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ABSTRACT

Less developed countries (LDCs) have experienced considerable business cycles in recent decades. This coincides with significant increases in their external debt to GDP ratios. Recent theoretical credit cycles literature suggests that indebtedness, and the resulting liquidity constraints, could explain LDC business cycles. This paper builds a macroeconomic model to trace the LDC income paths. In this model indebtedness and liquidity constraints reduce aggregate investment. We use the World Data (1995) to calibrate for the convergence parameter. It is found that LDC cycles are convergent and non-oscillatory, and indebtedness delays the return to long-term steady state income.

Keywords: LDCs, credits, liquidity constraints, business cycles

JEL E32, O16

1 Introduction

Less developed countries (LDCs) are by no means immune to business cycles. Indeed recent crises in Asia and South America suggest that LDC business cycles may have become more prevalent over the years. LDC cycles seem to differ from developed country ones in several ways. First, LDCs are typically small. Crucini (1997) uses data from 68 small countries and finds that country size is negatively related to its volatility in investment, consumption, and trade balance ratios. Second, LDCs may be eager to grow. So eager some may be that they resort to targeted investment in 'strategic', viz. risky, growth industries. Singapore recently went into a deeper recession than many countries because of her disproportionate reliance on the computer and electronics industries.[1] Small size and targeted growth diminishes her ability to spread eggs in many baskets, exposing her economy to external shocks. Blankenau, Kose, and Yi (2001) and Kose (2002) show that international price and interest rate shocks can explain a significant fraction of business cycle variability in developing countries. A third characteristic of LDCs is their dependence on foreign loans either to smooth their consumption or to finance their investments.[2] The present paper focuses on this third factor. We aim to investigate how foreign loans propagate LDC business cycles.

One of the most striking development in LDCs since the 1970s is the significant increase of their debt-income ratios. This is summarized in Table One. All empirical data used in this investigation are from the World Bank's World Data published in 1995. Table one shows the cumulative external debt stocks taken as snapshots at ten year intervals from 1971 to 1991. Almost every LDC in Asia (except Hong Kong and Singapore who did not borrow), as well as those in South America and Africa, has significantly increased her debt-GDP ratio. On average, as shown in Table one, Asian countries increased their indebtedness by 7.5 times, South American countries by 6.4 times, and African countries by 11.5 times

from 1971 to 1991. What may have caused such dramatic increase in their indebtedness? And what impacts it may have had on their business cycles?

Relatively speaking, South East Asian countries seem to have borrowed more often for investment, African countries for consumption, and South American countries somewhere in between. This can be seen from Table Two, which shows the annual GDP change averaged over ten year intervals from 1964 to 1994. Income grew fastest in South East Asia, less fast in South American, and the picture in Africa was predominantly one of contraction especially in the 1980s and 1990s.

Put Table One and Table Two about here

In this paper we are interested in the consequences rather than the causes of LDC indebtedness. Irrespective of its causes and where it took place, a rise in indebtedness is likely to have impacts on a country's investment behavior. Creditors generally demand collaterals. A high level of indebtedness, or a dramatic rise in debt, would make it difficult to borrow further to finance consumption or undertake investment projects. Further, if a country's financial and banking system is poorly developed, creditors will be particularly cautious when debts are already high, and the curb on expenditures will correspondingly be stronger.

At this point we could draw on an emerging and influential literature on how credits can lead to cycles. Bernanke and Gertler (1989, 1990) point out that businesses require external finance to undertake investment projects when they have low net worth, but low net worth leads to high agency costs to borrowers. Agency cost is higher during economic downturns than upturns. When cost rises in slumps and falls in booms, they tend to propagate business cycles. Greenwald and Stiglitz (1993) make essentially the same point by emphasizing the asymmetric information between borrowers and lenders. Their main

argument is that bankruptcy cost, which shifts the aggregate supply curve, is counter-cyclical. More recently Kiyotaki and Moore's (1997) point out that lenders require collaterals such as land and other assets for their loans. But the values of such collaterals are pro-cyclical. Consequently liquidity constraints will be tighter during slumps than during booms. They argue that credits produce cyclical transmission mechanisms both instantaneously and over time.

So the debt-collateral cyclical mechanism, much like Keynes' much debated "animal spirit", spreads external shocks through the economy. We shall describe the time path after a single shock hits, and how this path is affected by the increased indebtedness shown in Table one. Section two below contains a simple model of income determination with debts and liquidity constraints. The result is that greater indebtedness unambiguously increases volatility. In order to describe the income time path more clearly, we use data from the World Data to show that indebtedness delays the process of returning to long-term steady state. All convergence paths are found to be non-oscillatory and non-explosive.

The final Section four offers some concluding remarks.

2. Modeling LDC business cycles

Consider the accounting identity at time t between income Y, foreign capital net inflow F, consumption C, investment I, government expenditure G (assumed exogenous):

$$Y_t + F_t = C_t + I_t + G_t . \tag{1}$$

The item that distinguishes LDCs from others is F_t on the left-hand side. We shall argue shortly that F_t is related to both income and the level of indebtedness in a country. In addition, a set of financial liberalization policies seems to have encouraged F_t into LDCs especially since the 1980s. These are measures that open a country's financial market to foreign influences: abolishing credit controls, deregulating interest rates, relaxing entry into

the banking and the financial services industry, privatizing the banking sector, and freeing international capital-flows. Many of such measures, such as interest rate and foreign exchange policies, are sometimes implemented in a relatively short period of time.

A country's indebtedness, reflected in F_t, directly affects the severity of liquidity or credit constraints consumers and investors face. Our focus in this model is to study the interrelations between debt and consumption/investment constraints in the determination of income and cycles. Let us now examine each of the variables in (1) in more details.

A. Capital Flows

For simplicity we abstract form capital repayments. The net flow of foreign funds, denoted F_t, consists of two parts: *fresh loan*, denoted L_t, and *debt servicing* or interest paid in arrears, denoted $r_t D_{t-1}$. r_t is interest rate taken to be exogenous. D_t is cumulated debt stock outstanding at *t*. Hence

$$F_t = L_t - r_t D_{t-1}. \tag{2}$$

We could measure indebtedness by $\beta_t \equiv D_t / Y_t \geq 0$. We will treat indebtedness and interest rate as exogenous variables and suppress its time subscripts for the remainder of this section. Since there is no capital repayment, fresh loan is just the change in debt stock $L_t = D_t - D_{t-1} = \beta Y_t - \beta Y_{t-1}$. Using (2) we have

$$F_t = \beta[Y_t - (1+r)]Y_{t-1}. \tag{3}$$

Foreign fund in the form of equation (3) links current variables to past incomes and provides the first dynamic element in our model.

B. Consumption

On modeling consumption, recent empirical work has found little support for the life-cycle permanent incomes (LC-PI) theories (Marjorie Flavin, 1981; Hall and Mishkin, 1982;

Fumio Hayashi 1982). Instead there is growing evidence (see Hall, 1978; Jappelli and Pagano, 1989) that liquidity constraints significantly determine consumption behavior especially in developing countries.

Liquidity constraint reduces the opportunity to borrow in order to smooth consumption over time. In the extreme, consumers simply spend out of current income. We will indeed assume so and write the aggregate consumption function as

$$C_t = c_t Y_t . \tag{4}$$

$c \in [0, 1)$ is the marginal propensity to consume. From the World Data (1995), the fraction of current income spent on consumption has remained very stable in all LDCs. On average the value of *c* is 0.64 for South East Asian countries, 0.69 for South American countries, and 0.71 for African countries. For simplicity the time-subscript of *c* will be henceforth be suppressed. Their average values just mentioned will be used to calibrate for the convergence property of income in Section three below.

C. Investment

The credit cycle literature alluded to in the Introduction are concerned mainly with investment instead of consumption. Most businesses borrow in order to finance their investment projects. Empirical evidence shows that development in the financial infrastructure encourages domestic investment but external indebtedness discourages it. Carolyn Jenkins (1998), Joshua Greene and Delano Villanueva (1991), and Leonce Ndikumana (1999, 2000) show some of the ways in which liquidity constraints affect investment. For instance, how credits are granted and the amount of collateral required depend on habits and trust, which evolve with the social culture and the economic habits of a nation. Jappelli and Pagano (1989) find that nearly half (45%) of all housing loans in the US and the UK are extended to homebuyers 29 years or younger, but this occurs much more

rarely in Japan and Italy (17% and 21% respectively). They also show that such phenomena owe at least partly to liquidity constraints being less tight in the US and the UK. Further, liquidity constraints reflect market imperfections, which are so ingrained into supply and demand behavior that only democratization, strengthening of the rule of law, adoption of international accounting and banking practices are capable of relaxing liquidity constraints. Market imperfections abound in investment credit allocation in LDCs such as Indonesia, Thailand, the Philippines or China PRC. Those who have close connections (guan-xi in China and cronyism in Indonesia) with central government or bank officials invariably have easier access to money credits than others.

In short, investments are restricted by liquidity constraints, which in turn depend on two factors. First, the bigger is the existing indebtedness, the more difficult it will be to borrow to finance fresh investment projects. Second, for a given level of indebtedness, constraints will be tighter if a country's financial structure is less well developed or if market imperfections are more prevalent.

A linear equation of investment suffices to capture much of what we have just discussed:

$$I_t = \bar{I} - i\,r - \tilde{i}\,D_{t-1}, \tag{5}$$

where $\bar{I}$ is autonomous investment, i is interest-sensitivity of investment, and r_t is the lending rate for convenience taken to be the same as the rate on which debts are serviced. The parameter $\tilde{i}$ depicts the tightness of the constraint on investment given debt stock D_{t-1}. The time lag on D_{t-1} is introduced because of the usual lagged response of investment. A country with poorly developed financial market would have a *bigger* $\tilde{i}$. Since $\tilde{i}$ reflects habits, trust, and market imperfections, it is usually difficult for a government to change the size of $\tilde{i}$ (unlike β, which could be changed somewhat more easily by monetary and foreign exchange measures).

D. Long-Term Stationary Income

Upon substituting (3) to (5) into (1) and solving for Y_t we get

$$Y_t = AY_{t-1} + K\,, \tag{6}$$

where

$$A = \frac{\beta(1+r-\tilde{i})}{(1-c+\beta)}, \tag{7}$$

$$K = \frac{\bar{I} - ir + G}{(1-c+\beta)}. \tag{8}$$

The long-term stationary equilibrium income is given by the particular integral of the first-order difference equation (6).

$$Y_p = \frac{G + \bar{I} - ir}{(1-c) + \beta(\tilde{i} - r)}. \tag{9}$$

Two simple observations can be made from (6) and (7). First, $\frac{\partial Y_p}{\partial \beta} = \frac{(G + \bar{I} - ir)(r - \tilde{i})}{[(1-c) + \beta(\tilde{i} - r)]^2}$. Thus indebtedness raises Y_p if $r > \tilde{i}$, and conversely. The reason is not difficult to see. A rise in β puts a brake on investment, and the brake is harder the bigger is $\tilde{i}$. Hence a rise in β lowers income if $\tilde{i}$ is large. The appearance of *r* can be understood from examining equations (2) and (3). In the steady state both income and debt stock are constant. Although fresh loan is zero when income is constant, GDP must be big enough to service the debt. The higher is interest rate, the higher must be income for debt servicing to continue. It is simple to check that $\frac{dY_p}{d\tilde{i}} < 0$ and $\frac{\partial Y_p}{\partial r} > 0$ as we would expect.

E. Cycles and convergence to long-term steady state

The complementary function of the first-order difference equation (6) is given by

$$Y_c = \Phi(A)^t, \tag{10}$$

where Φ is an arbitrary constant having a scaling effect on income volatility. The sign and the magnitude of $A = \frac{\beta(1+r-\tilde{i})}{(1-c+\beta)}$ fundamentally govern volatility. It is simple to check that $\frac{\partial A}{\partial \beta} > 0$, $\frac{\partial A}{\partial r} > 0$, and $\frac{\partial A}{\partial \tilde{i}} < 0$. We conclude, in words, that indebtedness and higher interest rate tend to keep income off its long-term path for longer after an external shock strikes, but the structural constraint $\tilde{i}$ has the opposite effect. These qualitative results however cannot tell us the size and the sign of *A*, which are really what matters as far as convergence and business cycles are concerned. To investigate these rather more pressing questions we turn to the method of calibration.

3. Calibration

We mentioned in the introductory section above that LDC cycles have become more prevalent, and the rise in indebtedness shown in Table one may go some ways to explain such phenomena. The path of income would be convergent if the absolute value of *A* is less than unity, and divergent otherwise. The path would also be oscillatory if *A* is negative, but non-oscillatory otherwise. In this section we resolve these issues by calibrating the value of *A* for Asian, South American and African countries separately.

Annual data for most of the variables needed to calculate *A* in equation (10) are available for 1970 to 1993 from the World Data (1995). The main difficulty is the possible values of $\tilde{i}$. While the micro foundations of credit-constrained investment have been built recently by Bernanke and Gertler (1989, 1990), Greenwald and Stiglitz (1993) and Kiyotaki and Moore's (1997), empirical macro estimates of the constraint parameters do not exist. The World Data (1995) is also too aggregated for this purpose. I resort instead to some plausible values of $\tilde{i}$, in order to visualize the pattern of convergence and how it might have been changed by the increased indebtedness over the years.

For interest rates I use the official average interest rate reported for each country in the World Data. Figure one shows the fluctuation of interest rates for the three continents' LDCs. As mentioned earlier the fraction of consumption out of current income has been very stable for most countries, and we will use the average over the years, i.e. 0.64, 0.69 and 0.71 for South East Asia, South America, and Africa respectively. Combining these with average interest rate and debt-GDP ratio for each year, Figure two plots the value of A based on a hypothetical value of $\tilde{i} = 0.01$. This value has the interpretation that each additional \$100 of debt incurred in year t would so tighten the liquidity constraint that it reduces investment by one dollar in year $t+1$.

Figure three repeats the exercise assuming a tighter liquidity constraint $\tilde{i} = 0.1$, i.e. each additional \$100 of debt incurred in year t reduces investment in $t+1$ \$10.

Put Figures One, Two and Three about here

Several observations emerge clearly from Figures two and three. First, each curve shows a clear positive trend. Rising indebtedness has raised the value of A for all countries concerned. In other words, when an external shock pushes GDP below trend and brings about a recession, say, this country would remain in recession for much longer in 1990 than if the shock was received in 1970. By the same token, an external positive shock would keep the economy on a boom for longer in 1990 than in 1970. The prolonged recovery path increases the chances of subsequent shocks building on each other, and in that sense increases the volatility exacerbate their business cycles. Second, comparing Figure two with Figure three, it is interesting to see that tightening liquidity constraint (a larger $\tilde{i}$) *reduces* the value of A. The reason is that much of the cyclical movement in the system comes from the volatility of investment. If information and the market is imperfect, creditors will be more cautious in

financing investment and the liquidity constraint will be tight. This increases $\tilde{i}$, causing both a smaller long-term income (last section) and a smaller *A*. Thus GDP returns to its trend level *sooner* under a tighter liquidity constraint. This does not necessarily imply less fluctuation in income however. Again suppose the economy is hit by a contractionary shock. A quicker return to trend implies a more vigorous movement of GDP year-on-year than it would otherwise be the case.

3. Concluding remarks

In this paper we have focused exclusively on business cycles of less developed. Recent experience, especially from the 1980s and 1990s, has shown that LDC incomes are becoming more volatile. In addition, their external debt to GDP ratio has significantly increased over the same period. We tried to link the two phenomena, taking cues from the recent credit cycles literature. This theoretical literature would predict more volatility from the increased indebtedness. Our contribution is to describe the cyclical path of income in more detail.

As suggested by the literature we model indebtedness to affect mainly investment. More precisely it affects the liquidity constraint investors face. The more indebted one is, the more will be the demand on collaterals and the more difficult it is to borrow more to finance fresh investment. In Section two we also find that long-term steady state income may be reduced if such liquidity constraint is sufficiently tight. In Section three we the World Data to calibrate the convergence path implied by plausible values of liquidity constraints. In general we find LDCs in Asia, South America and Africa to have remained largely non-oscillatory and non-explosive. The rise in indebtedness slows the process of returning to long-term income after an external shock strikes. Tighter liquidity constraint has the opposite effect, leading to more vigorous movements of income year-on-year.

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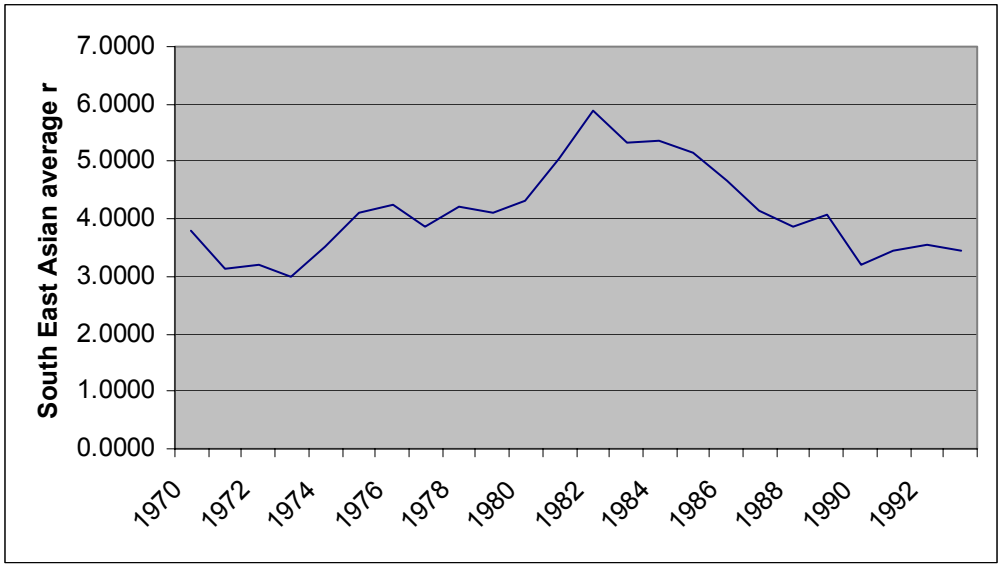
Table 1. External debt – GDP ratio (percents). Source: World Data 1995.

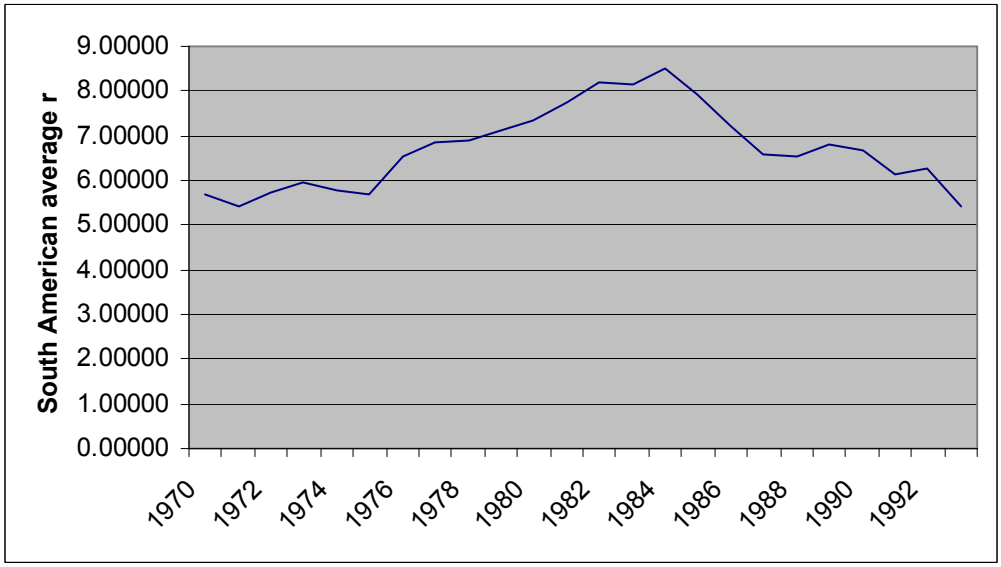
Asia	**1971**	**1981**	**1991**
Bangladesh	Not available (n.a.)	0.32	0.62
China	n.a.	0.03	0.17
India	0.06	0.11	0.26
Indonesia	0.13	0.39	0.73
Korea, Republic of	0.08	0.4	0.2
Malaysia	0.05	0.29	0.39
Nepal	n.a.	0.09	0.47
Philippines	0.12	0.53	0.79
Thailand	0.06	0.25	0.39
Asian average	**0.06**	**0.27**	**0.45**
South America			
Argentina	0.07	0.34	0.6
Brazil	0.06	0.34	0.4
Chile	0.21	0.85	0.66
Colombia	0.14	0.29	0.42
Costa Rica	0.13	0.84	0.77
Ecuador	0.09	0.75	0.99
El Salvador	0.06	0.26	0.45
Guatemala	0.04	0.17	0.35
Honduras	0.06	0.47	0.73
Mexico	0.1	0.55	0.72
Paraguay	0.08	0.32	0.47
Peru	0.2	0.35	0.95
Uruguay	0.07	0.28	0.8
Venezuela	0.05	0.71	0.62
Sth .Am. average	**0.1**	**0.47**	**0.64**
Africa			
Botswana	0.15	0.19	0.27
Burundi	0.02	0.2	0.73
Cameroon	0.04	0.26	0.63
Chad	0.07	0.36	0.57
Congo	0.17	0.87	1.93
Ghana	0.12	0.34	0.7
Guyana	0.4	1.94	5.8
Kenya	0.14	0.5	0.76
Nigeria	0.04	0.44	0.95
Oman	n.a.	0.16	0.29
Rwanda	n.a.	0.1	0.37
Sierra Leone	0.16	1.02	1.98
Somalia	0.14	1.2	2.4
Sudan	0.04	0.41	0.96
Swaziland	0.12	0.43	0.4
Togo	0.06	0.81	0.99
Trinidad and Tobago	0.03	0.18	0.52
Zaire	0.06	0.76	1.58
Zambia	0.46	1.58	3.09
Zimbabwe	0.07	0.26	0.52
African average	**0.11**	**0.6**	**1.27**

Table 2. Average Annual GDP growth. Source: World Data 1995.

Asia	**1964-1973**	**1974-1983**	**1984-1993**
Bangladesh	0.02	0.04	0.04
China	0.09	0.08	0.10
Hong Kong	0.09	0.09	0.06
India	0.03	0.05	0.05
Indonesia	0.06	0.07	0.06
Korea, Republic of	0.11	0.08	0.09
Malaysia	0.07	0.07	0.06
Nepal	0.02	0.03	0.05
Philippines	0.05	0.04	0.02
Singapore	0.11	0.08	0.07
Thailand	0.08	0.07	0.09
Asian average	**0.07**	**0.06**	**0.06**
South America			
Argentina	0.04	0.01	0.02
Brazil	0.09	0.04	0.03
Chile	0.03	0.02	0.07
Colombia	0.06	0.04	0.04
Costa Rica	0.07	0.03	0.04
Ecuador	n.a.	0.05	0.03
El Salvador	0.05	0.00	0.03
Guatemala	0.06	0.03	0.03
Honduras	0.05	0.04	0.04
Mexico	0.07	0.05	0.02
Paraguay	0.05	0.07	0.03
Peru	0.05	0.01	0.00
Uruguay	0.01	0.01	0.04
Venezuela	0.04	0.01	0.03
Sth. Am. Average	**0.05**	**0.03**	**0.03**
Africa			
Burundi	0.06	0.04	-0.07
Cameroon	0.03	0.09	-0.12
Congo	0.06	0.09	-0.10
Ghana	0.03	-0.01	-0.06
Guyana	0.04	-0.02	-0.09
Kenya	0.08	0.04	-0.07
Nigeria	0.05	0.00	-0.06
Rwanda	0.05	0.06	-0.09
Sierra Leone	0.05	0.02	-0.09
South Africa	0.05	0.02	-0.10
Sudan	0.02	0.05	-0.19
Togo	0.06	0.02	-0.10
Trinidad and Tobago	0.03	0.04	-0.12
Zaire	0.04	-0.01	-0.21
Zambia	0.04	0.00	-0.09
Zimbabwe	0.08	0.02	-0.07
African average	**0.05**	**0.03**	**-0.10**

Figure One: interest rates. Source: World Data (1995)





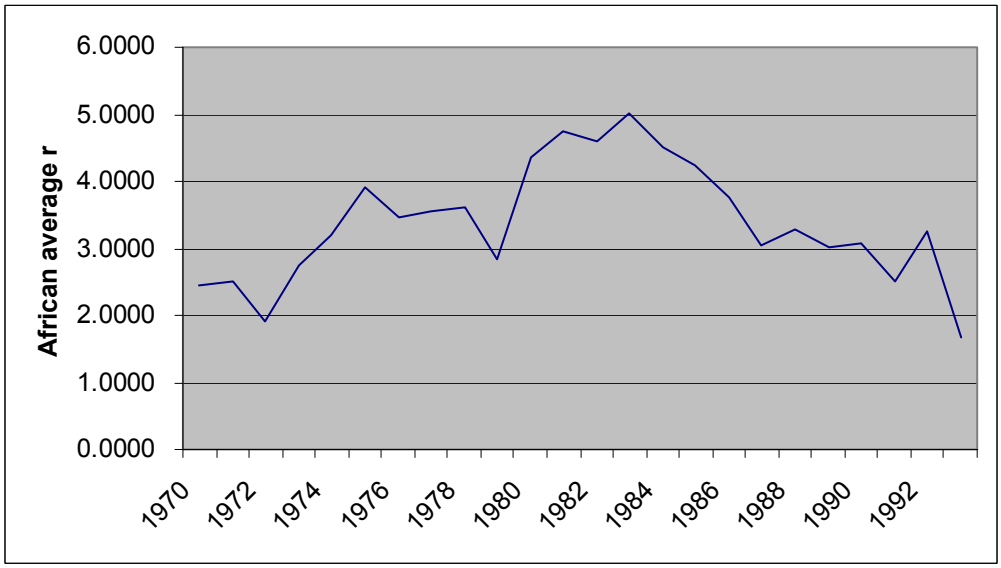
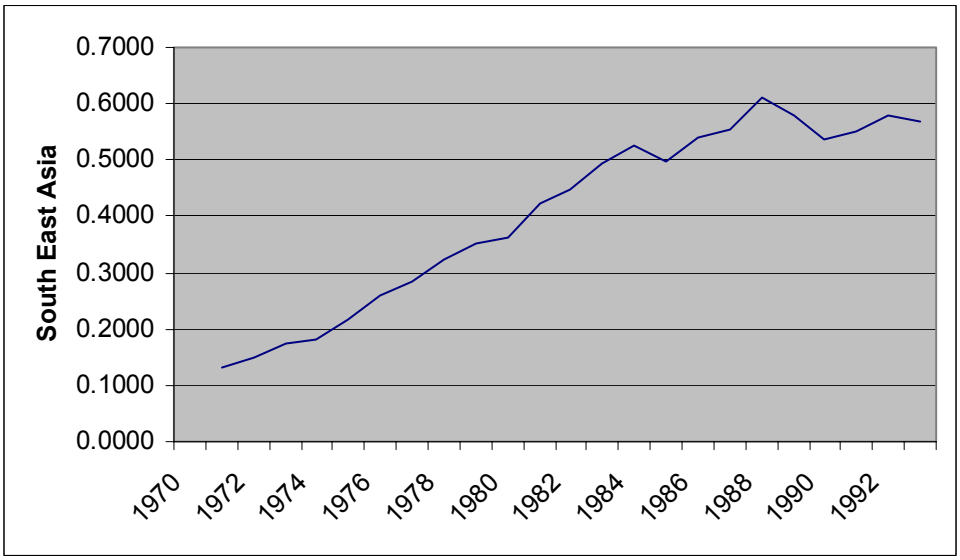
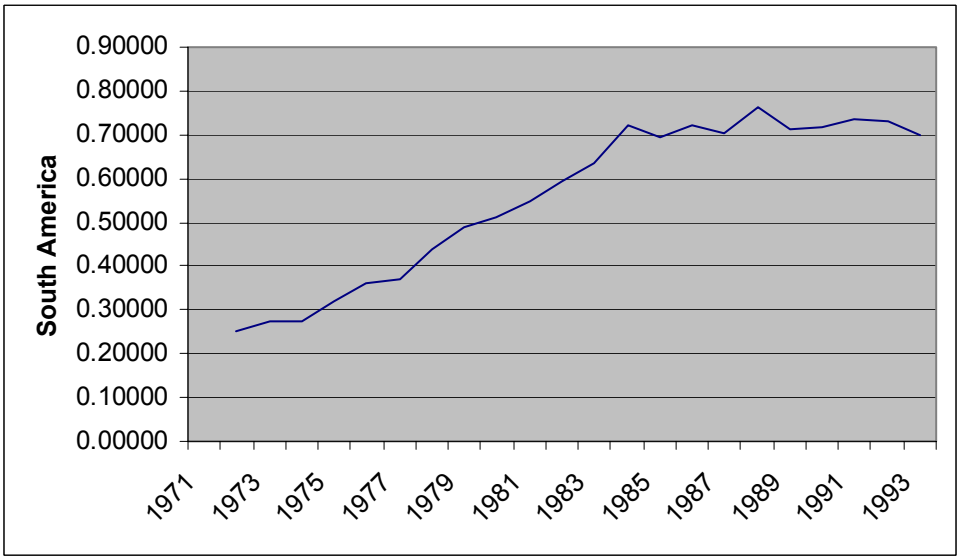


Figure Two: the value of A governing business cycles
(relatively loose liquidity constraint $\tilde{i} = 0.01$)





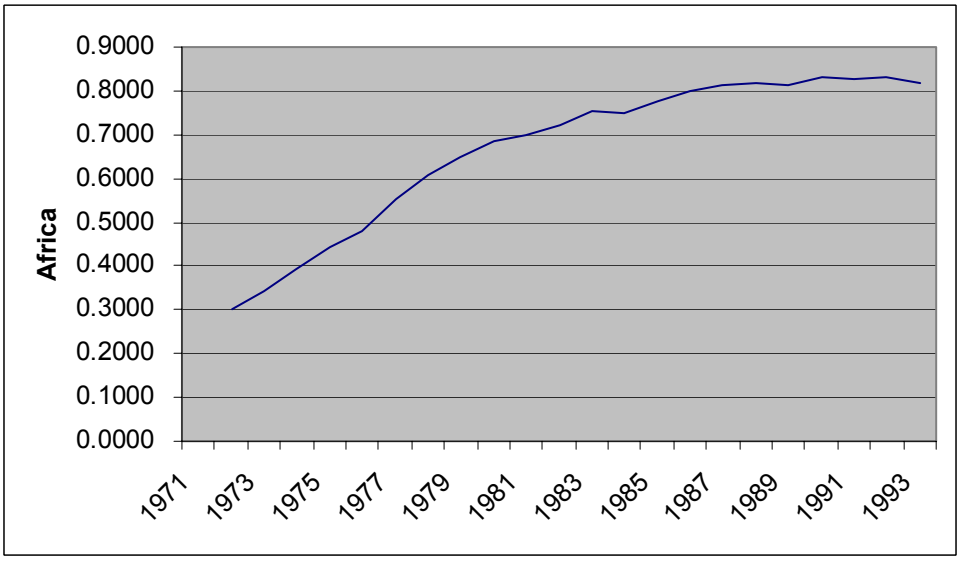
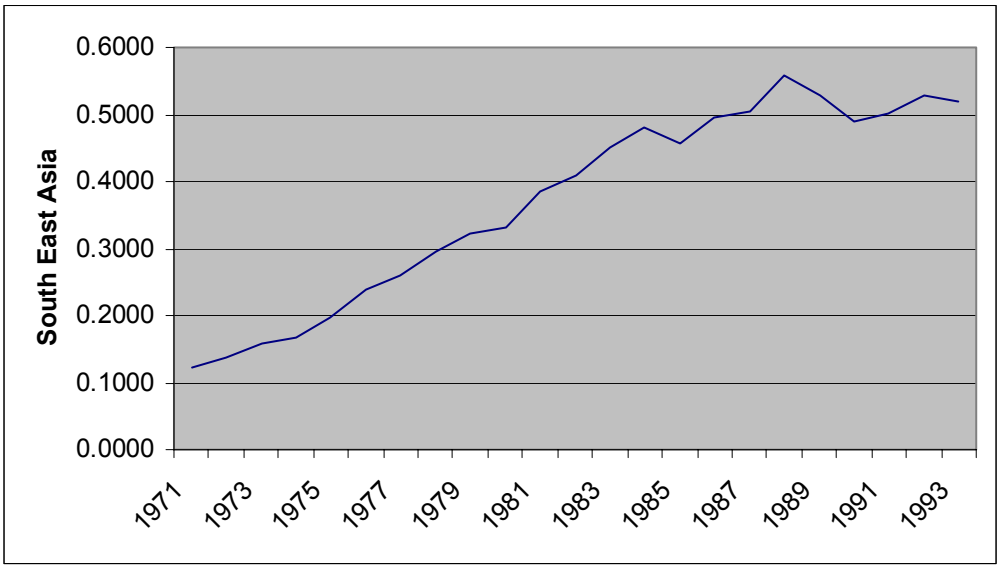
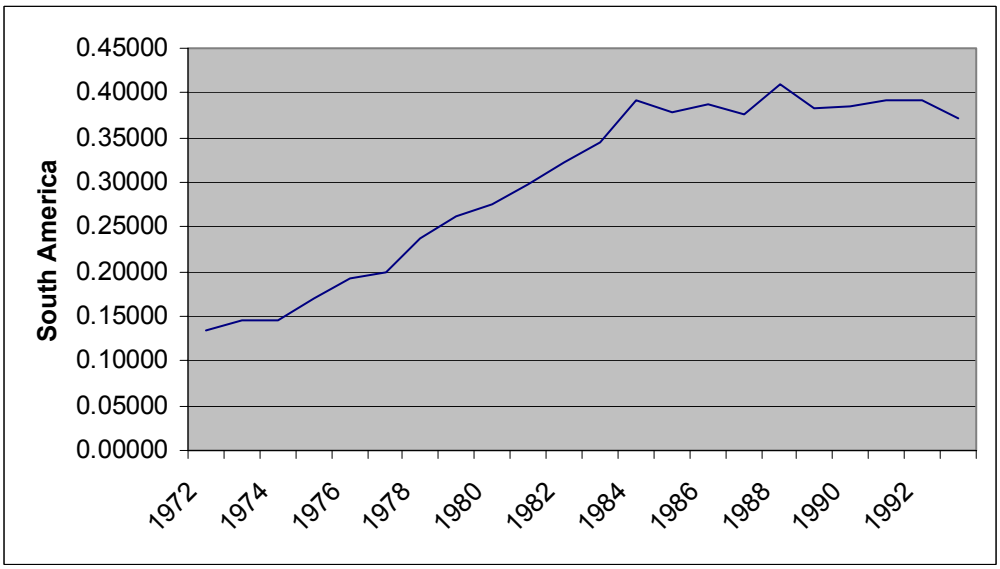
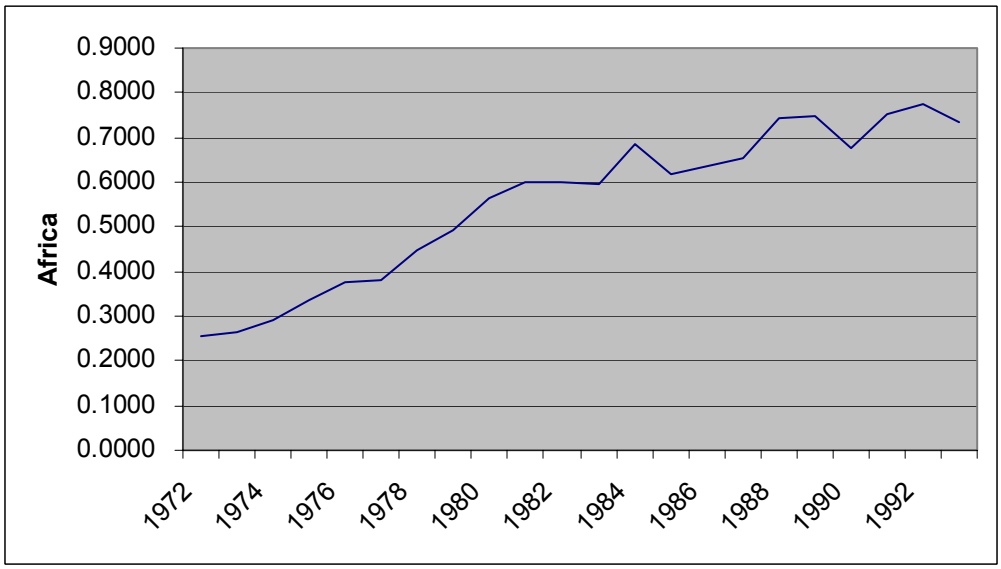


Figure Three: the value of A governing business cycles
(relatively tight liquidity constraint $\tilde{i} = 0.1$)







Endnotes

[1] Singapore's economy shrank by 7% in the fourth quarter of 1998, and by 12% in the fourth quarter of 2001.
[2] This third factor do not apply to two of the fastest growing LDCs in Asia, namely Hong Kong and Singapore, as they are both net creditors rather than debtors in terms of international finance and investment.