Economy

(1) $p = x + p^* + s$	Purchasing power parity
(2) $R = R^* + x^e + v$	Interest rate parity
(3) $r = r^* + v - s$	Equal expected real rates of interest, where $r = R - p$ and $r^* = R^* - p^*$
(4) $y = y_n + (p - p^e) + u$	Aggregate supply
(5) $m - p = a + by - \delta R + w$	Money demand
(6) $m = \mu + h$	Money supply

satisfaction of purchasing power parity (PPP, which requires the rate of exchange between the currencies of countries A and B to vary equally with the difference between their rates of inflation), when in fact Singapore's exchange rate, like those of other countries, has deviated greatly from PPP and for long periods. The data suggest that the MAS has instead followed a constant-money-growth rule.²²

Exchange rate management under purchasing power parity. In light of Singapore's size, dependence on foreign trade and investment, and freedom from currency or trade restrictions, the simple model of a small open economy in Table 4 may be more appropriate for Singapore than for any other country. It is a conventional description of an open economy under the assumption of PPP.²³ PPP is an example of the law of one price; specifically, identical goods should sell for the same price in different countries. Equation 1 asserts that the rate of change of Singapore's price level (p) equals the sum of the rates of change of the Singapore dollar price of foreign exchange (x) and an average of the price levels of Singapore's trading partners (p^*), and a random error term (s); s and other errors to be introduced have zero expected values.²⁴ Equation 2 is the interest rate parity (IRP) relationship, according to which, subject to the random error (v), investors require the nominal rate of interest on Singapore investments (R) to equal the foreign rate of interest (R^*)

plus the expected rate of depreciation of the Singapore dollar (x^e). PPP and IRP imply the expected equality of Singapore (r) and foreign (r^*) real interest rates, as indicated in equation 3. Equation 4 is an aggregate supply function such that the rate of growth of Singapore's output (y) equals the trend or natural rate of growth of output (y_n) plus a random error (u) and a constant times the excess of realized inflation (p) over expected inflation (p^e). Equation 5 is the demand for money, where m is the rate of change of the domestic money stock, δR is the change in the rate of interest, and w is a random error. The supply of

²² Several theoretical papers have considered optimal monetary policies for open economies; for example, Boyer (1978), Roper and Turnovsky (1980), and Henderson (1979). This study is not concerned with Singapore's optimal combination of policies but with those actually pursued.

²³ For example, see Marston's model with capital mobility and flexible wages and exchange rates (1985, 889).

²⁴ The following numerical example of PPP between two countries is based on data from the period of my empirical analysis, 1981–90. The average annual rates of change of the Singapore and U.S. consumer price indexes during this period were 2 percent and 4 percent, respectively. In 1981, US\$1 was worth S\$2.10. If PPP had worked perfectly, that value would have fallen 2 percent per annum to S\$1.73 by 1990. In fact, it fell only 1.2 percent per annum, to S\$1.89.

money is given by equation 6, where μ and b are rates of change of the money multiplier and high-powered money. The constants α , a , b , and c are nonnegative.

Given expectations, the natural rate of growth of output, the money multiplier, and the variables determined abroad, the model consists of six equations in seven unknowns— p , x , R , r , y , m , and b . The system is completed by MAS's instrument choice— x , R , or b . Suppose that, as asserted by the

MAS, its instrument is x . If the inflation objective is p^o (which is zero if price stability is desired), equation 1 implies $x = p^o - p^*$, so that realized inflation is $p = p^o + s$ and expected inflation is $p^e = p^o$. The stock of money is demand-determined in this situation (largely by p , which also determines y and R) and follows from the MAS's choice of x . High-powered money, b (provided mainly by MAS purchases of foreign exchange; see Figure 1), is determined by equation 6, given m from equation 5.

Regression R.1 in Table 5 assumes that the MAS's policy instrument is the exchange rate and reports the response of x to p^* and three seasonal dummy variables. x is a weighted average (an effective exchange rate) of Singapore's exchange rates with its principal industrial trading partners, the weights being relative GDPs valued in U.S. dollars. The same weights were used to compute p^* from consumer price indexes. Several weighting schemes were used, along with various lag distributions of p^* , but regression R.1 produced the best fit.²⁵ Regression R.2 adds y and f , both lagged one period, as explanatory variables to determine whether the MAS has tempered its stable price policy by depreciating the exchange rate (raising x) in reaction to slowdowns in the growth of output and foreign exchange reserves.²⁶ The sample period begins with 1981 because the MAS indicated a policy shift (from money to exchange rate management) in that year.

The coefficients of regressions R.1 and R.2 are significant (except the seasonals) and have the expected signs. However, the large deviations of the estimated coefficients of p^* from -1 raise problems for the hypothesis that the MAS aims at domestic price stability by exchange rate management in a PPP world.²⁷ Statements by the authorities and equation 1 imply $dx/dp^* = -1$, suggesting that the model is misspecified, the MAS's policy is different from that announced, or both.

In view of the accumulation of knowledge of exchange rate movements since the advent of floating rates in 1973, it would have been surprising if Singapore had been able to control p by manipulating x according to equation 1. PPP should hold in a one-good, free trade, frictionless world. But there is no theoretical justification for its satisfaction in terms of standard price indexes.²⁸ Large inflations are usually accompanied by large exchange rate movements, but changes in the patterns of

²⁵ The weights underlying x and p^* were suggested by Deputy Managing Director of the MAS K. P. Teh (1988) in a paper on Singapore's monetary policy. Teh used an index of OECD consumer price inflation as the indicator of p^* . Weights for quarterly series were obtained by regressing his annual 1976–87 series for p^* on the p s of the nine largest OECD countries and selecting the countries with significant coefficients (listed in Table 5). These coefficients approximated relative GDPs. Regressions of the form of R.1 and R.2 were tried using these fixed weights as well as weights varying with relative GDPs. The latter had higher R^2 s and are reported in Table 5. They also had higher \bar{R}^2 s than regressions based on trade-weighted indexes. All regressions had coefficients of p^* significantly greater than -1 in absolute value.

Trade-weighted indexes might be most useful in explaining exchange rates—unless, as it asserts, the MAS manipulates an OECD-weighted index. This assertion is the hypothesis under examination in regression R.1. The MAS's preference for an OECD-weighted index over a trade-weighted index is a result of its concern for the international competitiveness of Singapore industry. The main difference between the two indexes is the exclusion of food, textile, and handicraft imports from Malaysia, Indonesia, and Thailand.

²⁶ The Authority, in managing the trade-weighted exchange rate, was able to play a supporting role in the important adjustment measures undertaken by the government since mid-1985 to revive economic activity (MAS Annual Report 1985/86, 4).

²⁷ Variations of regressions R.1 and R.2, including different or additional independent variables, as well as alternative lag structures for the independent variables and alternative weighting schemes for x and p^* , had coefficients less than -1.9 . These results also are similar to those generated by Teh's annual data, for which the estimated coefficient of p^* is -3.7 (Teh 1988).

²⁸ See Manzur (1990) for a discussion of investigations of the empirical validity of PPP.

Table 5

Estimates of Exchange Rate, Money, and High-Powered Money Reactions (Quarterly Data, 1981:1–1990:1)

Eq. no.	Dep. var.	Independent Variables							\bar{R}^2 DW	Q Sig
		cons.	p^*	y_{-1}	f_{-1}	S2	S3	S4		
R.1	x	.028 (3.43)	-3.536 (6.23)			.021 (2.31)	-.002 (.25)	.008 (.91)	.508 1.75	36.3 .006
R.2	x	.059 (5.35)	-3.284 (6.50)	-.733 (3.32)	-.253 (2.46)	-.027 (1.81)	-.007 (.77)	.006 (.70)	.651 (2.16)	15.2 .650
R.3	m	cons.	p	y	δR	S2	S3	S4		
		.034 (2.91)	.096 (.02)	.890 (2.70)	-.004 (.86)	-.041 (1.83)	-.037 (1.75)	.009 (.44)	.444 1.69	9.4 .949
R.4	h	.015 (1.26)	.224 (.05)	.210 (.64)	-.006 (1.50)	-.018 (.82)	-.005 (.23)	.037 (1.83)	.435 2.47	16.3 .573
R.5	h^*	-.008 (1.58)	.319 (.80)	.093 (.67)	-.005 (1.32)				-.014 2.34	14.3 .711
BJ.1	h^*	cons.	AR(1)	AR(2)	MA(1)	MA(2)				
		-.004 (.68)	.435 (1.03)	.414 (.10)	-.626 (1.58)	.391 (.98)			-.089 2.40	14.2 .717

Definitions and sources

Except when indicated otherwise, the data are from International Monetary Fund, *International Financial Statistics*, with price and GDP series made intertemporally consistent by linking data with different (1980 and 1985) bases.

x, p^* Rates of change of effective exchange rate (quarterly average of S\$ per unit of foreign currency) and foreign consumer price level; weighted averages with weights determined by GDPs in US\$ of Canada, France, Italy, Japan, the United Kingdom, the United States, and West Germany.

p, m, y, h, h^* Rates of change of Singapore consumer price index, money stock (currency in the hands of the public and total domestic commercial bank deposits), real GDP (*Yearbook of Statistics, Economic Survey of Singapore*, and Liew 1989), high-powered money (currency of the public and bank reserves), and high-powered money seasonally adjusted by linear regression on seasonal dummies.

f Rate of change of Singapore foreign exchange reserves, in US\$ end of quarter; mainly monetary authorities' claims on nonresidents in bank deposits, government securities, European currency units, "and other claims usable in the event of balance of payments need..." (*International Financial Statistics*, line 1d.d).

δR Change (in basis points) in the three-month interbank rate (Monetary Authority of Singapore, *Monthly Statistical Bulletin*).

(Continued on the next page)

Table 5—Continued

**Estimates of Exchange Rate, Money, and High-Powered Money Reactions
(Quarterly Data, 1981:1–1990:1)**

Definitions and sources—continued

S_i	Seasonal dummies; unity in the i th quarter, zero otherwise.
$AR(i)$ $MA(1)$	Box–Jenkins estimates of i th-order autoregressive and moving-average coefficients.
\bar{R}^2	Coefficient of determination adjusted for degrees of freedom.
DW	Durbin–Watson statistic; in no case is the null hypothesis of zero first-order autocorrelation of the errors rejected with 95 percent confidence.
Q, Sig	Ljung–Box Q statistic for a test of general autocorrelation, distributed as χ^2 with eighteen degrees of freedom. Sig is its significance level. In only one case, R.1, is the joint hypothesis of all zero autocorrelations rejected with more than 42.7 percent confidence. (See Pindyck and Rubinfeld 1981, 500–01.)

Student's t statistics in parentheses; 2.04 and 2.75 indicate coefficients different from zero at thirty degrees of freedom with 95 percent and 99 percent confidence.

production in different countries imply that there is no unique relationship between price indexes. Furthermore, foreign currencies are assets as well as means of payment, which means that their values may change rapidly in response to expectations regarding their future values in ways not explained by PPP.

[Foreign exchange markets exhibit behavior that is characteristic of other asset markets. Exchange rates react quickly to

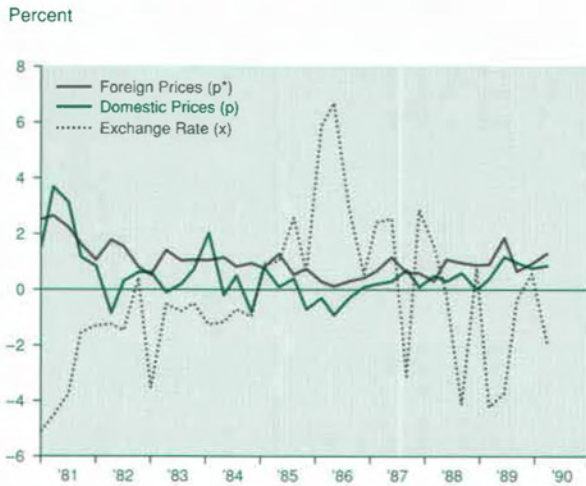
news; rates are volatile and difficult to forecast. Both spot and forward rates can be modeled as anticipatory prices, but the exact parameters are unknown. (Levich 1985)²⁹

The tendency of floating exchange rates (x) to fluctuate more widely than differences between rates of inflation ($p - p^*$) is illustrated for Singapore in Figure 2. If the MAS attempted to combat a speculative appreciation of the Singapore dollar by buying foreign exchange, it would lose control of its money supply and probably its price level.³⁰ **Monetary control.** Suppose the MAS seeks stable prices through control of the money stock. Letting the instrument be b and eliminating equation 1 from Table 4, the resulting system consists of five equations in five unknowns (R, r, y, p, m), which are determined by foreign data (R^*, r^*), expectations of the unknowns (p^e, x^e), the coefficients and random errors of the system ($\alpha, a, b, c, v, s, u, w$), the money multiplier (μ), and the instrument (b). Exchange rate expectations (as well as the current exchange rate) might or might not be closely

²⁹ See Dornbusch (1976), McKinnon (1979), Buiter and Miller (1981), and Cottrell (1986) for theoretical explanations of the high volatility of exchange rates relative to differences in inflation.

³⁰ Dornbusch (1982) argued that the PPP exchange rate policies adopted by some developing countries have increased the volatility of their prices and output.

Figure 2
Rates of Change of the Exchange Rate,
Domestic Prices, and Foreign Prices
(Quarterly Percentages)



SOURCE: See Table 5.

related to current and expected $p - p^*$.

The central bank can choose b each period subject to its forecasts of these data, or it can choose a path for b independent of such forecasts. Regressions R.3–R.5 in Table 5 are inconsistent with the former policy and consistent with the latter policy. If the MAS chooses b based on reasonably accurate forecasts of p , y , and R , then b and m will be closely related to these variables.³¹ Such a relationship is rejected by regressions R.3 and R.4. In fact, seasonally adjusted b , b^s , has the characteristics of a white noise process. It is not significantly related to prices, output, or interest rates, and its error terms are not serially correlated. The Box–Jenkins expression BJ.1, in which first- and second-order moving-average and autoregressive terms are insignificant, reinforces this conclusion. Movements in b^s are consistent with a money-growth rule in which the MAS offsets all but unpredictable influences on b^s .³²

Conclusion

It is dangerous to draw lessons from the experience of one country for the conduct of policy in another because the possibility and success of

any policy are conditioned by the history, politics, and institutional framework of the country in which it is employed. However, three aspects of Singapore's monetary policy are worth consideration by others.

First, Singapore's commitment to price stability is not limited to the monetary authorities but is part of a total macroeconomic approach that avoids budget deficits or the protection and stimulation of industries (by means of low interest rates and exchange rate devaluations, as well as tariffs and quotas) unable to compete in world markets. Second, Singapore has achieved stable prices by means of monetary control. This is a telling blow for the argument that control of the money stock is impossible in the United States, where the difficulties of such control are less than in a smaller and more open economy. Third, Singapore has adapted to changes in the world monetary environment, tying its currency to the predominant full-bodied coins circulating in the East (Mexican silver) during the nineteenth century, shifting to a sterling (gold exchange) standard in 1906 when silver depreciated, linking the Singapore dollar to the U.S. dollar with the devaluation of sterling in 1967, and finally, after the breakdown of fixed exchange rates in the 1970s, turning to the rigorous control of money that is made possible by a flexible exchange rate. Clearly, price stability in Singapore has been the consequence of determined policy rather than an accidental outcome of auspicious circumstances.

³¹ This may be illustrated by a simple case in which the MAS directly controls m , y is exogenous, and l abstract from R . Equation 5 implies $EP = m - a - bEy = p^o$, where p^o is the goal, so that the policy choice is $m = m^o = p^o + a + Eby$. Realized $p = p^o + b(Ey - y) - w$.

³² Write $h = Eh + z$, where z is the unanticipated portion of h . If the MAS makes Eh grow at the constant rate, h^o , realized $h = h^o + z$.

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