**MONEY FOR NOTHING:**

**THE INCREASING COST OF FOREIGN RESERVE HOLDINGS
TO DEVELOPING NATIONS**

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November 12, 2001

# EXECUTIVE SUMMARY

A striking development of the last decade has been the rise in reserve holdings among developing nations. The rise in the ratio of reserve holdings to GDP has occurred in every region of the world, and has been especially rapid in the years since the East Asian financial crisis. As a result, some countries, such as Taiwan and Malaysia, now hold an amount of reserves that exceeds 30 percent of their GDP.

Reserve holdings carry a considerable cost. A dollar held as reserves is essentially a dollar of foregone investment for a developing nation. If these nations had not increased their reserve holdings, they could have used this money to support investment in physical or human capital. The cost of the build-up of reserves is then the difference between the return on investment in developing nations and the small returns (typically 1-2 percent real returns) available on the assets held as reserves.

This paper uses World Bank data to document the rise in the ratio of reserve holdings to GDP. It finds:

- there has been a large rise in the ratio of reserves to GDP in every region from the 1960's to the 1990's, with a further increase following the East Asian financial crisis.

- the largest increases were in the East Asian region and the Middle East, with the average reserve holdings rising by more than 10 percentage points of GDP in each case from the sixties to the nineties, with the East Asian region experiencing an additional increase of more than 2 percentage points in the late nineties.

- South Asia, Latin America, and Sub-Saharan Africa all experienced a rise in the ratio of reserves to GDP of at least 4 percentage points from the sixties to the nineties, with both Latin America and Sub-Saharan Africa experiencing increases of close to 8 percentage points using data from the last three years of the decade.

- the implied cost of this rise in reserve holdings is 0.4-1.0 percent of annual GDP in South Asia, and between 1.0 and 2.1 percent of annual GDP in East Asia. The cumulative costs of a decade of reserve holdings at late nineties levels (compared to the cost of sixties levels of reserve holdings), could exceed 20 percent of current GDP in East Asia and would be close to 10 percent of current GDP for nations in Sub-Saharan Africa and Latin America. This would be equivalent to a loss of between 1 and 2 trillion dollars in the United States.

There is no widely accepted explanation for the rise in reserve holdings, but it is likely that an increase in the instability of the world financial system has played a major role. The data in this paper suggest that the growing instability of the international financial system has imposed a large cost on developing nations in recent years. This increase in instability, in spite of the

developments in technology and economic theory, constitutes a serious failure by the architects of the current financial system.

# INTRODUCTION

A striking, but little noted, phenomenon of the last four decades has been the increase in the amount of foreign reserves held by central banks throughout the world. In every region of the world central banks are holding far larger reserves, relative to the size of their economy, than they did in the sixties. In fact, in the developing world, the average ratio of reserve holdings to GDP has more than doubled between the sixties and the nineties. Some developing nations, such as Taiwan and Malaysia, now hold an amount of reserves that exceeds 30 percent of their GDP. A comparable sum in the United States would be $3 trillion.

This increase in reserve holdings has received remarkably little attention from economists and policy analysts. The lack of attention is striking because there are large costs associated with holding reserves. Essentially, the cost of holding reserves is the investment that these nations must forego in order to accumulate reserves. In other words, the dollars that developing nations must hold as reserves are dollars that cannot be spent on health care and education, on physical infrastructure, or on the promotion of private investment. By diverting resources from more productive uses, the dramatic rise in reserve holdings over the last four decades has significantly impeded economic and social progress in developing nations.

This paper documents the rise in reserve holdings over the last four decades and provides preliminary estimates of the costs attributable to this increase. These estimates indicate that the costs are quite large, on the order of 1.0-2.0 percent of annual GDP for most nations. Taken over the course of a decade, the cumulative costs could run as high as 15 to 25 percent of GDP. To put this in context, for the U.S. economy this would mean a cumulative cost over the course of a decade of between $1.5 and $2.5 trillion, or between $5,000-$8,000 for every person living in the country.

Before detailing the rise in reserve holdings over the last four decades, it is worth clarifying the mechanism through which reserve holdings impose costs on developing nations. This is the topic of the first section. The second section briefly examines possible explanations for the rise in reserve holdings. The third section presents the data on reserve holdings from the sixties through the nineties, and the cost of the increase in the ratio of reserve holdings to GDP. This is followed by a brief conclusion.

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# WHY RESERVE HOLDINGS ARE EXPENSIVE

The fact that nations now have a much higher ratio of reserve holdings to GDP would not be of much consequence, if there were no cost to holding reserves. However, the cost is in fact quite substantial. As Neely (2000) and Ben-Basset and Gottlieb (1992) have pointed out, the opportunity cost of reserve holdings is the marginal product of capital in the nation holding the reserves.[2]

This point can be seen by examining the process through which nations acquire reserves. In order to increase its holdings of reserves, a nation must manage to run a balance of payments surplus. The net increase in reserve holdings is the extent to which the total amount a nation receives in foreign currency – whether from trade, factor income flows, direct investment, portfolio investment, or aid – exceeds the total amount it pays out for these purposes.[3] Put another way, the increase in reserves is equal to the surplus of national savings over investment, plus the net inflow of foreign investment and aid. A dollar that is added to reserves is a dollar that could otherwise be spent on investment.

This can be demonstrated most clearly by taking an extreme case. A nation could, in principle, contract with a foreign firm to construct a factory or other facility, with the money it is accumulating as reserves. As a practical matter, there may always be leakages going from one form of saving (reserves) to investment, but, in principle, the entire value of a nation's reserves correspond to savings that could otherwise have been invested in physical or human capital.

The return on physical capital varies depending on the time period and the country. The before-tax return in the United States has averaged close to 10 percent over the post-war period (Baker 1996).[4] The returns in developing nations will generally be considerably higher to compensate for the greater degree of risk. It is likely that the return to capital exceeds 20 percent in many of the poorer developing nations. There is evidence that public investment in infrastructure or education, two other alternative uses of assets held as reserves, may provide

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[2] There has been some confusion in the literature on the appropriate opportunity cost to assign to reserve holdings. For example, Frenkel (1981), Shinkai (1979), and Iyoha (1976) treat the opportunity cost as the interest rate on government debt. As is explained in the text, this sets up the wrong counterfactual. If the assets were not held as reserves, they would be available to nations to fund domestic investment in physical capital. The return on such investment is therefore the correct measure of the opportunity cost of holding reserves.

[3] This can be expressed:

1) $\Delta R = (X-M) + (FY_d - DY_f) + (FI_d - DI_f) + (FA_d - DA_f)$,

where $\Delta R$ is the change in reserves, X-M is the surplus of exports over imports, $FY_d - DY_f$ is the surplus of receipts of factor incomes (e.g. interest and dividends earned on the foreign assets of the nation's citizens or the labor income earned by its residents when they worked abroad), $FI_d - DI_f$ is the surplus of foreign investment within the nation (both direct and financial) over investment that domestic firms and citizens undertake abroad, and $FA_d - DA_f$ is the surplus of foreign aid given to the nation over the aid that the nation may give to other nations.

[4] The before-tax rate of return would be the appropriate measure for calculating the opportunity cost of capital, since tax revenues are also part of the return to the country.

even higher rates of return than physical capital (e.g. Munnell 1994; Holtz-Eakin and Schwartz 1994).

In calculating the cost of holding reserves, it is important to recognize that reserves do provide some return. The cost of holding is therefore the difference between the opportunity cost and the real return on reserves. The portion of reserves held as interest bearing deposits, or as the short-term government debt of the United States and other nations that supply reserve currencies, will typically earn a small positive real rate of interest. In the post-war period this has averaged between 1.0-2.0 percent. Reserves held as gold, currency, or in non-interest bearing accounts will provide no real return, on average. Given the mix of assets held as reserves, the average return can be assumed to be in this range of 1.0-2.0 percent, although probably closer to 1.0 percent than 2.0 percent.

This analysis presents two sets of estimates of the cost to developing nations of holding reserves in order to construct a plausible range. The low end estimate assumes that the cost of holding reserves is 10 percent[5]. This assumption implies that the return to physical or human capital in developing nation is only slightly higher than in the United States, the difference being equal to the real return on reserve assets. The high end estimate assumes that the cost of holding reserves in the developing nations is 20 percent, implying a relatively high rate of return on human or physical capital. Since the return to capital (both physical and human) will differ across nations, the actual opportunity cost of holding reserves will vary. It is reasonable to assume that the opportunity cost in richer developing nations will be closer to low end of this range, while it will be nearer to the high end of the range in the poorest nations.

It is also worth noting that the costs to developing nations are benefits to the nations that supply reserve currencies. When developing nations increase their holdings of foreign reserves in the form of reserve currencies, they are effectively providing low interest loans to the nations (primarily the United States) that supply reserve currencies. This allows the suppliers of reserve currencies to import goods and services without having to pay for them in the present.

## EXPLANATIONS FOR THE RISE IN RESERVE HOLDINGS

There are two main explanations that could be put forward for the rise in the ratio of reserve holdings to GDP in the last four decades. The first is simply that trade has increased relative to GDP in most nations, and that it has been necessary to increase reserve holdings in step with the rise in trade. The second explanation is that the international monetary system has become more unstable over the last four decades, therefore it is necessary for developing nations to hold more money in the form of reserves in order to protect their economies from this instability. It is likely that both of these factors contributed to the rise in the ratio of reserve holdings to GDP.

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[5] Thereby implicitly assuming an opportunity cost of 11-12 percent (as the return on holdings in 1-2 percent).

The way in which trade would contribute to an increased need for reserve holdings is straightforward – reserves are needed to smooth out payment imbalances – for example if there are delays in receiving payments for exports, or the inflow of capital is temporarily disrupted for some reason. It is reasonable to believe that the amount of money needed to deal with these sorts of imbalances would bear a relationship to the overall flow of trade. When the ratio of trade to GDP rises, it should be expected that the ratio of reserves to GDP would rise as well.

While the basic logic of this explanation is quite simple, it is important to note that the rise in reserves should be less than proportionate to the rise in trade. There are two reasons why this would be the case. First, reserves held to maintain normal trade flows are needed only to deal with the random imbalances in trade and payment flows. The size of these random imbalances would increase less than proportionately to the size of trade flows.[6]

The second reason why it would be expected that the need for reserves would be less than proportionate to the increase in trade would be the innovations in the financial sector over the last four decades. It would be reasonable to expect that improvements in information technologies would allow central banks to gain greater knowledge and control over the flow of finances, so that they could support a much greater volume of transactions with the same amount of reserves. This has been the experience in the domestic banking systems of all the industrialized nations. For example, in the United States, the ratio of the reserves of the banking system to GDP fell from 1.7 percent in 1965 to 0.4 percent in 2000.[7] It is reasonable to expect that comparable developments would allow central banks to similarly economize on the use of reserves, and therefore offset the impact of a rising ratio of trade to GDP.

Even if the rise in reserve holdings could be fully explained by the increase in trade relative to GDP, it would still be important to note this development. If increased reserve holdings of the size actually observed are attributable primarily to the growth of trade, then a major cost of increased trade has been overlooked. Few, if any, of the major trade models have factored in the cost to developing nations of increased reserve holdings (e.g. Francois et al 1996; Stoeckel et al 1990). This is an extremely serious omission in the major models, if trade is the primary explanation of the rise in the ratio of reserves to GDP. A model that accurately measured the cost of the necessary increase in reserve holdings may find that the predicted gains from greater trade are significantly reduced, and possibly eliminated altogether.

The other explanation for a rise in the ratio of reserve holdings to GDP is that the world financial system has become more unstable over the last four decades. A nation's willingness to incur the costs associated with increased reserve holdings, for reasons other than maintaining stable trade flows, should depend on the perceived probability and severity of a currency crisis. If currency crises become more frequent, or the economic disruption they cause becomes more severe, then it would be expected that central banks would raise their reserve holdings. In this

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[6] If the imbalances are randomly distributed, then their size should increase in proportion to the square root of the increase in trade. So, if trade quadruples, then the expected size of imbalances – and the need for reserves – should double.

[7] Reserve holdings averaged $12.3 billion, or 1.7 percent of GDP, in 1965 and $40.4 billion, or 0.4 percent of GDP, in 2000, Board of Governors of the Federal Reserve Board, Aggregate Reserves For Depository Institutions, Table A1, http://www.federalreserve.gov/releases/H3/hist/h3hist1.txt.

sense, the ratio of reserve holdings to GDP can be seen as a simple (reverse) measure of the stability of the international financial system.[8]

If the international financial system gains stability through time, as a result of better management, improved technology in the financial sector, and advances in economic knowledge, it would be expected that the ratio of reserves to GDP would decline through time, holding everything else constant. The increase in the ratio of trade to GDP is one factor that would have worked in the opposite direction over the last four decades, as noted above. It is also plausible that increased political instability could lead to a need for greater reserve holdings. However, it would be difficult to argue that the last decade, including the present period, is a time of greater political instability than the sixties. That decade was marked by the Cold War between the United States and Russia, and hot wars in East Asia, South Asia, and the Middle East, along with serious guerilla struggles in Latin America and Sub-Saharan Africa. In conclusion, the increase in reserve holdings over the last four decades must be attributed either to the growth of trade or increasing financial instability.

## THE PATH AND COST OF RESERVE HOLDINGS

The ratio of reserve holdings to GDP has risen substantially for developing nations in every region of the world over the last four decades. Table 1 shows the average ratio of gross reserve holdings to GDP for developing nations in each major region of world for the four decades from the sixties to the nineties. The three years from 1997-1999 have been included separately to determine if the East Asian financial crisis may have further raised reserve holdings.

**Table 1 – Reserve Holdings As a Share of GDP, by Decade and Region**

| Region | 1960's | 1970's | 1980's | 1990's | '97-99 |
|---|---|---|---|---|---|
| East Asia and Pacific | 12.2% | 16.2% | 19.4% | 22.5% | 24.6% |
| South Asia[9] | 4.1% | 6.3% | 8.1% | 8.4% | 8.5% |
| Latin America and Caribbean | 5.0% | 9.1% | 8.9% | 11.8% | 13.2% |
| Sub-Saharan Africa | 5.7% | 7.6% | 7.4% | 11.7% | 13.6% |
| Middle East and North Africa | 10.9% | 14.0% | 24.2% | 21.4% | 20.1% |

Source: World Bank 2001 and authors' calculations.

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[8] It is worth noting that a measure of stability that only examined the volatility of movements in currency prices, without examining changes in reserve holdings, could present misleading findings. If there were two time periods in which the volatility of movements in currency prices were comparable, but the ratio of reserve holdings to GDP had risen substantially, then it would imply that nations had incurred a substantial cost in the second period to keep the level of volatility constant.

[9] The data for South Asia excludes Bhutan and Maldives. Both were outliers with ratios of reserve holdings to GDP which are far above the average for the region.

The sharpest increases in reserve holdings relative to GDP came between the sixties and seventies, with every region experiencing a significant increase in this ratio. This rise coincides with the breakdown of the system of fixed exchange rates in 1973. If the collapse of the Bretton Woods system was responsible for most of the need for increased reserve holdings in the seventies, it was a very costly event for developing nations. The average ratio of reserve holdings to GDP nearly doubled in Latin America over this period, rising from 5.0 to 9.1 percent. It increased by 4.0 percentage points in East Asia, and by approximately 2.0 percentage points in both South Asia and Sub-Saharan Africa.

In the eighties, the ratio of reserve holdings to GDP fell slightly in both Latin America and Sub-Saharan Africa. There was a large jump of 10.2 percentage points in the Middle East and North Africa, perhaps reflecting the new oil wealth in the region. In South Asia the ratio rose by 1.8 percentage points, slightly less than in the seventies. In East Asia, the ratio of reserves to GDP rose by 3.2 percentage points.

There was another large jump in the ratio of reserves to GDP in the nineties in Sub-Saharan Africa (4.3 percentage points), East Asia (3.1 percentage points), and Latin America (1.9 percentage points). The ratio rose by 0.3 percentage points in South Asia, while it fell in the Middle East and North Africa. In Latin America it was 1.4 percentage points higher.

The late nineties saw a further increase in this ratio relative to the decade long average (which includes the last three years). In both East Asia and Sub-Saharan Africa the ratio was approximately 2 percentage points higher in the last three years than the decade long average. In South Asia there was little change in the ratio reserve holdings to GDP, while it fell by 1.3 percentage points in the Middle East.

The rise in reserve holdings over the last four decades carries a large implicit cost to developing nations. As noted before, the cost of holding reserves is the marginal product of physical or human capital in the country minus the real return on reserve holdings. By treating this difference as 10 percentage points at the low end, and 20 percentage points at the high end, it is possible to estimate ranges of the cost to developing nations of the increase in the ratio of reserve holdings to GDP over the last four decades.

**Table 2 – Cost of Increased Reserve Holdings 1960's to 1990's**
(Percent of GDP)

| Region | Annual Cost | | Cumulative Cost – 10 years | |
|---|---|---|---|---|
| | Low Cost | High Cost | Low Cost | High Cost |
| East Asia and Pacific | 1.0% | 2.1% | 11.8% | 23.6% |
| South Asia[10] | 0.4% | 0.9% | 4.9% | 9.9% |
| Latin America and Caribbean | 0.7% | 1.4% | 7.8% | 15.6% |
| Sub-Saharan Africa | 0.7% | 1.4% | 4.6% | 9.2% |
| Middle East and North Africa | 1.1% | 2.1% | 12.0% | 24.1% |

Source: World Bank 2001 and authors' calculations.

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[10] Data for South Asia excludes Bhutan and Maldives.

Table 2 shows that the cost of the increase in reserve holdings over the last three decades has been substantial. The first two columns show the annual losses, expressed as a share of GDP, that result from having to hold additional money as reserves rather than invest it in physical or human capital. The calculations are measured against an alternative scenario in which the ratio of reserves to GDP remained at its average level for the sixties. South Asia is the region least affected by the increase in reserve holdings, but even here the implied loss is important. In the low cost case, even for South Asia, the opportunity cost is equal to 0.4 percent of GDP each year. In the United States, a loss of this magnitude would currently be over $40 billion a year. Also, it is worth emphasizing that this low cost estimate is a lower bound based on the assumption that the return to capital in developing countries is barely higher than in the US. So the real costs are certainly higher than this low cost estimate.

East Asia and the Middle East are the regions that have incurred the largest costs as a result of the increase in reserves. In the low cost scenario, the increase in the ratio of reserves to GDP has cost East Asian nations 1.0 percent of annual GDP, and nations in the Middle East 1.1 percent of GDP. In the high cost scenario the lost output due to increased reserve holdings has been 2.1 percent of annual GDP in both cases. In the United States, this would be equivalent to a loss of more than $200 billion in annual output.

The calculation of cumulative lost output in the second set of columns is a projection that sums over a decade the projected losses from maintaining the nineties ratio of reserves to GDP. The loss is expressed as a percentage of the first year's GDP. (This calculation assumes, conservatively, that the real growth rate averages 3.0 percent annually.) The least affected region, Sub-Saharan Africa, would still incur a decade long cost from its increased reserve holdings equal to 4.6 percent of GDP, even in the low cost scenario. In the United States, a loss of this magnitude would exceed $460 billion. The cumulative loss from the increased reserve holdings in East Asia and the Middle East would be close to 12 percent of GDP in the low cost case scenario and around 24 percent of GDP in the high cost scenario. In the case of the United States, this would translate into a loss of between $1.2 and $2.4 trillion.

While these losses are substantial by almost any criterion, the situation may have permanently worsened as a result of the East Asian financial crisis. In the wake of this crisis, developing nations throughout the world have sought to increase their holdings of reserves as a way to protect themselves from financial instability. As a result, in most regions of the world the ratio of reserve holdings to GDP increased substantially in the last three years of the decade, compared with the decade long average. Table 3 shows the cost to developing nations of maintaining the reserve to GDP ratios of the late nineties, compared to the ratios of the sixties.

**Table 3 – Cost of Increased Reserve Holdings 1960's to Late 1990's**
(Percent of GDP)

| Region | Annual Cost | | Cumulative Cost – 10 years | |
|---|---|---|---|---|
| | Low Cost | High Cost | Low Cost | High Cost |
| East Asia and Pacific | 1.2% | 2.5% | 12.6% | 25.2% |
| South Asia[11] | 0.4% | 0.9% | 4.5% | 9.0% |
| Latin America and Caribbean | 0.8% | 1.6% | 9.4% | 18.8% |
| Sub-Saharan Africa | 0.8% | 1.6% | 9.1% | 18.2% |
| Middle East and North Africa | 0.9% | 1.8% | 10.5% | 21.1% |

Source: World Bank 2001 and authors' calculations.

As can be seen, the cost of reserve holdings increased substantially in East Asia, Latin America, and Sub-Saharan Africa. It was little changed in South Asia and decreased slightly in the Middle East. The higher ratio of reserves to GDP implies a substantial new burden for many developing nations. The late nineties ratio implies an annual loss of between 1.2 percent and 2.4 percent of GDP annually, for the East Asian nations, the region most directly affected by the financial crisis. In Sub-Saharan Africa and Latin America the cost of the late nineties reserve holdings is between 0.8 percent and 1.6 percent of GDP, when compared to the ratios maintained in the sixties. The cumulative losses over a decade would exceed 25 percent of GDP in the case of the high cost scenario for East Asian countries.

At this point it is too early to know whether the late nineties build-up of reserves by developing nations was a temporary response to financial instability which will be reversed in the near future, or whether it marks a permanent increase in the quantity of reserves that nations consider necessary to protect their currencies. However, it is clear that developing nations have already incurred a substantial cost as a result of this rise in their reserve holdings.

To be certain that this increase in reserve holdings is not driven by the behavior of small countries, regional averages were constructed using GDP weights. This data appears in table 4.

**Table 4 – Reserve Holdings As a Share of GDP, by Decade and Region (weighted by GDP)**

| Region | 1960's | 1970's | 1980's | 1990's | '97-99 |
|---|---|---|---|---|---|
| East Asia and Pacific | 8.9% | 6.8% | 12.4% | 20.4% | 24.2% |
| South Asia | 1.9% | 3.8% | 4.3% | 5.7% | 6.9% |
| Latin America and Caribbean | 3.0% | 6.3% | 6.2% | 7.9% | 8.4% |
| Sub-Saharan Africa | 5.5% | 6.8% | 4.8% | 6.9% | 9.5% |
| Middle East and North Africa | 8.2% | 20.0% | 13.8% | 16.1% | 17.0% |

Source: World Bank 2001 and authors' calculations.

This table shows somewhat different patterns to the rise in reserve holdings, with the increase in reserve ratios being somewhat larger for the East Asia and South Asia, and slightly smaller in the

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[11] Data for South Asia excludes Bhutan and Maldives.

case of the Middle East. The data show that Latin America and Sub-Saharan Africa have a considerably smaller increase in reserve holding when GDP weights are used, suggesting that smaller countries have been the ones most affected by the need to increase reserve holdings.[12] But the weighted data does not change the general pattern. Reserve holdings increased substantially in all regions from the sixties to the nineties, with a further increase in the last three years of the decade.

Table 5 shows estimates of the cost of the increase in reserve holdings, using the weighted averages of the ratio of reserves to GDP for the late nineties.

**Table 5 – Cost of Increased Reserve Holdings 1960's to Late 1990's (GDP weights)**
(Percent of GDP)

|  | Annual Cost | | Cumulative Cost – 10 years | |
| --- | --- | --- | --- | --- |
| **Region** | **Low Cost** | **High Cost** | **Low Cost** | **High Cost** |
| East Asia and Pacific | 1.5% | 3.1% | 15.5% | 31.1% |
| South Asia | 0.5% | 1.0% | 5.1% | 10.2% |
| Latin America and Caribbean | 0.5% | 1.1% | 5.9% | 11.8% |
| Sub-Saharan Africa | 0.4% | 0.8% | 4.7% | 9.4% |
| Middle East and North Africa | 0.9% | 1.8% | 10.6% | 21.3% |

Source: World Bank 2001 and authors' calculations.

As can be seen, the cost of the increase in reserve holdings is still substantial for all regions, with the opportunity cost for nations in the East Asian region exceeding 3.0 percent of annual GDP in the high cost scenario. The costs are lower for nations in Latin America and Sub-Saharan Africa when the weighted averages are used, but even in the low cost case for Sub-Saharan Africa, the increase in reserve holdings over the last four decades still constitutes a loss equal to 0.4 percent of annual GDP.

## CONCLUSION

The rise in the ratio of reserve holdings to GDP over the last four decades is a striking but little noted phenomenon. By the late nineties, the vast majority of developing nations held reserves that were far larger, measured as a share of GDP, than they had in sixties. This increase has occurred in all regions of the developing world, although the timing has varied by region. In East Asia, the region with the biggest rise in reserve holdings, the ratio of reserves to GDP increased by more than 12 percentage points over the last four decades. In both Latin America and Sub-Saharan Africa the increase was close to 8 percentage points.

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[12] There is also an issue of data availability, especially for Africa, in which many countries became independent in the sixties.

This increase in reserves represents an enormous cost to developing nations. To accumulate reserves, nations have to forego domestic investment in either physical or human capital. The potential return on this investment is the opportunity cost of holding reserves. The gap between the return on investment in developing countries and the real return on the reserves is between 10 and 20 percentage points. This implies that the increase in the ratio of reserve holdings to GDP over the last four decades has imposed costs that exceed 1.0 percent of GDP, and possibly 2 percent of GDP, for many developing countries. The equivalent cost in the United States would be $100-$200 billion a year.

The main explanations for the increase in the ratio of reserve holdings to GDP are increased trade and increasing financial instability. If increased trade is primarily responsible for the increase in reserve holdings, then most trade models have excluded a very important cost. Estimates of the benefits from expanded trade would be substantially reduced if the cost of the implied increase in reserve holdings was included.

Alternatively, if increasing financial instability is the main explanation of the rise in the ratio of reserves to GDP, then this indicates a serious failing of international financial institutions. The improvements in information technology and innovations in economic and financial theory should have led to growing stability in the world financial system. If the financial system has instead become less stable, this is prima facie evidence of serious mismanagement.

## Appendix

The data on reserve holdings is taken from the *World Bank's World Development Indicators 2001*, tables for "Gross international reserves (includes gold, current US$)" and "GDP at market prices (current US$)." Data for Taiwan came from Central Bank of China (2000).

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