

# **The Basic Framework for International Reserves and Its Application to Macao**

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## **Abstract**

International reserves exist in every independent economy that does not completely block cross-border transactions. For the world as a whole and in the developing world in particular, reserves holdings have grown at a markedly fast pace notwithstanding the existence of holding costs and an increasing number of economies to opt for higher exchange-rate flexibility. Meanwhile, some national authorities continue to count on international reserves in enhancing external balance and monetary stability. This paper encompasses an extensive survey of the leading literature, with special focus on policy functions, demand models and indicators of reserve adequacy. By applying the basic framework to Macao, we conclude that the SAR is in a superior position in terms of reserve adequacy by international standards, and highlight important policy implications.

## 1. Definition of International Reserves

International reserves are indispensable financial resources of an economic region. They exist in every independent economy that does not completely close its door for international transactions, though the amounts held by the authorities in different economic regions are varied with an array of policy-determined and objective factors. Prior to the worldwide prevalence of the fiat money system, international reserves had had a prominent influence on domestic base money under a *specie* flow mechanism. In the contemporary era, this traditional link to domestic money supply has only been inherited by a limited number of small economies that operates under strict exchange-rate targeting monetary regimes such as currency board.<sup>1</sup>

According to Heller (1966), international reserves are bound to possess two qualities. First, they are acceptable at all times to foreign economic agents for payment of financial obligations. Second, their value, expressed in foreign units of account, should be known with certainty. In the Bretton Woods period<sup>2</sup> when exchange-rate rigidity prevailed, those assets were mainly used, directly or through assured convertibility into other assets, to support currency exchange rates in times of external payments deficit.<sup>3</sup>

The modern definition exhibits little deviation from the orthodox thinking. According to the latest Balance of Payments Manual (1993) of the International Monetary Fund (IMF), an economy's international reserves<sup>4</sup> refer to "*those external assets that are readily available to and controlled by monetary authorities for direct financing of payments imbalances through intervention in exchange markets to affect the currency exchange rate, and/or for other purposes.*"<sup>5</sup> In accordance with this general

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<sup>1</sup> Strictly speaking, the flow of base money is matched one-to-one by the flow of foreign reserves. See Ho (2002).

<sup>2</sup> That is the late 1940s–the early 1970s.

<sup>3</sup> This was a prevailing view advocated by the Group of Ten central banks in 1965.

<sup>4</sup> They are also named "official reserve assets" or "reserve assets" by the IMF.

<sup>5</sup> Some foreign currency assets held by monetary authorities or government are not included in international reserves, but included in "foreign currency liquidity". See Kester (2001)

framework of balance of payments (BOP), international reserves conceptually represent monetary authorities' financial claims on *nonresidents*.

To ensure their readiness for use in financing payments deficits, *international reserves should be liquid or marketable, and denominated in convertible foreign currency*. Four kinds of assets should be included in international reserves. They are (i) convertible foreign exchange held by monetary authorities in the form of currency, deposit, securities or financial derivatives, (ii) monetary gold, (iii) special drawing rights (SDRs), and (iv) unconditional<sup>6</sup> drawing rights with the IMF, or reserve position at the IMF.

In line with the residency principle of BOP, the IMF does not recommend that foreign currency deposits with or foreign currency securities issued by resident institutions<sup>7</sup> be included in international reserves.<sup>8</sup> Meanwhile, for those economies such as Macao that do not possess any amount of items (ii)–(iv), foreign exchange reserves, a narrowly defined but more popular terminology in international finance, are identical to international reserves.

Except for financial derivatives, the valuation of international reserves is adhered to a *gross* standard under which external liabilities of monetary authorities are not deducted from external assets. However, as international reserves are measured in gross values, data released by national authorities could be a misleading guide to their true payment capacity, especially for those economies where statistical transparency is not aptly enforced. The true level can be disguised by changes in the valuation method as well as by direct transactions with foreign monetary authorities (Williamson 1976).

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<sup>6</sup> International reserves are usually considered to be unconditional international liquidity. Conditional liquidity consists of the possibility of borrowing reserves through inter-central bank swap arrangements or from the credit tranches at the IMF (Williamson 1973).

<sup>7</sup> Locally incorporated bank and local branch of foreign bank are examples.

<sup>8</sup> With the exception that certain restrictive circumstances such as counterpart foreign currency claims are made available. For details, see Kester (2001).

In practice, some countries can institutionalise large swap arrangements between the central bank and the commercial banks, which can show up as increases in their gross reserve figures just prior to accounting or reporting days even though there has been no real purchase of domestic currencies with foreign currencies in the market to spur reserves accumulation (Suss 1976). Strictly speaking, such a “window dressing” portion should not count as international reserves, and some international organisations have provided specified principles of valuation to better reflect the true value of international reserves (Kester 2001).

It should be noted that *international reserves are restricted to those held by monetary authorities*, though the term “international money” is adopted by some economists to include private as well as official holdings of internationally liquid assets. One argument is that net foreign assets of commercial banks can be included in an economy’s international reserves, especially to the extent that the monetary authorities have control over the commercial banks, or the banks are simply state-owned. However, this extended definition of international reserves does not conform to the internationally accepted definitions such as that of the IMF because it is rather difficult to determine quantitatively the amount of commercial banks’ net foreign assets that can be used by the authorities in times of need (De Beaufort Wijnholds 1977).

Macao is a highly open economy in which external transactions account for a dominant share of its economic activity. Its legal tender, Pataca, maintains a fixed exchange-rate relationship with the Hong Kong dollar under the institutional arrangement of currency board, which emphasises full reserves backing of its base money. As a result, international reserves as a public financial resource independent of treasury accounts play a pivotal role in maintaining the external balance and monetary stability, and hence merit in-depth research.

This paper offers a comprehensive survey of leading literature on international reserves centering on their functions and demand determinants/adequacy, and explores its relevance to Macao. It is hoped that our work could enhance the

knowledge about the valuable resource of Macao, and serve as a basic reference for the design of Macao's international reserves policy.

The layout of this paper is as follows. The next section introduces three main policy functions of international reserves, which fundamentally justify the government holding of the financial resource. Section 3 outlines various schools of thought on the specification of the demand function of international reserves or determinants of demand for international reserves, which are inexorably tied to their functions presented in Section 2. To extend the discussion in Section 3 from an empirical perspective, Section 4 presents various popular indicators to quantify the adequacy of international reserves. The indicators appear to be simplistic, though they are widely used for international comparison. Section 5 analyses the trend of international reserves in Macao based on the theoretical framework presented in Section 3, and applies various indicators presented in Section 4 to illustrate Macao's outstanding position in reserves adequacy. The last section highlights policy implications of reserves accumulation for Macao. Our analysis would also be relevant for other comparable reserves-abundant economies.

## **2. Policy Functions of International Reserves**

From time to time, individual economies, especially for those with a high degree of openness, are likely to encounter random shocks to their external balance, prompting temporary discrepancies between international payments and receipts or “imbalance” in BOP.<sup>9</sup> International reserves as a *shock absorber* therefore represent an economy's ability to finance the payments deficit without solely resorting to painful, undesirable adjustments (Arndt 1948; Clark 1970a; Crockett 1978).

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<sup>9</sup> External balance is analogous to internal balance, which is conventionally defined as national income at full employment level.

Enough provision of reserves can contain the loss in national income and the variability of income and price<sup>10</sup> as adjustment to temporary external imbalance, especially when an economy is operated under fixed exchange-rate arrangements, can be made in the absence of extensive application of *expenditure-changing* policies.<sup>11</sup> When the domestic adjustment cost is unacceptably high,<sup>12</sup> the authorities, in the absence of enough reserves cushion, could be compelled to impose trade, price or exchange controls, which would severely disrupt the operation of a free-market economy (Johnson 1956). Even though the deterioration in external balance proves to be permanent,<sup>13</sup> international reserves allow the economy to “buy time” for its adoption of appropriate adjustment or structural policies (Clark 1970b). The resource then allows for adjustment to payments imbalance more gradually than otherwise.

For countries that borrow heavily abroad for the financing of BOP deficits, international reserves informally perform the function of *collateral for external liabilities* (De Beaufort Wijnholds 1977). However, it can be argued that this function is largely notional as external assets, including international reserves, possessed by an economy are ultimately the resources to be used to settle its external liabilities for a sustainable external balance.

International reserves also play a role in *enhancing confidence* in national currency. This is, to a larger extent, applicable to small economies or economies in a process of liberalising their external accounts. If international reserves decline below a certain zone, foreign and local holders of the currency could be doubtful about the officially guaranteed convertibility of the currency, or the ability of the authorities to maintain successfully the exchange rate at an acceptable level. The loss in confidence could induce the currency holders to export capital, and hence disrupt external balance and monetary stability.

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<sup>10</sup> In a sense, it is disruptive to the internal balance.

<sup>11</sup> Those are fiscal and monetary policies.

<sup>12</sup> For example, it can be a very sharp rise in interest rates to dampen drastically domestic activity.

<sup>13</sup> International cost or inflation differentials are examples of structural or permanent payments imbalance.

Under some monetary regimes such as currency board in particular, the level of reserve holding is strictly tied to the issuing amount of monetary base. It should be disseminated on a regular basis for enhancing the credibility of or confidence in the regime in which the authorities are committed to the full convertibility of the domestic currency into an anchor currency<sup>14</sup> at a fixed exchange rate (Chan 2004).

### **3. Demand for International Reserves**

The policy functions, as specified in the previous section, derive demand for international reserves. Among them, shock absorption with an emphasis on securing a smooth adjustment under fixed exchange rate arrangements is particularly pertinent. Needless to say, the choice of exchange rate regime is the utmost determinant of demand for international reserves.

In principle, perfectly flexible exchange rates could eliminate the need for holding reserves (Crockett 1978). On the contrary, with fixed or heavily managed exchange rates, the authorities, which are unwilling to use expenditure-switching policy<sup>15</sup> to resolve temporary payment problems, are prepared to intervene actively in the foreign exchange market and correspondingly demand for reserves (Kelly 1970; Frenkel 1974, 1980; Edwards 1983). Peg to a single, floating currency in a world of generalised floating would further increase reserve use because of added variability in BOP caused by the movement of exchange rates between third currencies and the anchor currency (Heller and Khan 1978).

A small number of economies, including Hong Kong and Macao Special Administrative Regions of China, adopt the currency board system as a credible institution to support the domestic currency's fixed exchange rate against a single external currency.<sup>16</sup> Active intervention in the foreign exchange market by the

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<sup>14</sup> It is also named intervention or linked currency.

<sup>15</sup> That is variable exchange rate policy.

<sup>16</sup> The 2006 IMF Annual Report on Exchange Arrangements and Exchange Restrictions identifies seven economies adopting the currency board system, i.e. Bosnia & Herzegovina, Brunei Darussalam,

authorities, which normally exists in other forms of pegged exchange rate system, is rare under this monetary arrangement. Nevertheless, the demand for international reserves is automatically derived from the credible backing for convertibility of the domestic currency into a specified external currency at a fixed exchange rate, while change in the holding amount of international reserves could be viewed as a passive adjustment to developments in the external balance.<sup>17</sup>

In this regard, it may look paradoxical that world reserves have been on a rising trend even though more countries have opted for higher exchange rate flexibility after the collapse of the Bretton Woods System in 1973.<sup>18</sup> Most recently, world reserves have even been growing at a notably fast pace. With reference to IMF data, foreign exchange reserves of developing countries nearly quadrupled during 1996-2005, while those of industrialised countries rose 150%.<sup>19</sup> This, however, could be a reflection of central banks' preference for "managed float" rather than free float (Calvo and Reinhart 2000).<sup>20</sup>

Since intervention in the foreign exchange market by monetary authorities for various reasons requires international reserves, one would expect a persistently strong or at least relatively stable demand, which might not differ greatly from the demand estimated for the adjustable peg regime or the Bretton Woods System (Frenkel 1983). Meanwhile, many developing or emerging-market economies have still maintained their currency pegs against major international currencies. This to some extent helps

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Bulgaria, Hong Kong, Djibouti, Estonia and Lithuania. Pao (2003a) identifies six more cases – Bermuda, Cayman Islands, Falkland Islands, Faroe Islands, Gibraltar, and Macao – according to other sources.

<sup>17</sup> In fact, under a typical form of fixed exchange rate regime, a surplus in the basic BOP would incur corresponding increase in international reserves, and also in monetary base/money supply given little capacity for the monetary authorities to conduct "sterilisation" operations.

<sup>18</sup> According to the European Central Bank (2006), world foreign exchange reserves have multiplied by a factor of 45 since the end of the Bretton Woods System.

<sup>19</sup> It was estimated that about 74% of world reserves were USD assets at end-2005. See The Wall Street Journal (Asia edition), 9 May, 2006, p. 11.

<sup>20</sup> Many Asian countries have actively managed foreign exchange after the financial crisis of 1997-98 (Terada-Hagiwara 2005). Dooley *et al.* (2003) argues that managing exchange rates could be "mercantilist" as preventing or slowing currency appreciation by hoarding reserves can promote exports. The heavy burden of external debt servicing also urges highly indebted countries to manage exchange rates.



explain the phenomenon of continuously rising demand for reserves, particularly in developing countries.<sup>21</sup>

While highlighting the choice of exchange rate regime as a fundamental determinant, earlier research failed to offer a solid basis for modeling the quantity demand for international reserves.<sup>22</sup> Significant work on specification of the demand function only started to emerge in the late 1960s. It generally shows that countries have a “desired” stock of reserves determined by a few number of independent variables, and deviations of the actual stock from the desired stock would trigger a process of policy-induced adjustment for closing the gap between the desired and actual levels. Quantitative estimation is for the theoretically desired rather than actual stock, which reflects the long-run behaviour of reserves holding.

There are basically three variables identified in the literature to explain the level of desired reserve holdings. They are the *cost of macroeconomic adjustment*, the *opportunity cost of holding reserves* and the *variance of international transactions*. The first one is a country-specific variable while the other two are general variables applicable to most cases.

#### (i) The cost of macroeconomic adjustment

Macroeconomic adjustment by taking policy measures<sup>23</sup> to restore payments balance often incurs a cost, which can be stated in terms of aggregate income or welfare forgone. The higher the cost is there, the stronger the demand for reserves would be. Meanwhile, the degrees of exchange-rate flexibility and openness of the economy reflect the cost of macroeconomic adjustment.

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<sup>21</sup> About 70% of foreign exchange reserves are held by developing countries according to the IMF.

<sup>22</sup> For example, as referred to the lively description in the classic work of Machlup (1966), under a generalised fixed exchange rate regime, the demand of central bankers for international reserves, “like that of women for clothes”, is just regarded as “a simple desire for a little more than last year”.

<sup>23</sup> For example, contractionary fiscal/monetary policy (i.e. expenditure-reducing policy) and exchange rate depreciation (i.e. expenditure-switching policy) to prompt BOP surplus.

Fixed exchange rates, which rule out the adoption of the expenditure-switching policy to relieve the adjustment burden on the expenditure-reducing policy, imply high cost of domestic income adjustment to external imbalance. The demand for international reserves would be strong, and the authorities would tend to gradually accumulate reserves in normal times. Once the economy encounters BOP shocks that cause significant payment deficits, the authorities will use reserves as a shock absorber to reduce the cost of macroeconomic adjustment. In other words, the economy would be able to finance rather than adjust in times of payments imbalance.<sup>24</sup> Besides, an open economy<sup>25</sup> is likely to encounter more frequently external shocks, and hence would bear high adjustment costs. In order to smooth out the adjustment process, economies with a high degree of openness should have strong demand for international reserves (Frenkel 1974, 1983; Flood and Marion 2002).<sup>26</sup>

Meanwhile, countries at different development levels appear to show divergent demand preferences for reserves with developed countries demanding for a smaller quantity of reserves. The speed of macroeconomic adjustments is normally faster in developed countries than in developing countries. This may reflect the relatively low efficiency and effectiveness of macroeconomic policies in developing countries, which therefore rely more on reserves financing than macroeconomic adjustment means to deal with payments imbalance (Bilson and Frenkel 1979).<sup>27</sup>

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<sup>24</sup> Nevertheless, a flexible domestic price system could serve as a substitute for floating exchange rates, enhancing speedy adjustment in real rather than nominal exchange rates to external imbalance. Then, the requirement for international reserves would be generally lower in those economies with high domestic price flexibility.

<sup>25</sup> The degree of openness can be indicated by the ratio of import, export or total trade to gross domestic product, marginal or average propensity to import, and the ratio of international capital flows to gross domestic product (i.e. financial openness). See, for example, Edwards (2005).

<sup>26</sup> Heller (1966) argues that higher degree of openness as indicated by marginal propensity to import would lower the adjustment cost as a small change in income (i.e. expenditure-reducing) causes a proportionally larger change in imports and hence larger impact on the BOP. Therefore the open economy tends to be less reliance on reserves as a shock absorber. However, the majority of empirical studies does not support Heller's argument, but supports the general belief that higher openness coincides with stronger reserves demand.

<sup>27</sup> Japan may be a notable exception. Meanwhile, faster adjustment entails a cost in the form of greater fluctuations in the level of aggregate income (Clark 1970a). Thus the authorities in developed countries may encounter a trade off between income variability and the level of international reserves.

(ii) The opportunity cost of holding reserves

Reserve holdings can reduce the level of aggregate income as international reserves can be used for domestic investment and consumption. This variable should therefore be negatively related to reserves demand.

A large volume of literature offers different methods to measure the opportunity cost of holding reserves. It can be simply proxied by the government bond yield,<sup>28</sup> the domestic discount rate,<sup>29</sup> or the yield on domestic securities.<sup>30</sup> However, international reserves would also yield return, though the return is relatively low partly attributable to the restrictions on their management.<sup>31</sup> Edwards (1985) therefore estimates the opportunity cost as the difference between the rate of interest on the external debt<sup>32</sup> and the London Interbank Offered Rate (LIBOR).<sup>33</sup>

Similarly, Ben-Bassat and Gottlieb (1992a) define the opportunity cost of holding reserves as the difference between the highest possible marginal productivity forgone from an alternative investment in fixed assets and the yield on international reserves. The real rate of return on capital is calculated as the ratio of profits to gross capital stock of the business sector. In periods of economic slowdown when the return on capital in the business sector drops to a very low level, the substituting measure is the marginal rate of return on government projects. The yield on international reserves can be approximated as the weighted average of real interest rates on short-term deposits in reserve currencies, or simply the US Treasury bond rate (Bird and Rajan 2003).

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<sup>28</sup> In equilibrium the rate of return on capital is equated to the long-term rate of interest, i.e. the government bond yield. See Courchene and Youssef (1967).

<sup>29</sup> It approximates the return on capital. See Iyoha (1976).

<sup>30</sup> See, for example, Frenkel and Jovanovic (1981).

<sup>31</sup> For a brief discussion about the restrictions, see Pao (2003b).

<sup>32</sup> It is the cost at which that the economy borrows from the international financial market.

<sup>33</sup> The LIBOR is a representative measure of interest earned from international reserves.

(iii) The stability of the external sector

High variability of international transactions or the BOP normally comes with strong demand for reserves (Kenen and Yudin 1965). Standard deviation of annual changes in the stock of trend-adjusted international reserves is a simple measure of the variability, especially under a fixed exchange rate regime, where changes in reserves largely reflect BOP developments.<sup>34</sup>

The recent literature focuses on the “precautionary” or “insurance” demand for international reserves, especially for developing countries under financial liberalisation<sup>35</sup> or increased uncertainty in the aftermath of a financial crisis,<sup>36</sup> in which their external sectors are potentially violate (Stiglitz 2002). International reserves can stabilise aggregate income, fiscal expenditure and domestic absorption during financial crises characterised by a sudden halt of net capital inflows or a current account reversal (Edwards 2004; Aizenman and Lee 2005). It can be viewed as a safety cushion against an undesired shortage of international liquidity in times of disruption<sup>37</sup> especially for developing countries that have limitation to borrowing foreign currencies when needed.<sup>38</sup>

To summarise, open developing economies with low exchange rate flexibility and high variability of international transactions tend to have strong demand for international reserves. However, at times when there is abundant opportunity for

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<sup>34</sup> For cross-country comparison, the standard deviation and other explanatory variables should be divided by imports or gross domestic product to obtain a free-of-scale measure (Frenkel and Javanovic 1981). See Section 4 of this paper.

<sup>35</sup> That is increased international capital mobility.

<sup>36</sup> For example, the 1994 Mexican crisis and the 1997/98 Asian crisis. Meanwhile, financial liberalisation would also increase vulnerability to financial crises, and hence lifts the precautionary demand. However, Edwards (2005) conducts an empirical study to show that countries with high capital mobility do not have a significantly higher incidence of external crises. But once a crisis occurs, countries with high capital mobility tend to face a higher macroeconomic adjustment cost in terms of income growth decline.

<sup>37</sup> Examples include war, banking crisis and BOP crisis.

<sup>38</sup> As discussed in Section 2, international reserves function to reduce the possibility to impose capital controls. To relieve the pressure to accumulate reserves, several Asian countries have recently signed on a mutual swap agreement under the “Chiang Mai Initiative”. Credible IMF aids would also help relieve pressure on reserves accumulation.

higher yield alternative applications of the financial resources, the desired stock of international reserves would be somewhat contained.

#### **4. Standard Ratios to Indicate Reserves Adequacy**

Indicators for reserves adequacy, in line with the analysis of the functions of reserves and demand for reserves in Sections 2 and 3, have been very limited. Most of them, which are expressed in ratio to some macroeconomic variables and still popular today, had been developed before the 1970s. Indicators in the form of ratio are typical scaling technique for international comparison (Flood and Marion 2002). The most popular ones are introduced as follows:

(i) The ratio of reserve to import. The ratio has been deemed as a standard measure of reserves adequacy since the 1960s.<sup>39</sup> This concept is originated from Triffin (1947), who argues that the demand for reserves could normally be expected to grow in line with international trade. The ratio shows how long an economy could finance its imports if it were suddenly deprived of all of its foreign exchange earnings due to payment shocks (Kenen and Yudin 1965).

The IMF started to use the reserve-to-import ratio to measure the adequacy of reserves in the 1950s. Under the Bretton Woods System, major nations aimed at maintaining a reserve level of no less than 40% of their annual imports in most years, while a 20% level was regarded as an absolute minimum (Triffin 1960). Most recently, the European Central Bank (2006) still recognises three to four months' import coverage as the "rule of thumb". Although its relevance is less specific than that of imports, gross domestic product as an indicator of aggregate economic activity has also been

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<sup>39</sup> However, Courchene and Youssef (1967) argue that the measure is oversimplified despite its high popularity. International payments include items other than goods and services, and changes in the composition of trade towards items subject to greater seasonal and cyclical fluctuations need not, at the level of imports, call forth the same demand for reserves.

widely used as a scaling variable in measuring comparative reserves adequacy among countries in recent years.<sup>40</sup>

(ii) The ratio of reserves to domestic money or central-bank monetary liabilities. Machlup (1966) suggests the ratio as a measure of reserves adequacy with a view to enhancing confidence in domestic currency, especially under a fixed exchange rate arrangement. The ratio indicates the degree of risk of capital flight from the domestic currency.

(iii) The ratio of reserves to net external balance or larger annual reserve loss. Brown (1964) proposes this ratio as a standard indicator in view of international reserves' function as a cushion against future payments imbalance for which the past balance is treated as a proper proxy.

(iv) The ratio of reserves to short-term external debts.<sup>41</sup> The ratio reflects an economy's financial ability to service its existing short-term external debt, especially in times of a sudden stop in short-term external debt flows. Some former top finance officials, such as Alan Greenspan and Pablo Guidotti, suggest a minimum ratio of 100% for developing countries. Meanwhile, Jeanne and Rancière (2006) offer a quantitative model to justify the Greenspan-Guidotti rule, with an assumption that the sudden stop of capital flows during crises is considerably sizable.

It is difficult, if not impossible, to determine scientifically the optimal ratios. As Grubel (1971) argues, the studies of prospective adequacy of reserves using those ratios are based on a theoretically inadequate foundation. Under the system of fixed exchange rates, in particular, destabilising exchange speculation is so unpredictable in its timing and duration that no objective notion of "adequacy" is possible. However, the ratios can still provide a simple base for cross-country comparison in reserves

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<sup>40</sup> Jeanne and Rancière (2006) offer a preliminary quantitative analysis, which shows optimal levels of reserves for emerging market economies with varied probabilities of a sudden stop in international capital flows, degrees of risk aversion and term premium of interest returns.

<sup>41</sup> Normally referring to debts maturing within one year.

adequacy. When the ratios are stable, it may also reveal that the desired demand is satisfied.

## **5. Application to Macao**

Macao is a highly open economy as its external sector, represented by exports and imports, accounts for a dominant share of the overall economic activity. As mentioned above, it adopts a currency board system with low exchange rate flexibility. The SAR's economy, which relies heavily on international transactions with a low degree of diversification, demonstrates a high degree of variability (Chan 2006).

In addition, official BOP statistics confirm Macao's solid status as a capital exporter, while the persistently weak growth of domestic credit under a surplus government sector and the low loan-to-deposit ratio indicate few alternative applications of financial resources, and hence low opportunity cost of international reserves. Macao is therefore expected to have strong desired demand for international reserves, though in practice the authorities are unlikely to provoke payments surplus by deliberate contractionary policy for reserves accumulation.<sup>42</sup> Market-driven developments in the BOP should by all means reflect in the change in international reserves under a fixed exchange rate monetary system.

Chart 1 presents the historical development of international reserves held by the monetary authorities since the 1980s. It is observed that Macao's international reserves have been moving along a long-term rising trend, indicating a sustained surplus position in its BOP.<sup>43</sup> The strong performance of the export sector, which has

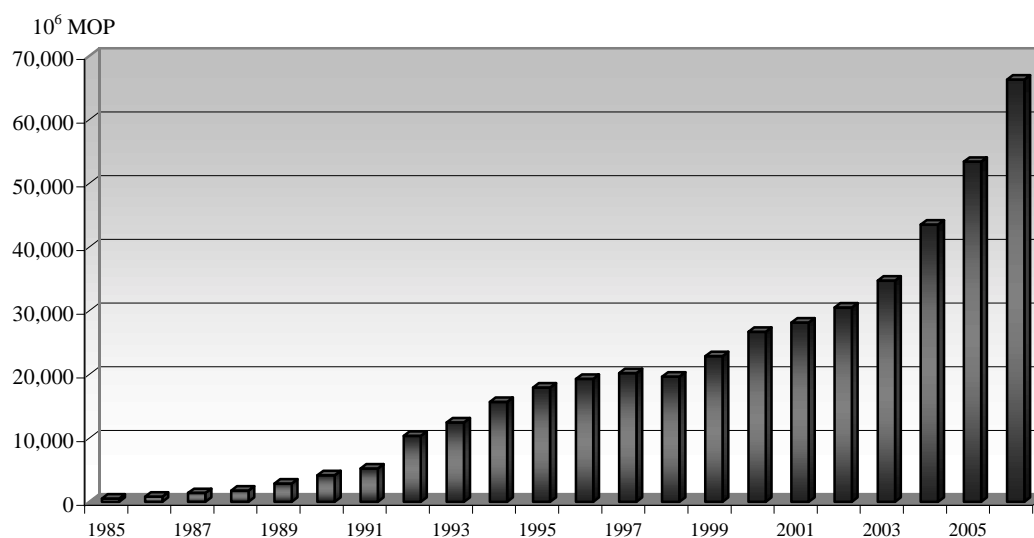
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<sup>42</sup> For a detailed discussion about the passive monetary operations of the authorities, see Chan (2004). However, the accumulated fiscal surplus in Macao, though not a discretionary policy action, does help explain the payments surplus and reserves accumulation under a linked exchange rate regime. The fiscal surplus also contains the growth of domestic money supply, sterilising the monetary expansion effect of international reserves accumulation without destabilising the fixed exchange rate.

<sup>43</sup> Macao's BOP statistics have been made available since the year 2002.

induced a continued surplus in the current account, is the primary reason for the one-sided development of the BOP.<sup>44</sup>

**Chart 1: Macao's International Reserves, 1985-2006**



*Source: AMCM.*

*Note: International reserves of 2006 indicate the figure at end-September of the year.*

Standard ratios further indicate Macao's superior position in reserves adequacy by international standards. Macao's import cover has exceeded 12 months, while its ratio of reserves to domestic money is one of the highest in the world (Table 1). Compared with other economies adopting currency board arrangements, the SAR is clearly at the higher end of the ratio scale. Most remarkably, Macao's international reserves are not only valued at 19 times its total currency in circulation, but also more

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<sup>44</sup> With reference to the data of the Economist Intelligence Unit, Macao's current account surplus as a percentage of GDP would be the second biggest in the world, just behind Kuwait. See *The Economist* magazine, 18 March 2006 issue, p. 94. In theory, the surplus implies excess domestic savings over investment, which is partly owing to the inability of domestic financial markets to channel private savings to investment. An indirect evidence for ineffective domestic financial markets is the continued accumulation of foreign assets by the private sector. However, some argue that in worldwide openness of the capital and financial account, the domestic savings and investment imbalance or current account imbalance could be a norm rather than exception. See Bank of England Governor Mervyn King's speech on Reform of the IMF to the Indian Council for Research on International Economic Relations, New Delhi, India, 20 February, 2006.



than adequate in covering all pataca-denominated broad money, M2, or guaranteeing a system-wide convertibility (Chart 2).<sup>45</sup>

**Table 1: Standard Indicators for Reserves Adequacy**

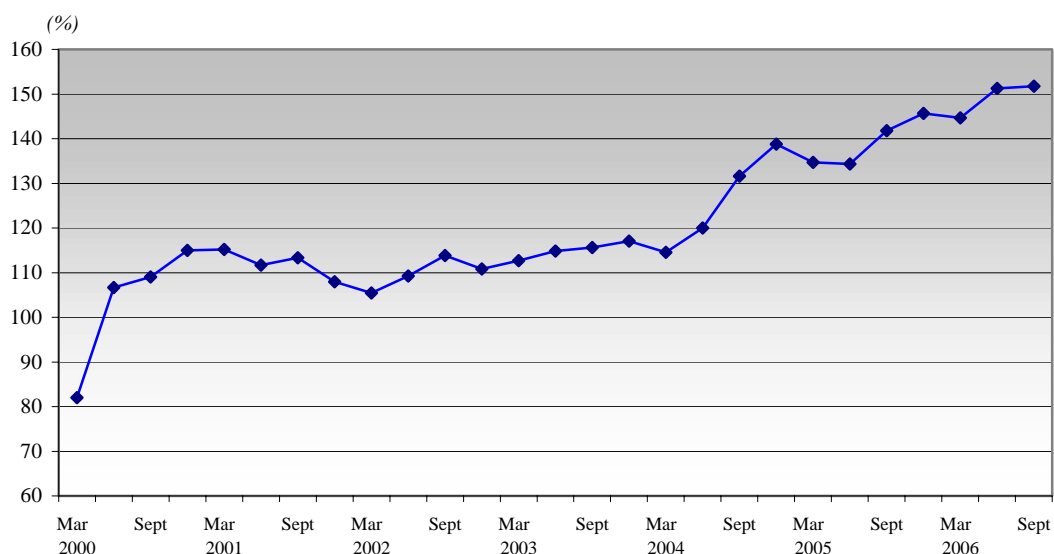
	Import Cover <sup>1</sup>	Reserves-to-GDP ratio <sup>2</sup>	Reserves-to-currency in circulation ratio <sup>3</sup>
	(Number of months)	(%)	(%)
Mainland China	15.9	36.9	321.9
Japan	17.3	18.3	135.6
Chinese Taiwan	14.6	73.1	1,131.0
South Korea	8.6	26.7	969.7
India	n.a.	16.5	165.2
Malaysia	7.2	53.4	935.6
Singapore	n.a.	99.2	1,368.9
Bosnia and Herzegovina*	4.5	n.a.	266.9
Brunei Darussalam*	n.a.	7.7	n.a.
Bulgaria*	5.4	31.9	259.7
Djibouti*	n.a.	n.a.	141.5
Estonia*	2.1	14.8	276.1
Lithuania*	2.9	14.5	177.0
Hong Kong SAR*#	4.6	69.9	674.9
<b>Macao SAR*</b>	<b>13.9</b>	<b>57.9</b>	<b>1,999.3</b>

Sources: *International Financial Statistics*, October 2006 Issue, the IMF.  
*Monthly Financial Statistics September 2006*, Authority of Taiwan, China.

Notes: <sup>1</sup> Total reserves minus gold indicate figures at end-June 2006. Imports of goods and services indicate figures for the whole year of 2005.  
<sup>2</sup> Total reserves minus gold indicate figures at end-2005. Nominal GDP indicate figures for the whole year of 2005.  
<sup>3</sup> Total reserves minus gold and currency in circulation indicate figures at end-June 2006, except currency in circulation of Korea, which indicate figure at end-May 2006.  
n.a.=not available.  
\*Economies adopt the currency board system.  
#Imports of Hong Kong SAR contain a large portion of re-exports.

<sup>45</sup> As Johnson (1958) argues, the BOP problem is monetary in nature and fundamentally related to the fact that the banking system can create credit. This implies that international reserves are very unlikely to back all domestic money supply. However, bank deposits, which typically account for a dominant portion of broad money supply, are liabilities of the banking system rather than the monetary authorities.

**Chart 2: Ratio of International Reserves to Pataca M2, 2000-2006**



Source: AMCM.

## 6. Concluding Remarks: Policy Implications

International reserves are important financial resources for an economy. They perform unique and crucial economic functions, and have notable implications for the external and internal balance of an economic system. Evolution in international reserves is closely linked to the stance of monetary and exchange rate policy adopted by the authorities, which should therefore possess a certain degree of influence on their developments.

The quantity of reserves holding should not be simply interpreted as an indicator of economic strength. It is determined by a number of factors as shown in this paper.<sup>46</sup> Macao, as a Special Administrative Region of the People's Republic of China with independent economic institutions, is apparently in a superior position in reserve holding by all international standards, though whether its current level of reserves in absolute terms is already more than enough is another question. To our best

<sup>46</sup> China, therefore, as a developing country, is holding the amount of international reserves, at about one trillion US dollars or 20% of world reserves at end-2006, larger than those of advanced countries such as the USA, Japan and Germany.

knowledge, there is still no norm for measurement of optimal or maximum reserves in the field of economics, though some demand-for-reserves models and standard reserve adequacy ratios apparently offer certain useful criteria for comparison across countries and sensible explanations for cross-country variation at the level of international reserves.

To the utmost policy concern for monetary stability, the 100% reserves cover of broad pataca money under the linked exchange rate system has already guaranteed the convertibility of all domestic monetary liabilities into foreign currencies. The continued accumulation of international reserves on top of that amount would simply reveal a prolonged imbalance in the SAR's BOP in the form of persistently large current account surplus, which is likely to stem from some structural factors in the economy worthy of further exploration. It also implies that the amount of reserves exceeding the level of "backing assets" could be managed under a more return-oriented investment strategy in order to minimise the opportunity cost of reserves holding. In fact, according to a recent Bank for International Settlements report, a gradual shift of international reserves into higher-yielding, higher-risk instruments has been a global trend in recent years, when the amount of world reserves has grown at a fast pace.<sup>47</sup>

Referring to some international examples such as the Government Petroleum Fund in Norway, the surplus reserves stemmed from a narrow base of external revenues could be considered to allocate to a separate stabilisation and savings portfolio. In view of Macao's heavy economic dependence on inherently volatile visitor gaming revenues, the portfolio could be tailored for financing temporary fiscal revenue shortfalls,

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<sup>47</sup> See Wooldridge (2006). It is reported that Macao's exchange reserves have been divided into a "liquid" portfolio and an "investment" portfolio with the latter being "targeted to enhance income while observing a significant degree of capital protection". See Monetary Authority of Macao Annual Report, 2005, p. 26. Meanwhile, over 70% of Macao's reserves are placed in bank deposits according to the Monetary Authority of Macao Annual Report while developing countries (industrial countries) hold about 33% (20%) of their reserves in deposits according to Wooldridge (2006), Table 2.

making direct investments to promote economic development and saving for future generations.<sup>48</sup>

One widely cited undesirable effect of reserves accumulation is the disruption to internal balance in appearance of over-expansion of money supply or inflation.<sup>49</sup> It is because monetary authorities create monetary base to purchase foreign currencies in the absence of corresponding complete sterilization.<sup>50</sup> In the case of Macao, this undesirable effect seems to be somewhat contained with a weak growth of domestic credit stemmed from fiscal surpluses<sup>51</sup> and moderate expansion in lending of local banking institutions to the private sector.<sup>52</sup> Between 2001 and 2005, the base money and broad money supply, M2, grew at annual average rates of 11.1% and 9.2% respectively, which were lower than the annual average growth rate of real GDP at 12.4%, and hence were far from over-expansionary.<sup>53</sup>

To conclude, change in international reserves in Macao is largely a residual of the external balance in the present economic and policy setting. As long as its external account remains strong, Macao will continue to accumulate international reserves. Correction in the BOP surplus, and hence reserves accumulation, would only be

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<sup>48</sup> In recent years, there have been some “innovative” uses of international reserves, such as creation of oil funds (Norway), recapitalisation of state-owned enterprises (China), repayment of external debt (Russia), and funding of investment projects (Chinese Taiwan). See European Central Bank (2006).

<sup>49</sup> See Mohanty and Turner (2006) for a detailed discussion about domestic implications of foreign exchange reserve accumulation in emerging markets. Even though monetary authorities are able to fully sterilise reserve accumulation, the economy could still face other undesirable implications such as large carrying costs, financial sector and future monetary imbalances, reduced efficiency in financial intermediation.

<sup>50</sup> In recent years, China has often been cited as a typical case for analysing this monetary hypothesis.

<sup>51</sup> Over the past five years, the international reserves grew at an average annual rate of 14.2%. The public-sector deposits, which are mostly maintained at the monetary authorities and excluded from the local money supply, recorded an average annual growth of 33.3% due primarily to accumulated fiscal surpluses. As a result, the surplus position of the government sector exerted a sterilisation effect on the monetary expansion.

<sup>52</sup> In recent years, sterilised intervention in emerging markets has been associated with large issuance of central bank or government debt paper (Mohanty and Turner 2006). Similarly, the increased issuance of central bank paper (i.e. monetary bills) has helped contain monetary expansion in Macao. However, the issuance is strictly speaking not a typical central-bank sterilisation operation but a standby liquidity absorption facility, as the monetary authorities just passively issue the paper at the request of commercial banks. See Chan (2004).

<sup>53</sup> The statistics indicate that rising inflation in Macao since 2005 would not be fuelled by monetary expansion. The inflation issue, however, is beyond the scope of this paper.

achieved with expanded domestic demand, real appreciation in the pataca,<sup>54</sup> or/and most undesirably, deterioration in tourism exports. Meanwhile, the successful maintenance of a high degree of reserves adequacy will enhance the public confidence in the committed convertibility of the domestic currency and the monetary stability.

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<sup>54</sup> Real appreciation will only appear with relatively high inflation under a fixed exchange rate regime.

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