

Monetary and Exchange Rate Policy for Small Developing Countries
: A Case Study of Nepal”

BY

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DEDICATION

I thank my family, especially my father and sister, who has given me the love, understanding and emotional support to pursue this degree and see it to completion, as well as my wife, Ladina, who had to live with me during the most difficult final year of this program.

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Abstract of Dissertation

**Monetary and Exchange Rate Policy for Small Developing
Countries : A Case Study of Nepal**

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Nepal is a small economy which pegs its exchange rate against the currency of its giant neighbor, India. How much has this peg constrained Nepal's monetary policy and whether the peg makes sense are the basic questions which this dissertation address.

Nepal's exchange rate policy is examined in terms of the criteria of the theory of Optimum Currency Areas (OCA). That is, the optimal choice of an exchange rate regime is determined from a cost benefit analysis of certain country characteristics. For example, the criteria of patterns of shocks suggests that regions who face symmetric disturbances may find it less costly to give up monetary autonomy, through a fixed exchange rate, since they would face similar policy prescriptions. The OCA criteria of patterns of shocks is operationalized, through a Vector Auto Regressive analysis, and suggests that the Nepalese and Indian economies do not face symmetric shocks. A cointegration analysis likewise suggests that the Nepalese and Indian monetary base do not share a long term

relationship. While these evidences point to a flexible exchange rate as being less costly, the open and contiguous border between both countries, no restrictions on labor and capital mobility and the rigid exchange rate between both countries for almost a forty year period point in the opposite direction. The evidence is thus mixed on what Nepal's exchange rate policy should be.

Nepal's monetary policy is examined through a monetary reaction function which suggests little relationship between the Nepalese and Indian monetary base; this conclusion is consistent with the VAR and cointegration analysis mentioned above. While these evidences point to the Nepalese and Indian monetary policy being independent of each other, this conclusion is hard to reconcile with an open and contiguous border, no capital controls as well as the large size of the Indian economy vis-à-vis the Nepalese economy. Further examination suggests that the agricultural economies of Nepal and India are influenced by the vicissitudes of the weather which add some noise into the analysis of monetary policy. When their respective economic structures are explicitly considered, the conditional Nepalese and Indian monetary base show a long term relationship. This description of monetary policy is consistent with both the policy of the Nepalese monetary authority as well as with onsite discussions at the Nepal Rastra Bank. In other words, this finding may be generalized to say that comparing monetary policy via simple monetary variables may give misleading results.

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CHAPTER 1 : Introduction

There is an ongoing debate about both the choice of a country's exchange rate and the efficacy of domestic monetary policy whose conclusion varies with the critical assumptions (i.e. such as price flexibility etc..). This suggests some answers may arise from an empirical examination of real world data. Since detail and focus may be lacking in an analysis of many nations, a case study is put forward which may result in some broader insights. The choice is tempered by the fact that industrialized countries have been examined quite thoroughly relative to developing countries, thus it may be beneficial to focus on the latter area even though some data problems may arise. In this vein, a country study is put forward examining Nepal's exchange rate and monetary policy.

Nepal is an interesting country to examine due, in addition to her developing nature, to her unique geographical situation. That is, the mountainous topography of the Himalayan range to the north (which borders China) compared to a strip of plain land bordering India to the South, West and East has compelled Nepal to seek access to the sea and international markets via India only. In other words, Nepal can be aptly described as being "India-locked." The geographical situation has affected Nepalese policy with India and is best represented by the 1950 Trade and Transit treaty which provides for unrestricted labor and capital movements between both countries.

Nepal's peg to India is examined in terms of the criteria of the theory of Optimum Currency Areas (OCA). OCA analysis emphasizes the "sterility" of the

exchange rate debate by putting forward a systematic approach to answering exchange rate regime determination where the costs and benefits may vary systematically depending upon a number of country characteristics (Tower and Willett, 1976). For example, the criteria of patterns of shocks suggests that regions who face symmetric disturbances may find it less costly to give up monetary autonomy, through a fixed exchange rate, since they would face similar policy prescriptions etc. In other words, an objective of this dissertation is to determine if Nepal's peg to India makes sense.

Also, the choice of an exchange rate regime influences the efficacy of monetary policy. For example in the Mundell-Fleming world of fixed exchange rate and perfect capital mobility, monetary policy for a small country would be impotent. That is, Nepal's rigid peg to her giant southern neighbor has existed for almost a forty year period. Given the relative size of the Indian economy and the open and contiguous border with no restrictions on labor and capital mobility this suggests that Indian monetary policy has a significant effect on Nepalese monetary policy. Another objective of this dissertation is to examine if the exchange rate regime has constrained Nepalese monetary policy and thus how similar it is to Indian monetary policy.

This dissertation proceeds as follows : the next chapter examines Nepal's exchange rate choice, the third chapter utilizes the OCA criteria of patterns of shocks, the fourth chapter examines Nepalese and Indian monetary policy using a cointegration analysis, the fifth chapter examines Nepalese monetary policy while the last chapter summarizes the empirical results.

CHAPTER 2 : Nepal's Exchange Rate Choice : An exploration using the analytical tools of Optimum Currency Areas

2.1 Introduction

There is an ongoing debate about the choice of a country's exchange rate whose

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However

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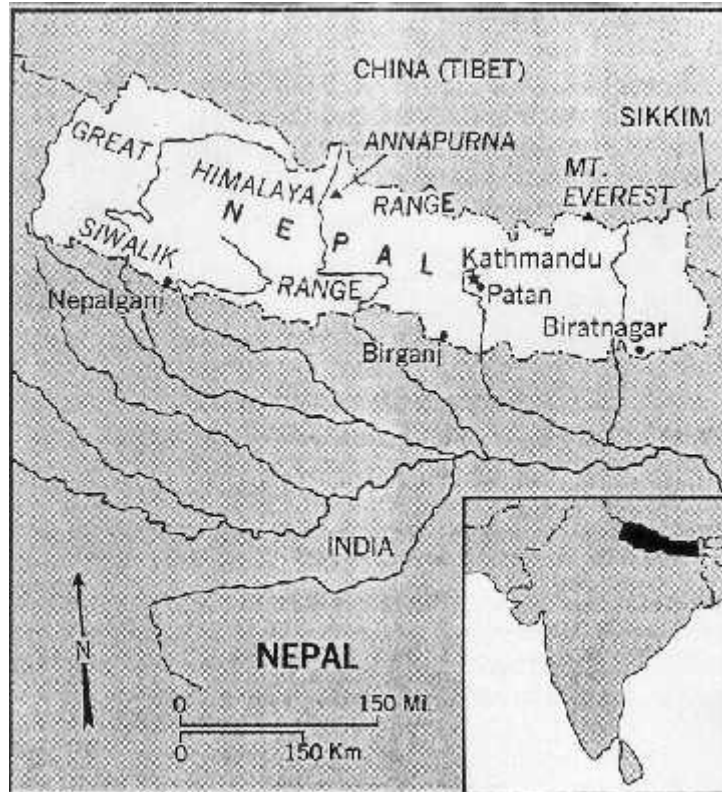
a sterile

approach where the costs and benefits may vary systematically depending upon a

number of country characteristics (Tower and Willett, 1976). One avenue of

empirical OCA research is an analysis of a broad range of countries. While some

general conclusions may arise, details and focus will be lacking. The other logical



¹ This dissertation presupposes an awareness of this debate although some of the key factors may be flexibility of prices and how expectations are formed; for nice discussion see Isard (1995).

extreme is a country study which, while being specific to that situation, may result in some broader insights. Also for the latter case it should be noted that industrialized countries have been examined quite thoroughly relative to developing countries, thus it may be beneficial to focus on the latter area even though some data problems may arise. In this vein, a case study is put forward examining various aspects of Nepal's choice of an exchange rate regime using the analytical tools of OCA. Also, and just as important, this paper lays the foundation and context for future papers in this area.

As stated, Nepal is a developing nation and is made more of an interesting choice by her unique geographical situation. The mountainous topography of the Himalayan range to the north (which borders China) compared to a strip of plain land bordering India to the South, West and East has compelled Nepal to seek access to the sea and international markets via India only and can be seen in the map above.² Nepalese policy with India is best represented by the 1950 Trade and Transit treaty which :

“...provides for unrestricted labor and capital movements through a provision for equal treatment of each others citizens and the periodic treaties on trade and transit.” Thapa (1992, 32)

Nepal's relationship with India is nicely summarized by Khatiwada (1994, 1-2) as :

² For example, Clad (1990) found, in one 1983 survey, transit costs consuming 8% of Nepal's GDP.

“...the country is totally India-locked and her dependence on the Indian economy for a smooth supply of essential goods into the country as well as the export of primary commodities has become a persistent feature inspite of stringent measures designed to insulate the economy from the dominance of the Indian economy.”

In other words India directly and indirectly influences the Nepalese economy and suggests that some evaluation should be done both with the present exchange rate peg to India and for the suitability of the present choice of India as the pegging country. In addition, Nepal's exchange rate performance to India is compared with some examples of successful rigid exchange rate experiences namely the Hong Kong currency board as well as the (rigid) pegged experience of Austria to Germany.

Nepal is examined from the perspective of three OCA criteria and found to have low labor mobility, a closed and diversified economy with high agricultural contribution relative to Hong Kong, USA, Austria and Germany.³ Also, India is examined and found to be a suitable candidate for Nepal to peg to on the criteria of labor mobility, openness, diversification, the real exchange rate and currency substitution for the period observed, which is in line with the relative stability of Nepal and India's pegged exchange rate for almost a forty year period and the performance relative to the experiences of HK-USA and Austria-Germany. In other words, Nepal's current exchange rate has not done so badly.

The structure of this chapter is as follows. The next section gives an overview of some OCA criteria. The third section gives a snapshot of Nepal and some select countries. The fourth section assesses Nepal's choice of an exchange

rate through the perspective of criteria. The fifth section examines the performance of Nepal's present exchange rate regime and assesses the choice of India as a pegging country. The last section gives some remarks and concludes.

2.2 Overview of Some OCA Criteria

Optimal Currency Area (OCA) theory originated from the seminal paper of Mundell (1961) where he defined the appropriate geographical domain of a currency area as a "domain within which exchange rates are fixed" against each other although flexible vis-à-vis the outside world so that the exchange rate would maintain external balance (Balance of Payments (BOP) equilibrium,) without causing inflation or unemployment. The main purpose of this section is to give a short review of OCA theory as background for exchange rate analysis in the rest of this chapter as well as to other chapters of this Ph.D. dissertation.

There are three main criteria for OCA which single out a crucial economic characteristic and "indicates where the lines should be drawn." One characteristic is labor mobility which was first introduced by Mundell (1961), as a way to moderate the pressure to alter real factor prices in response to various shocks. For example, a country with low labor mobility, *ceteris paribus*, would find that most adjustment to bring about external equilibrium comes through changes in the domestic economy. In this case, a substitute to a change in the domestic economy would be a movement in the exchange rate to bring about external balance.

³ An overview of OCA criteria is put forward in the next section.

A second characteristic is openness (McKinnon, 1963) where more open economies find the expenditure-switching instrument becoming less potent since exchange rate changes would be offset by price changes. In other words the author argued that the degree of exchange rate illusion that characterizes an economy is inversely related to its degree of openness. Additionally, in Keynesian models the marginal propensity to import is larger the smaller is the economy. This decreases the cost of adjustment from the domestic economy to a BOP disequilibrium.

A third characteristic is product diversification. Kenen (1969) argued that a highly diversified economy would be a better candidate for a fixed exchange rate. In other words “..diversity in exports, protecting the economy from external shocks, will surely help to stabilize capital formation, easing the burden that has to borne by internal policies.”

Of course, there are many other criteria’s which are discussed in Tower and Willett (1976).⁴ Since the many criteria are difficult to measure unambiguously, Vaubel (1976) proposed the use of the “smallness” of Real Exchange Rate (RER) variability to indicate possible candidates for a currency area. One factor which affects the RER is inflation differentials where small differential suggest little variability in the RER.

Recently there has been a resurgence in OCA brought about by the movement towards EMU and for the FSU countries with new criteria added as a

⁴ For example, one characteristic hinted at by Mundell (1961) when the author referred to currencies as being an “expression of national sovereignty” and that changes would necessitate “profound” political changes. Likewise, Minz (1970) argued that “the major, and perhaps only, real condition for institution [of monetary integration] is the political will to integrate on the part of the prospective members.” In other words, the survivability of a currency area may well boil down

result of the New Classical revolution as well as to allow for the formation of expectations and credibility.⁵ For example, one recently advanced criteria, currency substitution, the relative ease in changing the composition of currency holding, makes monetary policy less effective and flexible exchange rates unstable, by upsetting the stability of the domestic demand for money. This suggests less cost to a fixed exchange rate where currency substitution is high. Another criteria, which is dealt with explicitly in the third chapter, deals with the patterns of shocks where regions who do not face symmetric shocks may be forced to have conflicting policy prescription.⁶ In general, for regions who face symmetric shocks the greater is the case for fixed exchange rates and regions which face asymmetric shocks the greater the argument for flexible exchange rates. This analysis has been tested for industrialized and newly industrialized nations (for example Bayoumi (1992) put forward a VAR analysis and applied in Bayoumi and Eichengreen (1994)).

Although there have been some changes in the criteria the core analysis has remained the same. That is, the major benefit of joining a currency union is the enhancement of the usefulness of money (Mundell (1961), McKinnon (1963) and Tower and Willett (1976)). The use of single currency would eliminate the risk of exchange rate fluctuations and thus would be a great asset to trade and investment since it was felt that exchange rate fluctuations hampered them.

to the consideration each member pays to each other and thus to successfully determine jointly macro economic and political decisions (Cohen, 1993).

⁵ See Tavlas (1993) and Wihlborg and Willett (1991) for some recent reviews and De Grauwe (1993) for Europe.

Likewise with economies of scale from the move to monetary integration shall lead to a decrease in both the volatility of prices and the ability of speculators to influence prices and thus to disrupt the conduct of monetary policy (Mundell, 1961). On the other hand there are two major costs to joining a currency area. First, by joining a currency area, a country would lose the exchange rate as a policy tool. Secondly by joining a currency area, the country would lose her monetary independence. In the limiting case of the Mundell-Fleming model with fixed exchange rates and perfect capital mobility there shall be no role for monetary policy (Tower and Willett, 1976). OCA analysis examines the cost and benefit of exchange rate choice.

In sum⁷ the greatest value of OCA is thinking of the approach, rather than a specific theory, to determining the optimal exchange rate regime (Tower and Willett, 1976) which brings “sterility” to optimum exchange rate policy. In this vein the following sections examine Nepal’s exchange rate policy in terms of the criteria of the theory of OCA.

2.3 Some Selected Indicators

Before continuing some indicators are put forward to give a flavor of Nepal’s absolute as well as relative development with respect to five countries. The first,

⁶ This analysis is similar to that put forward by Poole (1970) where the choice of instruments in uncertainty, unless the (monetary) authority know the type of shocks in the domestic economy, leads to varied effects depending on the nature of the shocks.

⁷ For a different perspective see Cesarano (1997) who notes that “..the current approach to optimum currency areas is defective on both theoretical and empirical grounds.” Likewise Melitz (1995, 492) states that “..following...usual procedure of defining a general welfare function to be compared, if not maximized, under different, well specified conditions” may suggest some solutions.

India, is important due to both the pegged and geographical relationship with Nepal. The remaining two pairs of Hong Kong-USA and Austria-Germany are examples of rigid exchange rates whose experience shall be used in the next section to compare Nepal-India exchange rate performance.⁸ The indicators are :⁹

Table 2.3.1 : Selected Indicators

	Nepal	India	HK	USA	Austria	Germany
GDP (bill.)	25 ^a	1401 ^a	152 ^a	7575 ^a	226.1 ^b	2353.2 ^b
Population (mill.)	21.92 ^c	935.74 ^c	6.5 ^d	263.03 ^c	8.53 ^c	81.64 ^c
Per/Capita (\$)	180 ^a	355 ^a	24,455 ^a	26,620 ^a	17,500 ^d	16,500 ^d
Area (thous. Sq. mile)	56.3 ^d	1,222.2 ^d	0.4 ^d	3,563.2 ^d	32.4 ^d	137.8 ^d
Literacy	27.5% ^a	52.1% ^a	92.2% ^a	95.5% ^a	100% ^a	100% ^a

Source : ^a = *Asia Week Magazine*

^b = *Main Economic Indicators* of OECD

^c = *International Financial Statistics (IFS)* of the International Monetary Fund (IMF)

^d = *World Almanac and Book of Facts 1997* (WABF 1997 from now on)

Three relations are seen from the chart above. First, that Nepal, HK and Austria are over shadowed in Gross Domestic Product (GDP), Population and Area by

⁸ The exchange rate experience of HK-USA and Austria-Germany are discussed in other chapters of this dissertation. For a balanced over view of currency boards see Williamson (1995).

⁹ While the data have been gathered from a wide variety of sources for different years, they are pair wise consistent to allow relative comparisons. For example, Per Capita for Nepal, India, Hong Kong and USA are taken from *Asia Week* magazine however, for Austria and Germany they are taken from WABF 1997. While a rough comparison of the levels can be made, the important conclusion is that the pairs of Nepal-India, HK-USA and Austria-Germany have similar Per Capita.

India, USA and Germany respectively; more the case for HK and Nepal but less so for Austria. Second that Nepal, HK and Austria are similar to India, USA and Germany respectively in Per Capital and Literacy. Finally, that the pair of Nepal-India are quite different from the pairs of HK-USA and Austria-Germany in Per Capita and Literacy suggesting the level of economic development where Nepal and India are developing countries while HK, USA, Austria and Germany are industrialized nations. This statement is relevant since they indicate the subsistence level of the Nepalese and Indian economies which limit the ability for labor to be mobile (Bajracharya and Maskay (1997) generalizable to India). Since the three pairs of countries reflect “successful” experiences of pegging countries it suggests that the pegger has to be small relative to the peggee.

2.4 What is Nepal’s choice of an exchange rate regime?

Nepal’s choice for an exchange rate regime is assessed here from the view point of three OCA criteria.¹⁰ While there are many criteria, as shown in the previous section, this analysis is limited to the three main criteria of labor mobility, diversity and openness.¹¹ The criteria of labor mobility, introduced by Mundell (1961), shows the ability of a country to moderate the pressure to alter real factor prices in response to various shocks. There are a number of approaches to measure labor mobility. For example De Grauwe and Vanhaverbeke (1991) measure labor mobility as the flow of migrants, i.e. the sum of immigrant and

¹⁰ For this chapter, analysis is limited to the traditional OCA criteria although explicitly extended in the third chapter to patterns of shocks.

¹¹ The criteria of stability of RER as well as currency substitution are also discussed.

emigrant flows, from one region to the other expressed as a percent of the population of the former region. Likewise Eichengreen (1990) put forward a measure of the incentive for migration by considering the coefficient of variation for per capita income from different regions, although indicating that this method does not differentiate shocks from responses. Recently Carrington, Detragiache and Vishwanath (1996) look at the incentive, or disincentive, for migration by viewing the endogenous moving costs which decrease with the number of migrants already settled in the region.

Unfortunately for Nepal significant quantitative analysis is impossible due to data constraints. Rather some data of inter-district and inter-regional life time migration trends,¹² from the 1995 Population Monograph of Nepal published by the Central Bureau of Statistics, are put forward for a general flavor of Nepalese labor mobility :¹³

Table 2.4.1 : Life-time Migration (% Native born)

Year	No. of Districts	inter-district	inter-regional
1961	55	4.65	---
1971	75	---	4.52
1981	75	8.60	7.02
1991	75	9.60	7.8

¹² Ratio Estimate, inter-district migration 1991 = (inter-reg. 1991)(Inter-dist. 1981) / (inter-reg. 1981).

¹³ The data from four census years of 1961, 1971, 1981 and 1991 face many data problems; see Maskay (1997b) for similar problems in obtaining agricultural data in Nepal.

An increasing trend is observed in Nepalese labor mobility over time, higher at the district (a region is comprised of a number of districts) rather than regional levels, although precise measures relative to other countries are limited due to the difficulty of obtaining data.

A qualitative analysis is put forward similar to Eichengreen (1991) in analyzing the historical experience of labor mobility for Negroes in the Southern States of USA. As Eichengreen (1991) points out, labor market segregation retarded labor mobility especially if distinctive cultural and social factors are present, even though legal restriction on labor mobility had been removed. This observation is supplemented by Carrington, Detragiache and Vishwanath (1996) who find the cost of migration is endogenous to the number of people already present at the destination. This implies that labor mobility is proportional to the ethnic and cultural homogeneity of a region where a highly homogenous region may reflect a higher potential for labor mobility. Consider that Nepal, although relatively small in area, has a heterogeneous ethnic composition made up of “many tribes...of Indian, Tibetan and Central Asian migrants” with “many other languages” (from World Almanac and Book of Facts 1997 (WABF 1997)). The distinct ethnic groups may be the result of inaccessibility of regions due to extreme geography and to poor transportation infrastructure. Consider the topography of Nepal which is :

“Mountainous and hilly, although with physical diversity. Three broad physiographic areas run laterally-lowland Tarai Region in south; central lower mountains and hills constituting hill Region; high Himalayas, with 8,796-meters-high Mount Everest and other peaks forming Mountain

Region in north.” (Area Handbook Series : Nepal and Bhutan country studies, xxxiv).

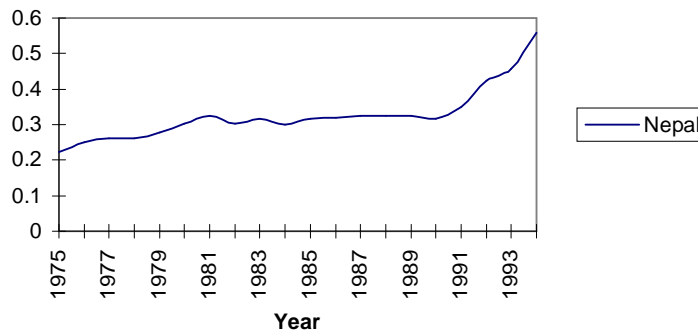
This suggests another, certainly naïve, comparison of labor mobility by viewing the geography and access to transportation facilities as a symbolic vehicle for labor mobility where good transportation facilities negate the effect of geography. Take an example of traveling from the capital of Kathmandu to Birgunj, a large industrial city bordering India, which takes around five hours (if there are no landslides and other such obstacles) by bus although it being only seventy miles “as the crow flies.” Likewise the limited number of roads make it the norm for someone to walk days from their village to get to a bus stop. In other words, many distinct cultures and languages suggest limited potential for labor mobility as well as diverse geography and poor transport infrastructure suggest difficulty of labor mobility in Nepal thus it would be safe to say that labor mobility is low in Nepal.

On the other hand consider the other countries, excluding India, have a fairly homogenous population and a developed transportation infrastructure. That is, in HK, Austria and Germany the ethnic composition of 98% Chinese, 99% German and 95% German respectively (from WABF 1997) suggest the cost of moving, from this narrow perspective, is low. Likewise, for USA, while a more heterogeneous population is present, they have a similar social setting whose cultural diversity can be characterized as that of “melting pot.” Likewise all the countries, except for India, have very good transportation facilities supported by anecdotal and personal evidence. Of course, in both cases India is excluded since she is also composed of many ethnic groups along with a poor transport

infrastructure suggesting that labor mobility may be along similar lines to Nepal. Thus, it is suggestive from this perspective that Nepal has low labor mobility in both absolute and relative terms when compared to the other four countries except for India.

McKinnon (1963) introduced the criteria of openness when he pointed out that open economies tend to prefer fixed exchange rate systems. “Openness”¹⁴ is represented over time for Nepal in the graph below :

Figure 2.4.1 Total Trade as a percent of GDP



“Eye-balling” the graph suggests two trends with a break in 1990. The fifteen year period prior to 1990 had relatively flat growth with a total increase of only 32% for the whole period. For the five years after 1990 there was a 77% increase of the level of “openness” from 32% in 1990 to 56% in 1994. This suggests some weak evidence of a structural break around 1990 which is in line with the 1990 political regime shift. Looking at the chart below, for 1993, shows Nepal in relation to other countries :

Table 2.4.2 : Openness

	Percentage
Nepal	45.7%
India	22.1%
Hong Kong	high ¹⁵
USA	24.0%
Austria	73.4%
Germany	43.7%

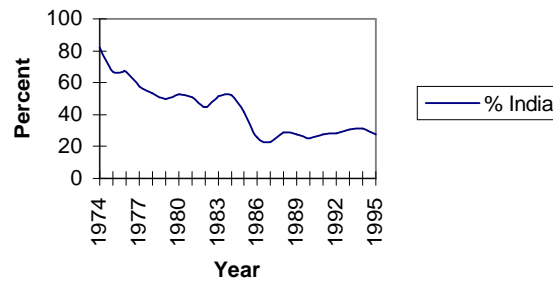
In 1993 Nepal appears to be the least open of the three small countries. This has to be taken with a grain of salt since Indian trade is underestimated and Nepal's "openness" accelerated to 56% in 1994. While this is more in line with the small county statistics it is still less than Austria and HK. Thus, it would be safe to say that Nepal, except for the last couple of years, has been a relatively closed economy more in line with large countries like Germany than with small countries like Austria.

Likewise, looking at the trade share of her large southern neighbor to Nepal's total trade shows that India is becoming a less important trading partner to Nepal as seen in the strongly declining graph taken from Table 6.1 of *Economic Survey 1996/97 (ES)* of HMG and is presented below :

¹⁴ Where "openness" is defined as the ratio of total volume of trade to nominal GDP; the *IFS* codes are : (f90ca +f98ca)/f99ba.

¹⁵ As stated by Williamson (1990, p. 33) "Hong Kong, despite its relatively large economic size, may well be the most open economy in the world, with a ratio of exports to GDP of more than 100 percent." When considering total trade this figure will be much higher.

Figure 2.4.2 : India as % of Nepal's Total Volume of Trade

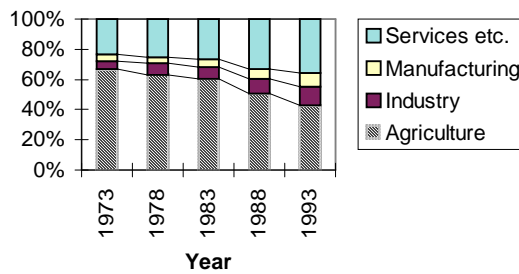


In 1974 Indian trade accounted for over 80% of Nepal's total trade. Presently Nepal has diversified to other partners although India still takes a significant chunk of Nepalese Total Trade Volume of trade at over 20%. In other words, Nepal is diversifying trade partners. This suggests that a flexible exchange rate may be less costly vis-à-vis a pegged exchange rate with India.

Kenen (1969) argued that the diversity of an economy makes the choice of a fixed exchange rate more desirable. Three levels of diversification are explored, the first, deals with the diversification of the whole economy¹⁶ shown in five year intervals, from 1973 and ending at 1993, taken from *World Tables 1995*:

¹⁶ GDP at factor cost, which is the sum of the value added in the various sectors of agriculture (i.e. agricultural and livestock production and services, fishing, hunting, logging, and forestry), industry (i.e. mining and quarrying; manufacturing; construction; and electricity, gas, and water) and the service sector (i.e. all service activities, that is, transport, storage, and communications; wholesale and retail trade; banking, insurance, and real estate; ownership of dwellings; public administration and defense; and other services to include any statistical discrepancy in the origin of resources.

Figure 2.4.3 Relative share of Nepalese GDP at factor cost



This graph shows a dynamic economy since Nepal’s share of agriculture dropped almost a third in twenty years. While the rough breakdown of the economy is similar to India, it is different from those of the other countries :

Table 2.4.3 : Breakdown of economy

	Nep-93	Ind-93	HK-87	USA-87	Aus.-92	Ger.-92
Service etc.	36%	41%	70.4%	69.0%	61.5%	60.5%
Manufacturing	9%	17%	21.7%	19.2%	25.6%	30.0%
Industry	12%	10%	7.5%	9.8%	10.2%	8.2%
Agriculture	43%	31%	0.4%	2.0%	2.7%	1.3%

At first glance it appears that HK, USA, Austria and Germany are concentrated in services since they each have at least 60% contribution to GDP. However, the composition of service is quite broad, as shown in the last footnote, and implies a greater level of diversity. The importance of agriculture for Nepal and India suggest something about the level of development of the country since the relative importance of agriculture declines in the development process replaced in importance by the manufacturing and service sectors (numerous example such as

Bajracharya and Maskay (1997)). For example, agriculture contributed less than 3% of GDP at factor cost for HK, USA, Austria and Germany¹⁷ while agriculture contributed over 30% for Nepal and India (for Nepal it was over 40%). Although the three pairs of countries each have relatively similar economic structures, it is important to note that the pair of Nepal-India is significantly different from the pairs of HK-USA and Austria-Germany where the large contribution of agriculture makes the economies of Nepal and India hostage to the vicissitudes of the weather and thus may force the economies of Nepal and India to follow erratic paths.¹⁸ Consider a statement from the 1989 *World Currency Yearbook*, for Nepal, that :

“..fiscal 1986/87 (mid-July) real GDP advanced only 2.2%...pulled down by an 8% drop in farm output due to adverse weather conditions. Agriculture, the mainstay of the economy, accounts for nearly 60% of GDP and 75% of export earnings, while employing directly or indirectly 91% of the labor force. Industrial production jumped 28% but did not impact on the economy as it only accounts for 10% of GDP.”

Thus output growth for Nepal and India may be erratic due to the unpredictable swings in the weather.¹⁹ A second level of diversification focuses on the composition of exports and imports. Data for 1991 and 1993 are taken from the 1994 *International Trade Statistic Yearbook* for Nepal where a flavor of export

¹⁷ While the breakdown for HK and USA only occurs in 1987, it does not invalidate this generalization.

¹⁸ The effects of the weather are explicitly explored in Bajracharya and Maskay (1997) for Nepal which found the weather consistently significant in a positive direction and robust to various specifications of output and generalizable to India.

¹⁹ Empirical results chapter three suggest that Nepal and India do not face symmetric shocks.

and import concentration is given by viewing the top three sub-Standard International Trading Category (SITC) :

Table 2.4.4 : Export/Import Breakdown by SITC Group

SITC	Nepal-Commodity : Exp.	1991	SITC	Nepal-Commodity : Exp.	1993
65	Textile Yarn, Fabrics, etc.	53.9%	65	Textile Yarn, Fabrics, etc.	56.8%
84	Clothing and Accessories	19.0%	84	Clothing and Accessories	24.0%
22	Oil Seeds, Oleaginous Frt	4.4%	54	Veg etc. Frsh, Prsvd	6.4%
SITC	Nepal-Commodity : Imp.	1991	SITC	Nepal-Commodity : Imp.	1993
72	Genrl Industrl Machy NES	8.8%	26	Textile Fibers and waste	8.3%
77	Elect. Machinery NES etc.	6.4%	78	Road Vehicles	5.6%
26	Textile Fibers and waste	5.6%	65	Textile Yarn, Fabrics etc.	4.5%

Nepal appears to have become more concentrated over the two years where the top three categories increased by almost 10% of total exports and the top two SITC sub-categories for 1993 accounted for over 80% of total Nepalese exports. On the other hand, Nepal appears to have a diversified import base, and this trend appears to be reinforced over time. Consider the top export and import SITC sub-categories of the six countries for 1993 :

Table 2.4.5 : Comparison of Export/Import Breakdown by SITC Group

	Export : SITC-Name	Percent	Import : SITC-Name	Percent
Nepal	65 : Textile Yarn, Fabrics	56.8%	26 : Textile Fibers and waste	8.3%
India	66 : Non Metal Minerals	17.6%	33 : Petroleum and other p.	25.0%
Hong Kong	84 : clothing and acc.	15.5%	77 : electrical machinry	10.9%

USA	77 : electrical mach.	9.3%	78 : road vehicles	14.1%
Austria	77 : electrical mach.	7.2%	78 : road vehicles	11.6%
Germany	78 : road vehicles	15.4%	78 : road vehicles	8.9%

The SITC sub-category of exports in 1993 for the five countries was less than 20% of total exports while for Nepal it was over half of total exports. On the other hand, Nepal's import SITC sub-category for 1993 appears to be as diversified as the other five countries. This suggests that Nepal is not diversified in exports but is diversified in imports relative to the five countries. A third type of diversification looks at the trade share of regional import and export partners. This flavor is captured, without losing the whole picture, by choosing the five countries who have the largest share of imports and exports for the year 1990 and 1995 obtained from the *1996 Direction of Trade Statistic Yearbook* given below :

Table 2.4.6 : Nepalese Export Partners

1990	Mill. \$	Percent	1995	Mill. \$	Percent
Ind. Countries	187	86.6%	Ind. Countries	295	90.0%
Germany	81	37.5%	Germany	135	41.0%
U.S.A	46	21.0%	U.S.A	99	30.0%
Switzerland	13	6.0%	Switzerland	11	3.3%
UK	12	5.6%	Austria	9	2.7%
Dev. Countries	29	13.4%	Dev. Countries	34	10.0%
India	14	6.5%	India	25	7.6%
<u>TOTAL</u>	<u>216</u>	<u>100.0%</u>	<u>TOTAL</u>	<u>329</u>	<u>100.0%</u>

Nepal is not diversified in export partners since the U.S. and Germany together accounted for 58.5% of her total in 1995. There appears to be an upward trend where the total share of USA and Germany jumps to 71% in 1995. Consider Nepalese import partners :

Table 2.4.7 : Nepalese Import Partners

1990	Mill. \$	Percent	1995	Mill. \$	Percent
Ind. Countries	213	47.1%	Ind. Countries	210	27.9%
Japan	65	14.3%	Japan	67	8.9%
France	32	7.1%	Dev. Countries	544	72.1%
Dev. Countries	129	52.9%	Thailand	142	18.8%
Singapore	76	16.8%	India	118	15.6%
China, P. R.	46	10.2%	Singapore	93	12.3%
India	43	9.5%	Hong Kong	82	10.9%
<u>TOTAL</u>	<u>452</u>	<u>100.0%</u>	<u>TOTAL</u>	<u>754</u>	<u>100.0%</u>

There appears to be some concentration of Nepalese import partners as the percentage increased from 57.9% to 66.5% for the top five countries. The export experience for the trade partners of the other five countries are shown in the chart below :

Table 2.4.8 : Comparison of Export Partners

	Top	Percent	Second	Percent
Nepal	Germany	41%	USA	30%
India	USA	18.1%	Japan	7.3%

Hong Kong	USA	21.8%	Japan	6.1%
USA	Canada	21.6%	Japan	11.0%
Austria	Germany	32.2%	Italy	9.4%
Germany	France	11.6%	UK	8.0%

Also, the import experience for trade partners of the five countries are given below :

Table 2.4.9 : Comparison of Import Partners

	Top	Percent	Second	Percent
Nepal	Thailand	18.8%	India	15.6%
India	USA	10.3%	Germany	8.4%
Hong Kong	Japan	14.4%	USA	7.5%
USA	Canada	19.2%	Japan	16.5%
Austria	Germany	44.8%	Italy	9.0%
Germany	France	10.7%	Italy	8.4%

A similar pattern is seen for Nepal where she is the most concentrated of all the countries sampled for export partners. On the other hand she seems to be as diversified in import partners relative to the five other countries. This suggests that Nepal is relatively diversified in imports but relatively not diversified in exports.

While the above analysis suggest that Nepal is relatively open compared to India, USA and Germany and relatively closed compared to HK and Austria as well as non-diversified in exports two important caveats are necessary to give a

broader view concerning the volume and composition of trade. First, that a large portion of imports are re-exported or smuggled to India due to differential import controls (Upreti, 1991). Thus :

“...imported goods were in high demand in India, and there was an incentive to import luxury goods into Nepal for smuggling into India, which was not difficult due to the open border and free mobility of residents between the two countries.” (Sharma, 1997, 552).

Likewise much of the concentration of exports were in two industries which :

“...seems unhealthy because the garment and carpet industries, which are directed by quotas available under the General System of Preferences. Most garment industries are established as a joint venture between Nepalese and Indian parties with a view to exploit Nepal’s GSP quotas, which are largely utilized.” (Sharma, 1997, 552).

Taking these facts into consideration may suggest that Nepal is closed²⁰ relative to Austria and HK and more in line to India, USA and Germany although as diversified in imports relative to the five other countries.

Likewise consider the flexibility of wage and prices. If wages and prices are flexible then there is a smaller cost for macroeconomic adjustment suggesting that the cost of a rigid exchange rate, would be lower. Since quantitative data is not available one avenue may be via anecdotal evidence which suggests low levels of flexibility for wages and prices exist in Nepal. For example, there are more sales in USA than in Nepal suggesting that the range of USA price movements are quite high; likewise, Nepalese workers tend to have life time jobs in contrast to

²⁰ There is a caveat in the next section about the misleading data for India.

the relatively fluid labor markets in USA. This suggests lesser variability in Nepal for both prices in the former and wages for the later and implies that a fixed exchange rate would be more costly to maintain.

Thus two OCA criteria suggest a more flexible exchange rate for Nepal since there is both limited labor mobility and a closed economy relative to HK and Austria although Nepal appears to be diversified in the import of both product and trading partners. More importantly, Nepal is a developing country with a significant agricultural base and this suggests that a large part of the economy is affected by the vicissitude of the weather. All this information point to a flexible exchange rate as less costly than having domestic macroeconomic adjustment.

2.5 Nepal's pegged exchange rate with India : some discussion

The preceding section suggests some flexibility in the Nepalese exchange rate may be less costly that a rigid exchange rate, however, the exchange rate with India has been rigid for almost forty year with no movement since 1994. This is surprising given the analysis for Nepal from the previous section especially where both Nepal and India have large contributions to GDP from agriculture. This section examines and evaluates the exchange rate regime between Nepal and India.

2.5a. Nepal's exchange rate history

Prior to continuing, some general historical background is given. The India currency had been legal tender in Nepal for some time especially prior to the establishment of the Nepal Rastra Bank in 1953 where :

“..Nepalese foreign exchange reserved used to be held in India. In exchange, Nepal used to receive Indian currency which, despite its inconvertibility with other currencies, was fully acceptable in Nepal. Though Nepal had her own currency, the Indian Rupee was in wide circulation and...people had more confidence in the Indian currency. This is vindicated by the fact that in 1957, 72.9 percent of total deposits and 81.1 percent of total credits in Nepal Bank Limited (the only commercial bank of the country at the time) were denominated in Indian currency.” (Demetriades and Luitel, 1996, p. 357)

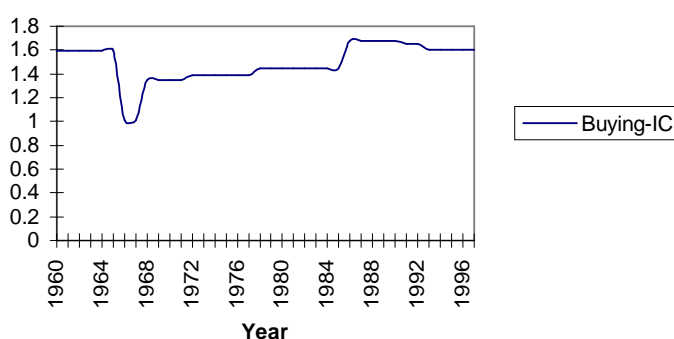
This suggests that some monetary integration had taken place and is consistent with the relative stability of the Nepalese-Indian exchange rate and anecdotal as well as personal experience of the wide acceptability of the Indian currency in Nepal today. This brings forth the criteria of currency substitution where individuals in Nepal or India may change their holding of currency since both currencies are very close substitutes. In the Nepal-India pegged exchange rate regime the low levels of currency substitution evident, from anecdotal and personal observations, suggest that the monetary and fiscal policy for both countries are similar²¹ and this is true up to 1994. The reverse would not be true, where monetary and fiscal policy diverge, making the peg unstable. In other words, this criteria suggest that it is less costly for a peg in the current situation.

Presently Nepal's exchange rate which is pegged (fixed) to the IC and floated against other major currencies (see Khatiwada (1994), World Currency

²¹ Shown in the sixth chapters of this Ph.D. dissertation.

Yearbook (various issues) and others).²² Also, no capital controls exist between Nepal and India,²³ guaranteed by the 1950 Treaty of Trade and Transit suggesting the difficulty of an independent Nepalese monetary policy. The performance of the exchange rate can be seen by plotting the official exchange rates from the *Quarterly Economic Bulletin 1996/97 (QEB)* of the NRB in the graph below :

Figure 2.5a.1 : Official Buying Rate of the Indian Rupee to the Nepalese Rupee



“Eyeballing” the graph suggests that the rate has had relatively little fluctuation except for the years of 1966 and 1967, since they reflected the IC devaluation during the turmoil of Bretton Woods, along with the year 1986 where there was a realignment to correct a reserve imbalance (Maskay, 1997a). Some summary statistics for the period 1960 to 1997, along with statistics when the years 1966 and 1967 are excluded, are presented below :

Table 2.5a.1 : Buying rate of IC for NC

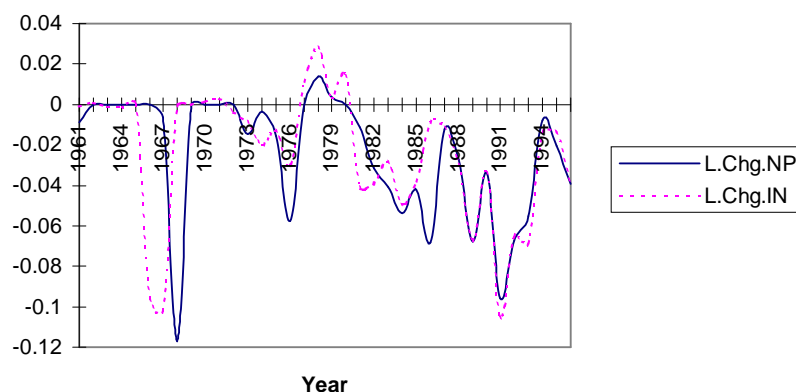
²² For detailed description see World Currency Yearbook; for chronological changes in the Exchange rate from the *QEB* of the NRB please see Appendix 2.1.

²³ While there have been some recent attempt to regulate capital flow they are not effective due to the contiguous and open border.

	1960-1997	1960-1965, 1968-1997
Average	1.490789	1.560714
Standard Deviation	0.161808	0.117812

In both cases the official exchange rate has maintained a fairly narrow band with 10.8% variation for the whole period decreasing to 7.5% when 1967 and 1968 are excluded although there have been periods of zero fluctuations. This close relation can be seen in their exchange rate against the USD taken from the IFS tapes of the IMF :²⁴

Figure 2.5a.2 : Log Changes in the Nepalese and Indian Exchange Rate to the USD



This close relation of the Nepalese and Indian exchange rates to the USD are consistent with their highly significant coefficient of correlation (0.4633) for the whole period.²⁵ Thus, Nepal's exchange rate to India appears relatively stable for almost forty years.

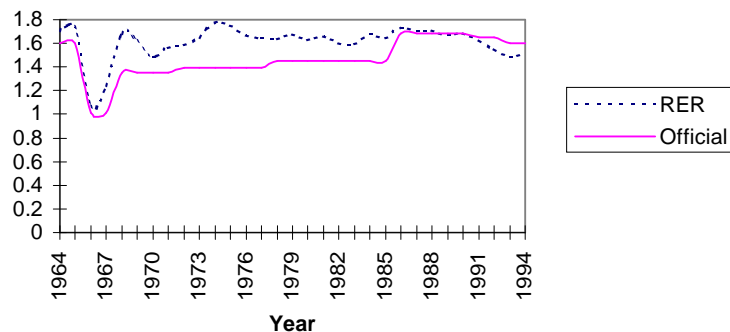
²⁴ Taken from *IFS* (code *faha*).

²⁵ A more significant relationship is seen after 1973, the end of Bretton Woods, with a coefficient of correlation of 0.83668; see McCloskey and Ziliak (1996) for recent description differentiating statistical and economic significance.

2.5b Some tests evaluating Nepal's peg to India

However, the question arises, how well has the exchange rate reflected the economic fundamentals? One approach may be to view the real exchange rate (RER)²⁶ against the official exchange rate below :

Figure 2.5b.1 : RER and Official Exchange Rate of the India Rupee to the Nepalese Rupee



“Eye-balling” the graph suggests two things. First, that there was little variability from the RER.²⁷ This suggests that there were no BOP disequilibrium and thus no speculative attacks on the official exchange rate. Second, prior to 1990 the official exchange rate for the NC to IC was undervalued against the RER making imports of Indian good cheaper however after 1990 it appears to be slightly over valued. There was an attempt to correct this in 1986 where the exchange rate was revalued (Maskay, 1997a) and the gap of the official exchange rate was closed with the

²⁶ While there are a number of ways to calculate the real exchange rate, this paper uses the common formula from Pilbeam (1992, 11-12) for RER such that $Q = S \frac{P^*}{P}$ where Q is the RER, S is the nominal domestic exchange rate taken from the *QEB*, P^* and P are the foreign and domestic prices respectively taken as Consumer Price Index (CPI) base 1990 form the *IFS* code f64b. Data constraints force the utilization of CPI although this is also used by the IMF.

RER. It is important to remember that the data force the RER and the official exchange rate to intersect at 1990 although this does not detract from the conclusion of the analysis.

The stability of the RER for Nepal vis-à-vis India suggest that it would not be so costly for Nepal to have a fixed exchange rate with India (Vaubel, 1976). This suggests another approach may be to look at inflation differentials of the three pair of countries for the thirty year period of 1965 - 1994 :

Table 2.5b.1 : Inflation Differentials for 1965 - 1994

	Nepal-India	HK-USA	Austria-Germany
average	+0.45%	+2.23%	+0.84%
std	5.21%	3.71%	1.21%

Likewise, it may be beneficial to consider a shorter span that indicate the general commencement of the currency board in Hong Kong and the rigid exchange rate in Austria; thus the period is shortened to 1983 - 1994 :

Table 2.5b.2 : Inflation Differentials for 1983 - 1994

	Nepal-India	HK-USA	Austria-Germany
average	+1.47%	+4.30%	+0.53%
std	3.87%	2.32%	1.20%

²⁷ This is in line with results from the fourth chapter which suggest that Indian and Nepalese price levels are cointegrated.

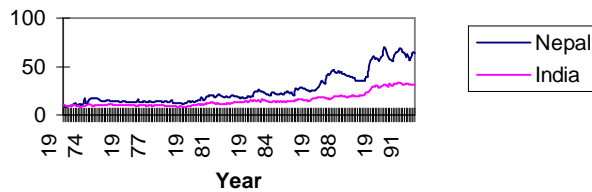
Looking at the above three pairs does not suggest that any single statistics stands out, however, three relationships can be seen. First, that the average differential for the smaller country vis-à-vis the larger country has a positive inflation differential for all three cases. While the relation may not be statistically significant they may indicate the level of trade to non-traded good prices. Second, that the average inflation differential for Nepal-India and Austria-Germany is quite low in contrast for HK-USA. This latter relationship is paradoxical given that a currency board exists between both countries but it can be explained by the relatively rapid increases in HK productivity vis-à-vis for USA (Williamson, 1995, 8)²⁸ and suggests a different story would come using PPI.²⁹ Secondly that the standard deviation for Nepal-India is the largest especially for the thirty year period of 1965 - 1994 where it was 5.21%. One possible explanation for this variation may be due to the agricultural nature of both economies which cause large price fluctuations. Also, as economic development occurs and the portion of agriculture diminishes, this may lead to less variable inflation rate differentials and this is consistent with the shorter period of 1983 - 1994.

Another perspective is to look at the Black Market Rate (BMR) of the NC and IC against the USD from various issues of the World Currency Yearbook.

²⁸ Two other explanations are given by Williamson (1995, 9) which involve the initial undervalued exchange rate and arbitrage while the second deals with the trading partners of HK where the constant rate against the USD led to effective devaluation against trading partners leading to arbitrage pressures.

²⁹ Not used due to data constraints.

**Figure 2.5b.2 : Black Market Rate of
NC and IC to USD**



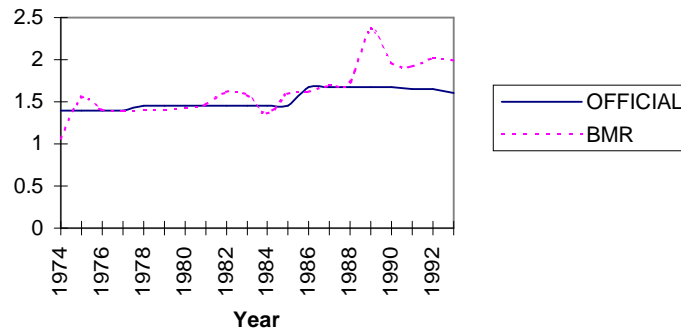
“Eyeballing” the monthly raw data suggests a break, corresponding to the collapse of Bretton Woods, causing a depreciation of the Nepalese BMR and maintaining the gap with the Indian currency. A divergent trend is also observed after 1989, corresponding to the commencement of the transport impasse with India, until the end of the data series. Nepal’s average and standard deviation of the BMR is both larger and more variable than India’s reflecting an undeveloped and thinner market with a positive coefficient of correlation significant at the 1% level of confidence.

A final perspective is to derive Nepal and India’s exchange rate by looking at the ratio of their BMR’s to the USD and compare it to the official exchange rate

.³⁰

³⁰ At present three way arbitrage opportunities exist where the NC/USD is slightly undervalued at 56.8 versus IC/USD at 57.32 given a fixed exchange rate of 1.6 (*Kathmandu Post*, 1st February 1997).

Figure 2.5b.3 : Derived BMR to Official Exchange Rate



The diverges at the tail end of the sample period is made more prominent in this graph reflected in the transit impasse with India starting in 1989. Prior to the transit impasse there was no discount or premium for the NC (the average ratio was 1.004) however for 1989 there was a 40% discount on the NC (that is the derived BMR was 2.36 NC for IC while the official was 1.68 NC for IC; a large difference) although stabilizing from 1990 till the end of the sample with a discount on the derived rate of about 20%. While no significant effect can be seen by “eye-balling”³¹ Nepalese Price level, as well as from both standard Chow tests and recursive residuals for log changes of the CPI, the official exchange rate for NC vis-à-vis IC has moved from being undervalued to being slightly overvalued against RER.

In other words, Nepal’s exchange rate performance with India has not been so bad. Her official exchange rate has been rigid for almost a forty year period, although the RER suggests a slight misalignment with India which had been corrected for by the sharp devaluation of the Nepalese currency in 1986, and give

³¹ The graph for the Nepalese and India price levels are shown in the third chapter.

some support by the derived BMR. Nepal and India's exchange rate relationship compares favorable with HK-USA and Austria-Germany although more variable inflation differential for Nepal-India may be attributed to the agricultural nature of both economies and thus does not detract much from this observation. Also, the pegged exchange rate regime has survived for almost forty years, versus the existence of the currency board in HK-USA for only fifteen years and about twenty years for the peg of Austria-Germany, giving indirect support to its durability.³² Finally, the derived BMR gives some weak evidence of a break in 1990 coinciding with the political regime shift.

2.5c Assessing the suitability of pegging to India

There appear to have been conflicting evidence from the analysis of Nepal's exchange rate regime. That is, the third section suggests a relatively fixed exchange rate would be more costly for Nepal given the low level of labor mobility, the relatively low level of openness and the large contribution of the agricultural sector relative to HK, USA, Austria and Germany. On the other hand the previous sub-section find that the peg with India has not done so badly relative to HK-USA and Austria-Germany given almost a forty year period. This sub-section further explores this paradox by once again using the analytical tools of OCA to assess the suitability of a peg with India.

On one hand there is an open and contiguous border with India as well as no controls as labor mobility, from the 1950 Treaty of Trade and Friendship,

³² To put this in perspective consider Bretton Woods which lasted about twenty five years and that

suggesting a high level of labor mobility. There is some evidence of migration towards the southern regions (Terai) of Nepal (Population Monograph of Nepal (1995) and Statistical Pocket Book of Nepal (1996)). As Niraula (1995, p. 139) states the “Terai absorbed more than 90 percent of the total migrants in 1971, it declined to 78 percent in 1981 and increased again to 83 percent in 1991.” When this information is taken with anecdotal evidence as well as from observation of Birganj,³³ a border town, suggests that mobility in the Terai with India is quite large. Consider the observation by Dr. Gunanidhi Sharma, a leading Nepali economist :

“The Terai of Nepal is perfectly integrated with India counterpart but it is little attached with Hill economy of Nepal. It causes economic dualism and geographical fragmentation.”

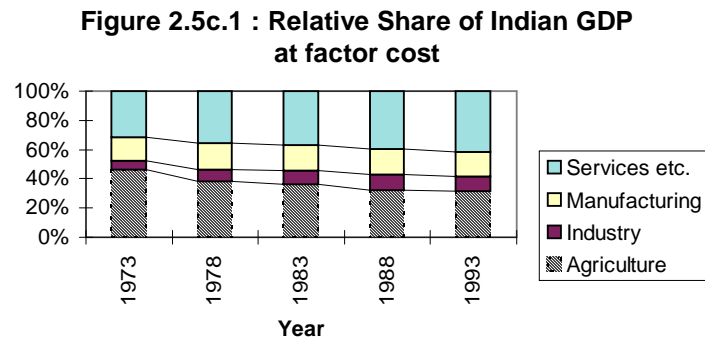
This first part of the above statement is consistent with the low cost of labor mobility due on one hand to a similar society, culture and religion as well as to the flat (plains) geography in the southern portion of Nepal and can be seen by the large number of skilled and unskilled Indian workers in the Terai. The second part of the statement is consistent with the analysis of the previous section suggesting that labor mobility in Nepal as a whole is quite low. Labor mobility appears to follow the topography of the land, given poor transport infrastructure, where extreme geography diminishes labor mobility. In other words, labor mobility occurs in the Terai of Nepal, reflected in a homogenous population and culture

of the Exchange Rate Mechanism for EMS countries which lasted much shorter.

³³ Appendix 2.2 at the back discusses observations of Birgunj, a border town.

and language in the relatively flat border regions while there is low labor mobility in the hilly and mountainous regions of Nepal, reflected in a heterogeneous population with distinct cultures and traditions. In other words, the southern portion of Nepal and the bordering portion of India experience labor mobility although it may be somewhat diminished when looking at the whole of Nepal. Likewise, labor mobility for Nepal-India does not compare well to HK-USA and Austria-Germany. While HK-USA do not share contiguous borders there is anecdotal evidence of high factor mobility. On the other hand low labor mobility of Nepal-India relative to HK-USA and Austria-Germany can be attributed to the poor transport facility which is reflective of the low level of economic development. Thus it would be safe to say that there is a higher level of labor mobility between Nepal and India than within Nepal however the labor mobility of Nepal-India compares poorly to HK-USA and Austria-Germany in large part to lower level of economic development.

Also the Indian economy seems to be as diversified as the Nepalese economy in 1993 :



This is comparable to Nepal, as seen from Figure 2.4.3, and their relative relations compare favorable to the relative relationships seen in the pairs of HK-USA and Austria-Germany. That is, in these two pairs a large portion of the economy was devoted to services (greater than 60% for both pairs) as with Nepal-India where a large portion of the economy is devoted to Agriculture. This later portion suggest that both economies are affected by the vicissitudes of the weather and has been explicitly tested in the third chapter of this dissertation whose preliminary results suggest that both countries do not face symmetrical shocks. Likewise, India's export³⁴ composition is much more diversified than that of Nepal since the largest recipient in 1991 has less than of half of Nepal's major export recipient. India's imports on the other hand are more concentrated with "Petroleum and Other Products" consistently over 25% for both 1991 and 1993 although India's import and export partners appear to be more diversified than that of Nepal. Of course, taking into account the caveats discussed in the third section suggests similar diversification in trade and trade patterns, thus a similar pattern of shocks, which compares favorably to HK-USA and Austria-Germany. In other words at the economy level Nepal-India are similarly diversified, where a large portion of GDP (at factor prices) is contributed by agriculture, and there are no significant differences in both composition of SITC sub-categories as well as trading partners when taking the previous caveats into account which compares favorably relative to HK-USA and Austria-Germany.

³⁴ The following information is presented upon request.

The graph of Indian Trade share of Nepalese trade volume suggests that Nepal has been diversifying away from India although at present the trade share statistic falls between those of HK-USA and Germany-Austria. That is, the chart below shows some relative numbers for 1993 :

Table 2.5c.1 : Trade Share for Nepal, HK and Austria

Pair	Percentage³⁵
Nepal-India³⁶	23.2%
HK-USA	15.5%
Austria-Germany	49.8%

These statistics suggest that the level of Nepal-India's "openness" is respectable since it falls between that of HK-USA and Austria-Germany. However, this has to be taken in context of the open and contiguous border as well as the developing nature of the economy. Anecdotal evidence suggests that only 20% of trade with India is recorded implying that over half of the total volume of trade occurs with India. In other words India may be more important to Nepal than Germany is to Austria in terms of trade share suggesting a duality exists for Nepal where she is partly closed to the world however relatively open to India (as seen in the large

³⁵ Derived from *1996 Direction of Trade Statistics* for all three pairs.

³⁶ A discrepancy should be noted between figures reported above and those of *Economic Survey 1996/97* which state that India's portion for total trade was 25.1% and 27.5% for 1990 and 1995 respectively. However, from above we see that it is roughly 16% and 23.2% only; a discrepancy of about 10% for the former and 4% for the later. One explanation may be that the government statistics, which are given in the official currency, may capture additional interaction between both countries however this does not account for the magnitude of difference of the former but

imbalance of % of total trade). Also the upward trend towards openness since 1990 may suggest some consideration towards a more flexible exchange rate since there is diversification in trade share away from India although the present level of “openness,” when considering hidden trade, would be on the level of Austria-Germany and much over that of HK-USA.

Another perspective may be to look at the convergence criteria for the European Monetary Union (EMU) set up in the Maastricht Treaty. That is :

“First, the inflation rate of any country joining the single currency must be within 1.5 percentage points of the average of the three lowest rates in Europe. Second, the long-term interest rate in a country joining the single currency must not exceed by more than 2 percentage points the interest rates observed in the three countries with the lowest inflation rates, on the grounds that high long-term rates reflect high expected inflation. Third, the exchange rate must have remained within the normal bands of the existing EMMS “without severe tensions” for at least two years...[fourth] the ratios of debt/GDP (60 percent) and [fifth] deficit/GDP (3 percent) ratios.” (Wyplosz, 1997, p. 8)

Two of the above have already been discussed with favorable results; that is Nepalese inflation differential is on average only 0.45% more than Indian inflation, although for 1994 there was a 1.8% inflation differential (the criteria is for 1.5%), and there has been no change in the nominal exchange rate between both countries for the last three years (two years is required). Also, favorable results are seen for both the Bank Rate³⁷ for August 1995 with a one percent differential (2% is required) and for the debt/GDP ratio which was 12.2%³⁸ and

understandable for the later. A more likely explanation may be that for 1990 there was a regime shift thus the discrepancy can be attributed to noise.

³⁷ Taken from *IFS* (code f60).

³⁸ Taken from *ES* (Table 8.11/Table 1.1).

50.9%³⁹ in 1993 for Nepal and India respectively (60% is required). Lastly, the government deficit in 1994 as a proportion to GDP⁴⁰ for Nepal and India is 3.7% and 6.5% respectively. This later statistic is problematic since they do not meet the 3% criteria although the movement of both statistics from 1964 to 1994 is highly significant at the 1% level. This last criteria, as with the 1.8% interest differential for 1994, may not be so important considering that Nepal and India are developing countries with a significant agricultural base and both collection of revenue as well as possible stabilization may take either a monetary policy as well as a fiscal policy form. Thus, Nepal and India fail the strong form for EMU, however, this does not significantly detract from concluding that Nepal and India are suitable candidates for entering into a monetary union.⁴¹

Thus, Nepal's rigid exchange rate with India is consistent with the OCA criteria of labor mobility, openness and to a large extent with diversification. In general there is a favorable comparison with HK-USA and Austria-Germany and this is consistent with Nepal-India meeting some of the convergence criteria for EMU. Also, the large contribution of agriculture for the Nepalese and India economies suggest that vicissitudes of the weather are important in forcing their economies along non-similar paths. This has been given empirical support in third chapter which suggests that Nepal-India do not face symmetric shocks. While this would suggest that a flexible exchange rate is less costly the stable exchange rate suggest some mechanism may be reducing the cost for the pegged exchange rate

³⁹ Taken from *IFS* (code f88a/f99ba).

⁴⁰ Taken from *IFS* (code f80a/f99ba).

regime. One possible explanation, put forward in Maskay (1997a), is that the monetary authority plays some stabilizing role although this is contrary the expected result of a small open economy which should make monetary authority impotent.⁴² Thus the data suggest India as a relatively good candidate for Nepal to peg in comparison to the exchange rate experience of HK-USA and Austria-Germany.

2.5d A Note

One criticism of the previous analysis may be the exclusion of the effects of the recent political regime shift in 1990 from the guided democracy of the panchayat system to the present post-democracy period. There was suggested evidence that some change occurred in the Nepalese economy as seen in the trend toward openness and in trade shares as well as the derived BMR suggesting a discount on the NC to the IC. However, some empirical analysis have shown that the regime shift has not had a significant effect on the economy up to 1994 (many results for example Bajracharya and Maskay (1997) for agricultural production, standard Chow tests on changes in output and inflation etc..).⁴³ In other words, the analysis up to 1994 was not so much affected by the regime shift thus it seems safe to exclude it without loss of generality.⁴⁴

⁴¹ Of course, this is a generalization which may grossly simplify the arguments since some form of stabilization is necessary given that Nepal and India do not face symmetric shocks.

⁴² This question is explicitly explored in the appendix to this dissertation by estimation of Nepal's offset and sterilization coefficient.

⁴³ Of course there are some exceptions as suggested in Maskay (1997a), albeit at a weak confidence level, for the monetary response function as well as suggestive in the derived BMR.

⁴⁴ The effects of the 1990 political regime shift on the cost and benefit of maintaining the present exchange rate regime are explored in the final chapter of this dissertation.

2.6 Remarks and Conclusion

Looking at each section independently would suggest that there is no clear choice for Nepal's exchange rate regime. Low labor mobility, a closed economy and a significant agriculture contribution for Nepal relative to the four countries, with India excluded, suggest that a flexible exchange rate is less costly. On the other hand the performance of Nepal's exchange rate with India and her suitability as a peg to Nepal relative to HK-USA and Austria-Germany suggest some exchange rate rigidity may be workable. However, the peg to India, while relatively stable, has had some changes suggesting that some flexibility has occurred to bring external balance vis-à-vis India.

While this may imply some short run independence, in the long run the pegged exchange rate regime results in a loss of monetary independence. While the previous paragraph suggests that some exchange rate rigidity is workable, has this been to Nepal's benefit? On one hand, prior to 1990 India can be characterized as more unstable vis-à-vis Nepal, due to changes in government, wars, assassinations etc.. which may have resulted in slower growth for Nepal due to imported inflation. On the other hand, the present Nepalese experimentation with democracy has resulted in more instability vis-à-vis India which may make the peg (or some form of a rigid exchange rate) discipline the government. Thus an answer, while difficult to quantify, says that the peg may not have made sense in the past but seem to make more sense in the present and definitely in the future.

To end, Nepal's exchange rate regime has some similarity with Mundell's (1961) description of the appropriate geographical domain of a currency area which is a "domain within which exchange rates are fixed" against each other although flexible vis-à-vis the outside world so that the exchange rate would maintain external balance (BOP equilibrium) without causing inflation or unemployment. While there are some differences, notably the existence of a pegged exchange rate between Nepal and India rather than a fixed exchange rate from a single currency, the evidence presented in this chapter suggest that Nepal may be in a quasi-currency area with India, more so in the past than in the present and, arguably, less so in the future if current trade patterns continue.

Appendix 2.1

The following is obtained from the *QEB*.

1. Effective April 13, 1960 the exchange rate of the rupee vis-à-vis the Indian rupee was fixed at Rs. 1.5975 buying and Rs. 1.6000 selling per Indian rupee.
2. On June 6, 1966 following the devaluation of the Indian rupee the exchange rate of the rupee vis-à-vis the India rupee was appreciated by 57.5 per cent.
3. On December 8, 1967 the rupee was devalued by 24.8 per cent.
4. Following the realignment of currency on December 17, 1971, the exchange rates of the rupee vis-à-vis Pound sterling, Deutsche mark, Japanese yen and Indian rupee were revised effective December 22, 1971. The exchange rate of the Pound sterling was floated from July 3, 1972.
5. After the devaluation of the US dollar, the exchange rate of the rupee vis-à-vis the US dollar was changed effective February 9, 1973. The exchange rate of Deutsche mark, Swiss franc and Japanese yen were floated since February 20, 1973.
6. Effective October 9, 1975, the exchange rate of the rupee vis-à-vis the US dollar was revised. The exchange rates of other convertible currencies were quoted daily with reference to the US dollar rate in the international currency market.
7. On March 22, 1978 the rupee was devalued 4.0 per cent vis-à-vis the US dollar.
8. On September 19, 1981 the rupee was devalued about 9.1 per cent vis-à-vis the US dollar.
9. On December 17, 1982, the rupee was devalued by 7.7 per cent vis-à-vis the US dollar. On June 1, 1983, the existing exchange rate system was pegged to US dollar.
10. On November 30, 1985, the Nepalese rupee was devalued by 14.7 per cent against foreign currencies. Nepalese rupees was pegged to a basket of currencies including the Indian Rupee in May 1986.
11. On July 1, 1991 the Nepalese Rupee was revalued against Indian currency by 1.79 percent, and on July 1 and 3, 1991, Nepalese Rupee was devalued against US Dollar by 20.9 percent. However, the system of exchange rate fixation was not changed.
12. On February 1, 1993 Nepalese currency was made fully convertible in current accounts. Exchange rate published onwards are for the purpose of Nepal Rastra Bank. Open market exchange rates quoted by different banks may differ.

Appendix 2.2

Birgunj is a major port of entry to Nepal from India with essentially no restrictions for labor mobility from Raxaull, a border town across from Birgunj in India, to Brigunj and back. Conversations suggest going from Birgunj to Raxaull, and vice versa, simply entails walking across the border. For example, groceries are purchased from the cheaper side of the border where the only check, such as it is, occurs when a vehicle is brought in a check may be made for taxable goods (i.e. such as luxuries and such) however this is simply a minor inconvenience. The high labor mobility can be seen in the spoken language (Maythali, essentially a regional border language, and Hindi, which is the official language of India) as well as the culture of the town (i.e. clothing, food etc..) where it is hard to differentiate from an ordinary Indian town.

CHAPTER 3 : An Exploration on Nepalese and Indian Monetary

Relations Utilizing the Optimum Currency Area Criteria of Patterns of Shocks

3.1 Introduction

This chapter utilizes the analytical tools of OCA theory to assess the suitability of Nepal and India to a currency area. One aspect, recently discussed with the movement towards EMU, deals with the pattern of shocks. If regions face similar shocks there shall be less cost, and more benefit, to joining a currency area since regions would face similar policy prescriptions. Fortunately the experiences and tools obtained from this vast amount of work can be applied to Asia in exploring Nepal and India's monetary relationship from the view point of the OCA criteria patterns of shocks.

While there have been a number of empirical papers which measure the pattern of shocks (see discussion in next section) Bayoumi and Eichengreen, in Bayoumi (1992) and Bayoumi and Eichengreen (B&E:1992,1994 for both), correctly point out that the earlier approaches failed to provide enough information to “distinguish disturbances from responses.” Rather, the authors in B&E (1992,1994), address the issue by utilizing the Vector Auto Regressive (VAR)⁴⁵ technique, put forward by Blanchard and Quah (1989), to identify aggregate supply and aggregate demand disturbances and to distinguish them from subsequent responses. Although this chapter applies B&E (1992,1994) to India and Nepal the developing economies of Nepal and India may not meet B&E's

(1992, 1994) “over-identifying” conditions due to poor data quality and the close connection between prices.^{46;47} The prior point is addressed by Bayoumi and Ostry (B&O:1995), who use a simpler estimation strategy, and the later in Bayoumi and Eichengreen (B&E:1995), who introduces linkages into their theoretical framework.

The results of this chapter suggest that Nepal and India are not suitable candidates for a currency area under the criteria of patterns of shocks which is robust to the application of B&O (1995) and B&E (1995). This result may be attributed to the developing nature of both economies which make them susceptible to the vicissitude’s of the weather. Also, the transformation of Bayoumi and Eichengreen (1995) suggests, given the finding of a rigid exchange rate between Nepal and India, that the money supply may be endogenous to the patterns of shocks. While the actual channel has not been determined, a plausible explanation given the assumption of low short run capital mobility, which is consistent with the policy of the Nepalese monetary authority (Maskay, 1997a), is that the Nepalese monetary authority plays some stabilizing role.

The structure of this chapter is as follows : the second section reviews the literature, the third section discusses the data, the fourth section gives an overview of the model, the fifth section discusses the estimation methodology, the sixth section examines the empirical results while the last section concludes and puts

⁴⁵ For a clear and critical discussion of VAR methodology see Pagan (1987).

⁴⁶ The coefficient of correlation of the price level for 1964 - 1994 for India and Nepal is 0.99640 which is significant at the 1% level; also, empirical results from the fourth chapter indicate that both variables are cointegrated for a single lag given annual data.

forward some reflections.

3.2 Literature Review

There have been numerous papers looking at the suitability of European Monetary System (EMS) member countries for EMU through the lenses of OCA. One perspective is the OCA criteria of patterns of shocks, where regions facing symmetric shocks are more suitable candidates to a currency area since there is less need for independent macroeconomic policy. This section reviews some of these methods.

One approach looks at the variance of the Real Exchange Rate (RER) as a condition for the suitability of candidates in a currency area initially put forward by Vaubel (1976).⁴⁸ A stable RER between two currency areas would suggest that shocks demanding RER adjustments are small while on the other hand the observation of large RER instability between two currency areas would indicate the superiority of flexible nominal exchange rates. There have been a number of empirical papers, whose conclusions vary with the yardstick used, to determine if variance of RER is large or small. RER between country A and B is defined as :

$$(3.2.1) \quad Q_{AB,t} = P_{A,t} + S_{A,t} - P_{B,t}$$

where $P_{A,t}$ and $P_{B,t}$ are the logarithms of the country A & B's price in period t and

⁴⁷ The close connection of prices results in arbitrage which pushes domestic prices back to foreign prices and suggests an intuitive explanation why aggregate shocks lead to increases in prices.

$S_{A,t}$ is the nominal exchange rate between the A and B where the variance of prospective candidates are compared against the variance of regions in a well running currency area.

For example Eichengreen (1991) compared regional RER between four U.S. regions and ten members of the European Community (EC) and found that the RER within the EC was more variable than with in the U.S. implying that the EC countries are not suitable candidates for participating in a currency area. Similarly De Grauwe and Vanhaverbeke (1991) considered the RER by using unit labor costs as the price variable for regions within and between the EC countries and found that there was more variability at the national than the regional level. However von Hagen and Nuemann (1994) reached the opposite conclusion when they used six West German regions as a standard of comparison.⁴⁹ The authors concluded that the results suggest a “Europe of two speed,” that is a core union among Germany, her smaller neighbors and France, would be viable today.

A limitation of the RER approach, as pointed out by Eichengreen (1991), is that relative prices “conflate” information on the symmetry of shocks and on the speed of adjustments. For example, if real prices in two regions move together then it is impossible to differentiate whether the regions experience the same shock or whether capital is mobile and quick to capitalize on higher rates of return. Similarly if relative real prices show little variability then it is impossible

⁴⁸ The RER for Nepal and India has been explicitly considered in the second chapter and found to be quite stable for almost a forty year period.

⁴⁹ For their analysis, the authors looked at the conditional variance of RER, i.e. the unexpected component of RER which is derived by looking at the error from the regression of lagged

to differentiate between shocks and responses since this may either reflect markets experiencing the same disturbances or factors quickly flowing between regions to minimize relative price variability.

This had led other authors to focus on the behavior of output rather than prices. For example Cohen and Wyplosz (1989) utilized output to investigate the asymmetry of shocks by transforming data on real GDP into sums, for symmetric disturbances, and differences, for asymmetric disturbances. The authors conclude that monetary integration makes more sense between France and Germany than between “Europe” and the United States since the prior has less asymmetric shocks. Also De Grauwe and Vanhaverbeke (1991) measured patterns of shocks by looking at both the average of the yearly standard deviations as well as the standard deviation of the average growth rate of output for short-term and long-term divergence of national output growth respectively where they found more asymmetric shocks at the national level than at the regional level.

Once again the limitation of focusing on output is much the same as that of focusing on prices. The observed movements in real GDP reflects the combined effects of shocks and responses thus making it impossible to distinguish their separate effects. Rather B&E (1992,1994) utilize the VAR technique put forward by Blanchard and Quah (1989) to identify aggregate supply and aggregate demand disturbances and to distinguish them from subsequent responses. For example Bayoumi (1992) shows that ERM members have significantly more correlated shocks than members the Group of Seven (G7 = U.S., U.K., Germany,

seasonally adjusted RER changes, since the unexpected variation of relative prices are generally

France, Japan, Canada and Italy) while B&E (1992) found that the underlying shocks for eleven EC nations were more significantly idiosyncratic than those of eight US regions. Likewise B&E (1994) applied the VAR analysis to the rest of the developed world and found three plausible candidates for monetary unification, one of which was a Northern European group comprised of Germany and a subset of countries. Lastly Bordo (1993) used B&E (1992,1994) to decompose shocks for the G7 countries, however, extending the data by going back over 100 years (1881 - 1989). The author finds that the Bretton Woods and floating exchange period were relatively more stable than the Gold standard regime in terms of dispersion of supply shocks.

Since most of the analysis has focused on industrialized or highly developed countries, (for example Bayoumi (1992) and Bordo (1993) look at G7 countries, B&E (1992) looks at EC countries and the U.S. regions, while B&E (1994) looks at highly developed countries around the world) problems may arise extending the analysis to developed countries like Nepal and India, such as not meeting B&E (1992, 1994) “over-identifying”⁵⁰ conditions, due to poor data quality as well as to the close connection of prices from an open and contiguous border. The prior problem is addressed in a paper by B&O (1995) where the authors use a simpler estimating strategy to focus on the behavior of real output disturbances for Sub-Saharan African countries. The authors regress the output growth upon its own first and second lags and calculate the size of the underlying disturbances from the standard deviation of the residuals. B&O (1995) find large

thought to matter more than expected variations, against eight European countries.

variation of real disturbances and concluded that the reviewed Sub-Saharan African countries may not be suitable candidates for a currency area.

The later problem of a close connection with prices may not be very different from the gold standard period. That is, under a relatively fixed exchange rate market arbitrage would prevent Nepalese and India prices from diverging substantially, as is seen in reality, and may result in both countries not meeting B&E (1992, 1994) “over-identifying” condition (as Bordo’s (1993) result for the period of the Gold Standard). B&E (1995) address this by introducing *linkages* between domestic and foreign prices, since the gold standard years relied on the arbitrage of international commodity and factor markets, which open the analysis to transactions with the rest of the world. B&E (1995) re-estimate the VAR for seven countries for the 1880 - 1913 gold standard period using relative prices, i.e. domestic price level relative to the foreign price level, and find that there is a very steep AS curve and a very shallow, but negatively sloped, AD curve suggesting that the money supply tended to adjust endogenously to shocks. That is, in a commodity standard the money supply adjust through the BOP to restore equilibrium to both asset and commodity markets. In other words, the close connection between prices across countries, implied by a commodity standard, provides an intuitive explanation for why aggregate supply shocks appear associated with increases in prices.

Although the VAR approach of B&E (1992,1994) was chosen some shortcomings are highlighted. Already mentioned are the possible

⁵⁰ The B&E (1992, 1994) “over-identifying” condition is discussed below.

inappropriateness to applying B&E (1992, 1994) technique to Nepal and India due to the close connection of prices as well as the poor data quality problem. Another important point put forward by Nuemann (1993) is that the technique of B&E (1992,1994) does not differentiate between nominal and real demand shocks. The author also adds that presently all countries today are in an inter-dependent system so a demand shock in one country may turn up as a supply shock in the other. These are important criticism and may give some insight into why developing countries may not meet the “over-identifying” restrictions imposed by B&E (1992,1994). In sum, a number of approaches to estimating asymmetric shocks were reviewed. It is concluded that the VAR methodology is the most preferable until a more sophisticated and comprehensive methodology arises.

3.3 Data on Nepal and India

The data for changes in output and also inflation are presented by log changes in the GDP at 1990 prices for the prior and the log changes in the CPI with base 1990 for the later.⁵¹ The data are available from the *IFS* tapes of the IMF and were chosen on an annual basis from 1964 - 1994 for both variables respectively.⁵² The following graphs represent the changes in output and inflation for Nepal and India :

⁵¹ All variables are well behaved since they accept the null of a unit root at the 20% level in their levels and reject the null of a unit root in log changes at the 1% level except for log changes in Nepal output at the 5% level (with a p value of 0.014017).

⁵² The series name, under the *IFS* categorization, are f99b_pa and f64a respectively and are from the September 1996 issue of *IFS*; likewise it is important to note that while Nepal also has monthly and quarterly data on CPI there is only annual data available on GDP for both countries.

Figure 3.3.1 : Change of Output

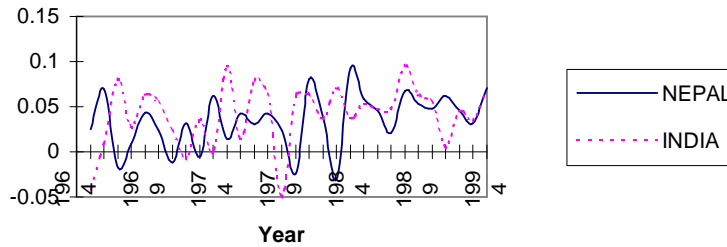
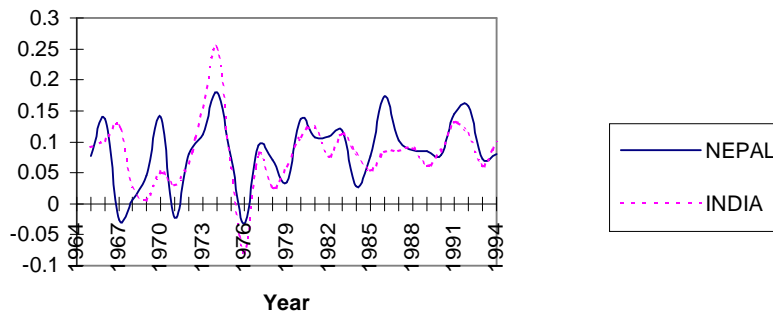


Figure 3.3.2 : Inflation



Inflation, appears to have some similarity, although the changes of output does not appear to have any relation. The table presented below reports the Average and the Standard deviation of the changes in output and inflation along with the correlation coefficient of both respectively between Nepal and India; they are :

Table 3.3.1 : Change in Output and Inflation

	Nepal	India	Nepal	India
Average	0.034756	0.041108	0.084233	0.080086
Standard Deviation	0.030969	0.035319	0.055551	0.055123
Coefficient of Correlation		-0.054850		0.62534

Since the results are measured in log change, a value of 0.01 represents a change

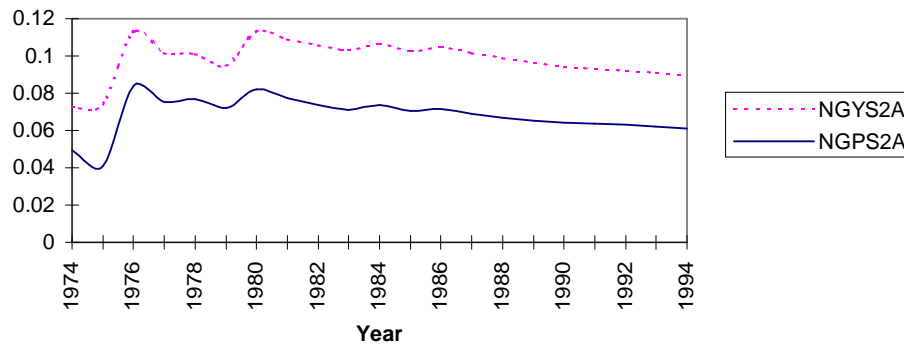
of roughly one percent. Although both the simple average and standard deviation show some similarity, along with a positive coefficient of correlation for inflation, changes in output are correlated in the negative direction.⁵³ As with B&E (1992, 1994) the significance of the correlation results are assessed. The test on the coefficient of correlation shows that the prior is not significant at the 5% level while the later is significant at the 1% level.⁵⁴

Additionally, a test for a structural break was made in 1990 coinciding with the regime shift from the guided democracy of the partyless panchayat to the present democracy. Initially the data was “eye-balled,” however, no breaks were found. Second, Chow tests were run for the period 1986 to 1990 on the individual lagged series without significant results. Since the sample size is small, the Chow test is to the end of the sample period, there may be too few observations in the second period to run a separate regression. Thus, as a final step, a recursive regression, with the end year constant, on the individual lagged series is run to determine if the variance of the residuals change over time whose graph, for Nepal, is presented below.

⁵³ Also, if Indian output growth has a period lead then the coefficient of correlation jumps to 0.24632 although not significant at the 5% level. This suggests different speeds of adjustment, i.e. the monetary side reacts immediately while the real side has a one period delay with India, along with a dichotomy in interaction between the monetary and real side of the Nepalese and Indian economies.

⁵⁴ As with BE (1992,1994) the formula $Z = \frac{1}{2}\sqrt{N-3}\{\ln[(1+r)(1-\dots)/(1-r)(1+\dots)]\}$, is utilized from Romano (1977, pp.156-160) with $H_0:\dots = 0$ versus $H_A:\dots \neq 0$ and using $r = 0.05, 0.01$ thus the rejection region is $Z = \frac{1}{2}\sqrt{N-3}\{\ln[(1+r)/(1-r)]\} > 1.96, 2.58$ and by substituting the above coefficients of correlation with an N of 30 (since we are looking at the growth rates) we obtain statistics of -0.2853 and 3.812556 for output growth rate and inflation growth rate respectively.

Figure 3.3.3 : Std. of residuals for Nepal



Looking at the graph for Nepal⁵⁵ finds the standard deviations leveling off as the sample size increased although there was some initial fluctuation which can be attributed to a small sample size. In other words, the results of the data analysis suggests that the political regime shift in Nepal did not have a significant effect on changes in output and inflation of the Nepalese economy.

The low coefficient of correlation for output growth may be a reflection of the poor quality of the underlying data. Summers and Heston (1991) provide an assessment of data quality across a wide range of countries and rate the data from South Asia a unreliable.⁵⁶ On the other hand it is hard to reconcile a high coefficient of correlation for inflation growth between Nepal and India, although expected due to the fixed nature of the peg exchange rate system, with poor data quality. In part the sharp contrast between monetary and real data may be due to a consistent standard for the monetary sector by the Nepal Rastra Bank while the measure for the real sector has gone through at least two revisions in addition to

⁵⁵ Similar results were found for India although the graph is not included.

⁵⁶ For example Summers and Heston (1990) give a quality rating for the data ranging from A (best) to D- (worst) with Nepal having D+ and India enjoying a C quality rating.

the measurement problem of a least developed country. In other words for Nepal there appears to be a relatively greater reliability on the monetary sector figures, vis-à-vis the real sector, which is generalized to India.⁵⁷

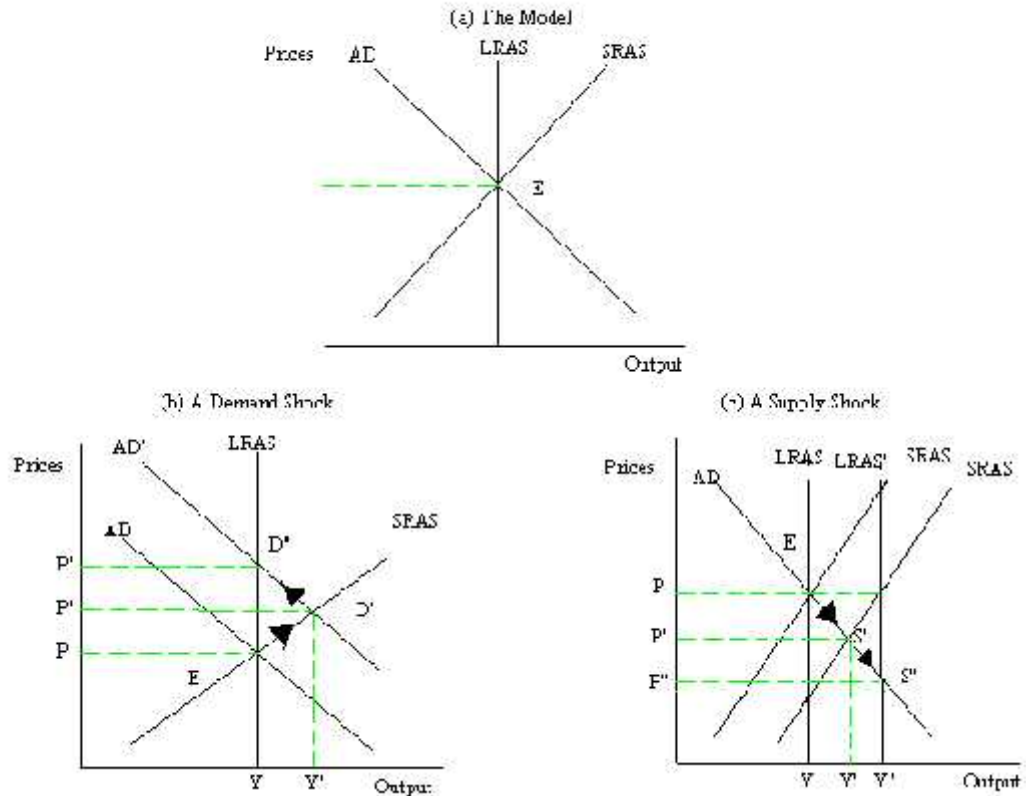
3.4 Model⁵⁸

The point of departure is the familiar aggregate demand (AD) and aggregate supply (AS) framework, where the AD curve is downward sloping reflecting greater quantity demanded at a lower price, the short run AS (SRAS) curve is upward sloping reflecting greater quantity supplied at a higher price and the long run AS (LRAS) is vertical reflecting the adjustment of real wages to prices in the long run. This model is represented in graph (a) of Figure 3.4 below where “E” is the equilibrium level :

⁵⁷ Consider that the real sector has had a number of data shocks dealing with how numbers are accounted for at the national level (Shrestha, 1994), the difficulty of collecting agricultural data (Maskay, 1997b) and the ongoing controversy of real sector data after 1993 (with the coalition governments).

⁵⁸ The model comes from Bayoumi (1992).

Figure 3.4 The Aggregate Demand and Supply Model



A positive demand shock (b) has a temporary effect seen in a rise of output from Y to Y' then a subsequent fall to Y although there is a permanent increase in prices from P to P' to P'' . Likewise a positive supply shock (c) has a permanent increase in output from Y to Y' to Y'' and a permanent reduction in price from P to P' to P'' .

This framework is estimated by B&E (1992,1994) using a procedure initially proposed by Blanchard and Quah (1989) for distinguishing temporary from permanent shocks to a pair of time series variables and subsequently extended to the present case by Bayoumi (1992). Consider a system where the true model can be represented by an infinite moving average representation of a vector

of variables X_t :

$$(3.4.1) \quad \begin{aligned} X_t &= A_0 v_t + A_1 v_{t-1} + A_2 v_{t-2} + A_3 v_{t-3} \dots \\ &= \sum_{i=0}^{\infty} L^i A_i v_t \end{aligned}$$

where the matrices A represent the impulse response function of the shocks on elements in X . The specific model, using Lag operators L^i , is put forward as :

$$(3.4.2) \quad \begin{bmatrix} \Delta Y_t \\ \Delta P_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} \\ a_{21i} & a_{22i} \end{bmatrix} \begin{bmatrix} v_{dt} \\ v_{st} \end{bmatrix}$$

Where ΔY_t and ΔP_t are the logarithms in the output and prices, A is a 2 X 2 matrix representing the impulse response function of the shocks to Y_t and P_t and v_{dt} and v_{st} are independent demand and supply shocks. The AS-AD framework implies the restriction :

$$(3.4.3) \quad \sum_{i=0}^{\infty} a_{11i} = 0$$

The model defined by equation (3.4.2) and (3.4.3) can be estimated using a VAR, that is each element of X_t can be regressed on the lagged values of all the elements of X . Using B to represent these estimated coefficients the estimating equation becomes :

$$\begin{aligned}
(3.4.4) \quad X_t &= B_1 X_{t-1} + B_2 X_{t-2} + \dots + B_n X_{t-n} + e_t \\
&= (I - B(L))^{-1} e_t \\
&= (I + B(L) + B(L)^2 + \dots) e_t \\
&= e_t + D_1 e_{t-1} + D_2 e_{t-2} + D_3 e_{t-3} + \dots
\end{aligned}$$

To convert equation (3.4.4) into the model defined by equation (3.4.2) and (3.4.3), the residuals from the VAR, e_t , must be transformed into demand and supply shocks, v_t . Writing $e_t = Cv_t$, it is clear that, in the two-by-two matrix considered, four restrictions are required to define the four elements of the matrix C. The normalization and the orthogonality restriction of supply and demand shocks define the matrix C to be any matrix such that $CC' = \Sigma$, where Σ is the variance covariance matrix of e_t . The final restriction, which allows the matrix C to be uniquely identified, is that demand shocks only have a temporary effect on output represented above by (3.4.3).⁵⁹ Additionally, B&E (1992,1994) put forward “over-identifying restrictions”, i.e. restrictions not imposed in the estimation procedure, which predict that a positive demand shock will cause a price increase while a positive supply shock causes a price decrease and to be verified in the impulse response functions prior to analysis of the VAR decomposition.

3.5 Estimation Methodology

The estimation methodology follows B&E (1992,1994) where equation (3.4.4) is estimated using Time Series Program (TSP) for all computations. The estimation

proceeds in three stages. First, the optimal lag length is determined for the estimation equation utilizing the strongly consistent Bayesian Information Criterion (BIC) as a model selection criteria.⁶⁰ For the testing of equation (3.4.4) the BIC statistic selects the optimal lag length from lags of 1, 2, 3, 4 and 5. Secondly, the impulse response function to Choleski factored shocks are viewed to see if they meet with B&E (1992,1994) “over-identifying restrictions,” i.e. the response of prices to aggregate supply and demand shocks, and confirm the validity of B&E (1992,1994) decomposition. Finally, the residuals from the VAR estimation are transformed into their component demand and supply shocks and compared in a correlation table. The demand and supply shocks are “just” identified since we have four restrictions to define the four elements in the matrix.

Since the “over-identifying restriction” may not hold, due to data quality problems and the close connection of prices, different estimation strategies are used. For the former a simpler estimation strategy, used by B&O (1995) to look at macroeconomic shocks in Sub-Sahara Africa, was used while a transformation, from B&E (1995), was used to address the later. The simpler estimation strategy of the former focused solely on the behavior of real output disturbances. That is, output growth was regressed upon its own first and second lags.⁶¹ The size of the underlying disturbances were calculated using the standard deviation of the residuals. Similar analysis as above would occur where the coefficient of

⁵⁹ This final restriction of B&E (1992,1994) differs from Blanchard and Quah (1989).

⁶⁰ B&E (1992) use BIC to obtain a lag length of 2.

⁶¹ B&O (1995) use changes in the logarithm of real GDP per capita however maintaining the previous standard does not detract from the analysis although benefit occurs to the analysis by virtue of continuity.

correlation of the disturbances are assessed as an indication for the suitability of joining a currency area. For the later estimation strategy, Nepal and India are chosen as the candidates of interest⁶² since they are contiguous nations with no controls on capital or labor mobility. The CPI base 1990, from the *IFS* of the IMF is used, relative to a GDP weighted aggregate, for both countries.⁶³ As with B&E (1995) the optimal lag lengths are determined from the BIC for the transformed data and the VAR procedure is run to analyze their impulse response functions.

3.6 Empirical Results

The BIC model selection criterion chose an AR(4) and AR(3) for Nepal and India respectively. An impulse response function for Nepal and India of AR(3), which illustrate the effect of a unit shock in demand and supply on the level of price, is given below :

⁶² B&E (1995) used GDP weighted average for the seven industrialized countries they were working with.

⁶³ Two criticisms of this choice are forthcoming. First, the size of India relative to Nepal may drown out information from Nepal however since the weighted average of GDP is considered, where the later has different growth rate, some additional information is conveyed. Second, the transformation magnifies the effect of Indian output shocks to Nepal; this is addressed by considering three and four year averages of output to limit the noise from the vicissitude's of the weather.

Figure 3.6.1 : AR(3) Nepalese Price effect to AS & AD shocks

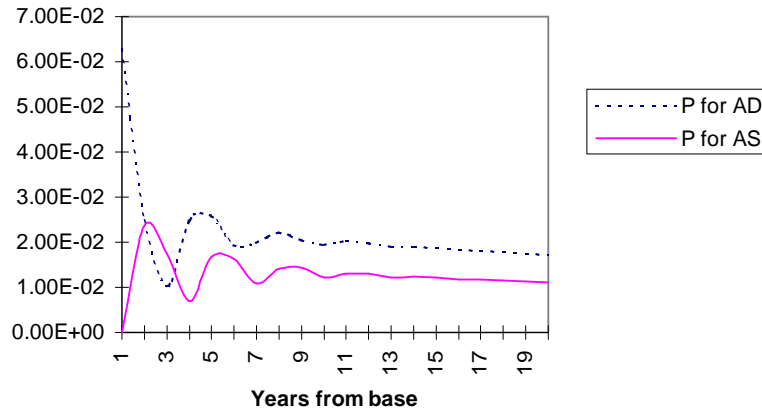
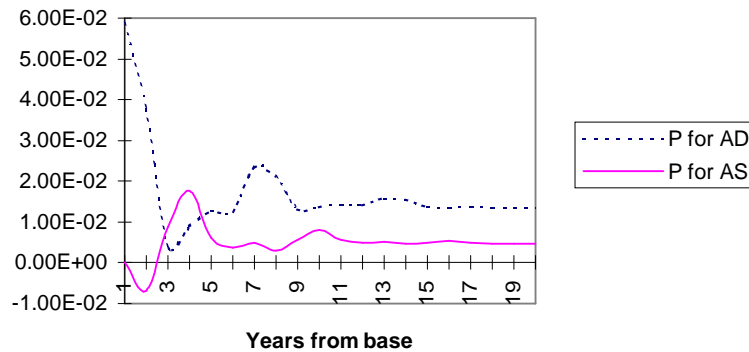


Figure 3.6.2 : AR(3) Indian Price effect to AD & AS shocks



The impulse response functions are viewed, as with Bayoumi and Stern (1995), however they do not meet B&E (1992,1994) “over-identifying” conditions that prices rise in the face of a demand shock and fall in the face of a aggregate supply shocks. Rather the impulse response function show a price fall in the face of an AD shock. This result, while similar to Bordo (1993) for pre-1946, especially during the Gold Standard, is paradoxical since it implies a positively sloped AD curve.

One problem with the results may be attributed to the low quality of data since both India and Nepal are developing nations. B&O (1995) address this problem by using a simpler estimating strategy where the authors regress the output growth upon its own first and second lags and calculate the size of the underlying disturbances from the standard deviation of the residuals. In the chart below the standard deviation of the residuals of output growth is presented.

Table 3.6.1 : Coefficient of Correlation and Std. of Residuals

	Std. of Res.	Coefficient of Correlation
Nepal	0.0388509	
India	0.0428998	-0.11289

The standard deviation of the residuals, being in the 3%-4% range for both cases, are similar to the results of B&O (1995) for Sub-Saharan African nations and are much higher than the 2%-2.5% they calculated for Germany, Japan, and the United States. For Nepal and India there is a negative coefficient of correlation although it is not significant at the 5% level, indicating that output shocks for Nepal and India are not symmetric.⁶⁴

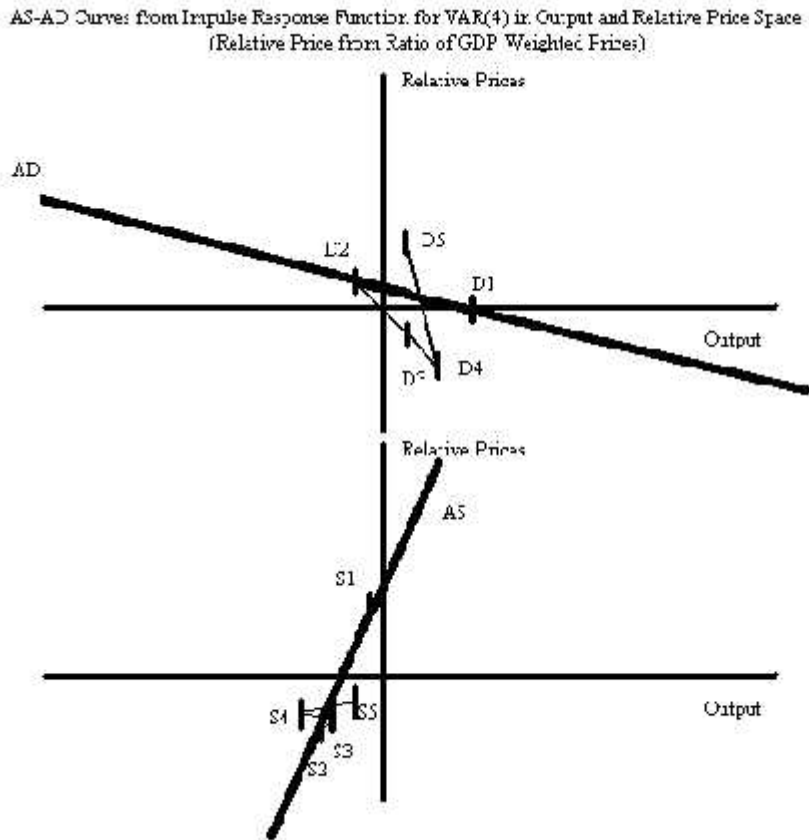
Likewise, the second problem is addressed in B&E (1995) by inferring the slope of the AD and AS curves from the plots of the impulse response functions for supply and demand shock⁶⁵ in relative price-output space.⁶⁶ Doing the same

⁶⁴ If India is leading by one period the coefficient of correlation jumps to 0.04009 but is not significant at the 5% level.

⁶⁵ The price and output response of a demand shock for the AS curve while the price and output response of a supply shocks for the AD curve.

for Nepal with four lags meets B&E (1992,1994) “over-identifying” condition with a downward sloping demand curve and an upward sloping supply curve which are given below⁶⁷ :

Figure 3.6.3



The correlation coefficient is consistent with earlier results and indicate that Nepal and India do not face symmetric shocks. This is robust to the representation of output.⁶⁸

⁶⁶ Since the first impulse response function implies a horizontal demand curve I infer the slope of the AS-AD curve from the first and second period impulse response functions.

⁶⁷ For graphs of relative price and three and four year average of output, they are available on request although the results are similar.

3.7 Conclusion and some reflections

The tentative conclusion drawn from this chapter is that Nepal and India are not suitable candidates for a currency area on the criteria of patterns of shocks. There was an indication of this conclusion in the initial data analysis with a negative and insignificant coefficient of correlation for output growth. Since the impulse response function of the VAR decomposition for Nepal and India did not meet B&E's (1992,1994) "over-identifying" restriction some other estimation strategies were used. That is, both a simpler estimation strategy, from B&O (1995), was used to address some data problems and a transformation, in line with B&E (1995), was used to address the close connection of prices. The results, robust to estimation methodology, suggest that India and Nepal do not face symmetric shocks and thus are not suitable candidates for a currency area under this criteria.

One possible reason for this finding may be the developing nature of the economies with their focus on agriculture and their susceptibility of the vicissitude's of the weather (explicitly explored in Bajracharya and Maskay (1997) for Nepal and generalizable to India).⁶⁹ Likewise, the results of B&E (1995) suggest that the money supply may play some role in the relatively well behaved exchange rate between Nepal and India (i.e. that the money supply may be "endogenous to shocks"). While the specific channel has not been

⁶⁸ The coefficient of correlation is -0.11558 while for three and four year averages it is -0.18046 and 0.12186 respectively (previously for application of B&E (1995) the coefficient of correlation was calculated as -0.11289); in all three cases none are significant at the 10% level.

⁶⁹ Another explanation may be that shocks to Nepal and India may not be independent as is assumed in the model (Nuemann, 1993).

determined,⁷⁰ a plausible explanation may be that the Nepalese monetary authority plays some stabilizing role which is consistent with the with the policy of the Nepalese monetary authority (Maskay, 1997a) and suggests that the cost of a fixed exchange rate may be smaller that would appear at first glance from this criteria.

The above results suggest that some caution may be called for when using this single criteria to determine the suitability of a currency area. That is, the patterns of shocks by themselves suggest that Nepal and India are not suitable candidates for a currency area. This is in sharp contrast to the relatively stable exchange rate between both countries and suggests the opposite conclusion. While this may appear to point to a deficiency in the OCA in my mind it simply suggest that determining the suitability of a currency area, and in other words optimal exchange rate policy, does not allow for simple analysis.

⁷⁰ An attempt is made to estimate Nepal's sterilization and offset coefficients in the appendix to this dissertation.

CHAPTER 4 : A Cointegration Analysis of Nepalese and Indian

Monetary Policy

4.1 Introduction

Cointegration examines if variables share a long term relationship. However, Keil, Soydemir, Westbrook and Willett (KSWW:1997) have questioned the application of cointegration analysis to assess monetary convergence (see MacDonald and Taylor (1991) and Hafer and Kutan (1994)) in EMU since :

1. The standard tests for convergence are unable to differentiate between the magnitude of constant trends. For example, both Germany and Austria and Germany and Italy may have convergent inflation rates, i.e. a constant differential, however the later example is inconsistent with convergent prices.
2. The standard test identifies convergence once it has taken place however it is unable to identify convergence if it is in the process of occurring. This makes it difficult to test empirically for monetary convergence for members of EU since they commenced with a significant initial disequilibrium thus a significant result can only be found long after convergence has taken place.

Some empirical tests for Nepal and India are presented in this chapter which try to address some of the above mentioned deficiencies with the standard cointegration tests. That is, it is assumed that Nepal and India do not start from a significant disequilibrium since both are contiguous countries with free labor and capital movement guaranteed by the 1950 Treaty of Trade and Transit. This may be reflected in the relative stability of Nepal's exchange rate, which is both pegged to the IC and floated against major currencies, for almost a forty year period. In addition to the standard, unconditional, cointegration tests, a conditional test for

monetary convergence, from Westbrook (1998), is run which considers variables that account for “institutional design and macroeconomic trends” where the two variables of interest are velocity and output. This chapter applies the conditional and unconditional testing procedure, to determine if monetary convergence has occurred and thereby gain insight into the monetary relationship between Nepal and India.

Looking ahead, the price levels between Nepal and India have a long run relationship but the level of the monetary base does not. However, some evidence of a long run relationship for the monetary base is found by conditioning it to output shocks. The results suggest that the money supply plays some short term role in the relatively stable exchange rate between Nepal and India.

The structure of this chapter is as follows. The second section discusses the various definitions of monetary convergence. The third section discusses the data while the fourth section discusses the testing methodology. The fifth section discusses the empirical results. The sixth section discusses granger causality while the last section concludes.

4.2 Convergence - A definition

Some authors (see for example Aderton, Barrell and Willem in't Veld (1992) and Briton and Mayes (1992)) distinguish three types of convergence for the EMS :

“nominal convergence, which is the convergence of the development of costs and prices and their underlying determinants, *real* convergence or working conditions and living standards and the convergence of economic

institutions or *structures*.” (Aderton, Barrell and Willem in’t Veld, 1992, p.2))

For this chapter monetary convergence is limited to nominal convergence.

There have been a number of papers testing for monetary convergence between EMS countries. For example, MacDonald and Taylor (1991) look at monetary convergence as an indication of a harmonization of monetary policies which meets the formal objective of the EMS for stabilizing nominal exchange rates and the informal commitment to maintain the competitiveness of its member countries; that is, convergence of monetary policies would reduce the temptation to break with the union in order to make up for a loss of competitiveness. The authors look at “low - frequency monetary convergence,” that is whether or not money supplies show a tendency to move together over long periods of time, by using a multivariate co-integration technique of Johansen and Juselius (J&J, 1990) on monthly narrow nominal money supplies from March 1979 to December 1988 for three EMS countries and three non-EMS countries. Empirical results indicate a unique co-integrating vector leading them to conclude that monetary convergence has occurred in the EMU.

On the other hand Hafer and Kutan (1994) reached a different conclusion by differentiating between complete and partial monetary convergence. The authors define complete convergence as having $(p-1)$ cointegrating vectors among p policy measures. In other words there is only one common trend shared by all members. On the other hand partial convergence is the finding of less than $(p-1)$, but more than no cointegrating vectors, indicating that there is more than one but

less than p common trends. Hafer and Kutan (1994) use the short term market interest rate along with the monetary base, of monthly data from March 1979 to December, with the J&J (1990) multivariate co-integrating technique to obtain their results. The authors reject the notion of complete monetary convergence, however, they do find that partial convergence has occurred.

Westbrook (1998) extended the definition of monetary convergence to include certain macroeconomic and policy variables (specifically output and velocity shocks) in a framework of fixed exchange rates where countries target their inflation rates suggesting an endogenous money supply. The author chose to consider both output and velocity as conditioning factors since they best reflect “institutional design and macroeconomic trends.” Testing the conditional definition of monetary convergence, for velocity but not output, the author found a greater degree of monetary convergence than the standard tests.

4.3 Data

Annual data was chosen, versus monthly data of the earlier studies (MacDonald and Taylor (1991), Hafer and Kutan (1994), Westbrook (1997) and KSWW (1997)), due to availability of GDP only on an annual basis for India and Nepal, and is obtained from the *IFS* of the IMF for the period 1964 to 1994. The levels of the price, output and money supply are given by the natural log of the CPI base 1990, GDP base 1990, and the monetary base (Hafer and Kutan (1994) and

Westbrook (1998)) while their growths are represented by the log differences.⁷¹ Unlike some earlier studies (MacDonald and Taylor (1991) and KSWW (1997)) the monetary base was chosen since it is a good predictor of the money supply in Nepal (Khatiwada, 1994) and India (Rani and Ramachandran, 1994) as well as was most stable (Lothain, 1976)⁷² across countries. Additionally, the growth rate of velocity, whose equation is given below, shall be calculated from the preceding data.

4.4 Methodology

The test for cointegration, from Engle and Granger (E-G, 1987), involves two parts. The first part tests to see if the individual series are integrated of order one while the second tests if the residuals from their linear combination are integrated of order zero. The first part entails determining if the variable has a unit root. Consider the general relationship :

$$(4.4.1) \quad \Delta y_t = (r - 1)y_{t-1} + v_t^{73}$$

If $|r| < 1$ then y is $I(0)$, i.e. stationary, but if $r = 1$ then y is $I(1)$, i.e. non stationary and has a unit root. There are different tests for unit roots looking at the value of r . The Dickey Fuller (DF) test, from Dickey and Fuller (1979), and the Weighted

⁷¹ The data is labeled f14a, f64a and f99ba for reserve money, CPI base 1990 and GDP by the *IFS* of the IMF respectively.

⁷² Studies on the money supply have shown that the NRB does not have great control over high powered money due to the component of net foreign assets and claims on government (Poudyal, 1991).

Symmetric (WS) test, from Pantula, Gonzales-Farias and Fuller (PE-FF, 1994), is utilized against the null of a unit root (i.e. $H_0 : \tau = 1$). Critical values are given in Davidson and Mackinnon (1993) and PG-FF (1994). The WS test is chosen in preference to DF due to its higher power (i.e. the WS test is more likely to reject the null hypothesis when it is in fact false) as shown in PG-FF (1994). The second step tests the residuals of the co-integration equation for a unit root using DF where the critical values are put forward in Davidson and Mackinnon (1993).

There are two major critiques of the E-G technique; they are :

- a. "...In practice, it is possible to find that one regression indicates the variables are cointegrated, whereas reversing the order indicates no cointegration. This is a very undesirable feature of the procedure since the test for cointegration should be invariant to the choice of the variable selected for normalization."
- b. "...the Engle-Granger procedure is...a two step estimator...hence any error introduced by the researcher in Step 1 is carried into Step 2." (Enders, 1995, p.385)

The J&J (1990) maximum likelihood technique addresses these short comings and extends the analysis to a multivariate framework.⁷⁴ While lag lengths are important, for the purpose of this chapter they can reasonably be set to a single lag since annual data is used.⁷⁵

⁷³ Which is therefore $y_t = \tau y_{t-1} + V_t$.

⁷⁴ A useful textbook discussion is Rao (1994) and Enders (1995) while a summary is given in Appendix 4.1.

⁷⁵ Determination of lag lengths is problematic. Unlike MacDonal and Taylor (1991) and Westbrook (1998) who minimize AIC and KSWW (1997) who minimize AIC2 to obtain optimal lag lengths and Hafer and Kutan (1994) who utilize a separate methodology with similar results for quarterly data, a single lag is used for annual data consistent with Hafter and Kutan (1997) and Maskay (1997a). One perspective for the choice of lag length is to test the errors of running the model for serial correlation. The residuals from running the model failed to reject the null of no serial correlation at the 5% level except for India price levels with a p value of 0.030.

Two basic equations are put forward in Westbrook (1998) for conditional monetary convergence given that the monetary authority has inflation convergence as a goal (i.e. $P=P^*$). However for Nepal and India a stronger assumption, that price has already converged, is used.⁷⁶ Thus, the equations of Westbrook (1997) are in *log levels*, rather than *log differences*, where the equation for monetary convergence conditional on output shocks is :⁷⁷

$$(4.4.1) \quad m - y = m^* - y^*$$

where m and y are log levels of money supply and output respectively; likewise the equation for the conditional definition of monetary convergence given velocity shocks is :

$$(4.4.2) \quad m - y + v = m^* - y^* + v^*$$

Where velocity is measure by :

$$(4.4.3) \quad v = p + y - m$$

$$(4.4.4) \quad v^* = p^* + y^* - m^*$$

⁷⁶ This is reasonable given an open and contiguous border with India, a high coefficient of correlation between both price levels, a close connection of agricultural prices (Bajracharya and Maskay, 1997), arbitrage at the border town (Bohara and McNown, 1989) as well as first hand experience.

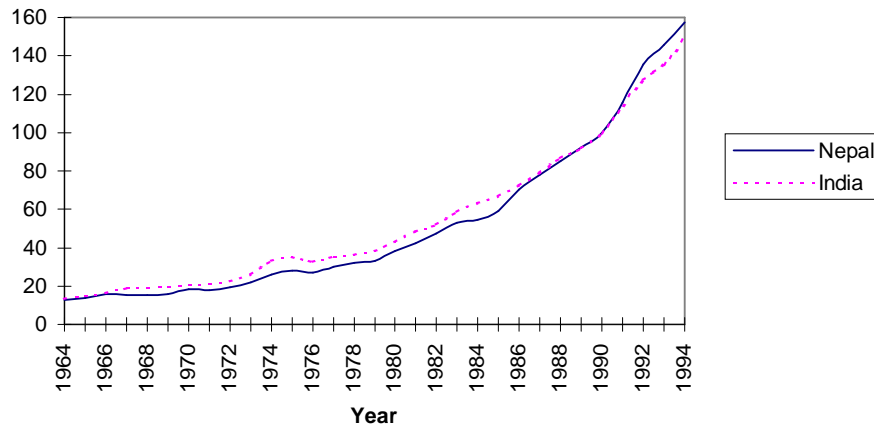
⁷⁷ Derivation is as in Westbrook (1998)

Besides the issue of specifying the appropriate lag lengths, another problem is the data span necessary to capture a long term relationship. For example, the four preceding studies, on average, only covered eleven years.⁷⁸ This chapter tries to address this by looking at a span of over thirty years starting from equilibrium.

4.5 Empirical Results

Initially the plots of the levels are “eye-balled;” consider the plots of the price level :

Figure 4.5.1 : Price Level



“Eye-balling” the graph it appears that the price levels of India and Nepal share a strong relationship between both countries and this is confirmed by the statistics.

Table 4.5.1 : Nepalese and Indian Price Statistics

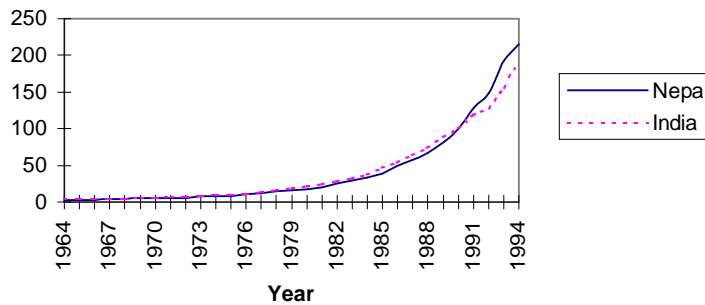
	Nepal	India
Average	48.64667	54.49355

⁷⁸ A long run relationship should be caught in about a thirty year span for example Stock and Watson (1991) , if not longer as in Hafer and Kutan (1997).

Standard Deviation	37.82604	38.77373
Coefficient of Correlation		0.99640

The coefficient of correlation of the price level is significant at the 1% level (Romano, 1977, pp. 156 - 160). Consider the plot of the monetary base :

Figure 4.5.2 : Monetary Base



“Eye-balling” the graph there appears to be a strong relationship between the levels and is confirmed by the statistics :

Table 4.5.2 : Nepalese and Indian Monetary Base Statistics

	Nepal	India
Average	42.59914	41.73071
Standard Deviation	57.3081	50.17997
Coefficient of Correlation		0.993435

The level is significant at the 1% level. Also, the plots suggest that the variables in their levels have a trend and that there are no structural breaks.⁷⁹

⁷⁹ This is verified by running standard Chow tests of the model for a single lags against a break in 1989 which is the start of the regime shift and had shown a break, albeit with weak confidence, in Maskay (1997a); see Appendix 4.2 for results of Chow tests.

Finally unit root tests are run on all variables. In general all variables in their levels fail to reject the null of a unit root at over the 25% level of confidence and are corrected for by taking their first difference which reject the null of a unit root at greater than 1% level (except in one case which is at the 5% level).⁸⁰ The single exception is the level of the Nepalese monetary base conditional on velocity shocks where the null of a unit root was rejected at the 1% level of confidence. As with Westbrook (1997), unit root tests are run on the generated velocity variables whose results are given below :

Table 4.5.3 : P-value of WS Statistic for Lag 1

	Unit Root for velocity
Nepal	0.00458
India	0.49707

The velocity of Nepal has no unit root and may be explained by the level of financial development in Nepal. Since the level of the monetary base conditional on velocity shocks does not have a unit root they are not considered in the later analysis.

J&J (1990) maximum likelihood estimation are then run where the p-values of the trace statistics with a single lag and are taken from TSP; the results are :

Table 4.5.4 : P-value of Trace Statistics with Annual Data

⁸⁰ See Appendix 4.3 for statistics of unit root tests.

	$\log(P_t)$	$\log(MB_t)$
H0:r=0	0.009801	0.53769
H0:r<=1	0.025251	0.34889

The price levels in India and Nepal reject the null of zero cointegrating vector at the 99% level and fail to reject the null of less than one or equal to one cointegrating vector at the 97.5% level. The monetary base levels, on the other hand, fails to reject the null of both zero or less than or equal to one cointegrating vectors at the 80% level. The results for the price levels were consistent with the initial data analysis. On the other hand the levels of the monetary base are not cointegrated although both are contiguous countries with a highly significant coefficient of correlation.

Another perspective may be to redo the analysis using monthly monetary data, with lag specification to be chosen by using the modified AIC, as suggested by PE-FF (1994) and consistent with KSWW (1997), for ease of comparison with earlier studies and as a simple test of robustness of the results. After accepting the null of a unit root, at the 10% level of confidence, and rejected the null of a unit root for the log differences, at the 5% level of confidence except for the Indian monetary base ($p=0.062604$), for all variable, J&J (1990) maximum likelihood estimation are then run :

Table 4.5.4 : P-value of Trace Statistics with Monthly Data

	$\log(P_t)$:Lag 25	$\log(MB_t)$:Lag 27

H0:r=0	0.012752	0.34824
H0:r<=1	0.009442	0.15238

The results are slightly different from the previous paragraph. On one hand the monetary base levels once again suggest that there is no long run relationship between Nepal and India. On the other, the price levels reject both the null of zero and zero or less than one cointegrating vectors at the 95% level of confidence for the prior and at the 99% level of confidence for the later. At first this appears paradoxical, however, the results from the second null hypothesis are barely rejected with a p-value close to 0.01 suggesting that the result is a border line case. A likely reason may be the higher power⁸¹ of the test given the same span but higher frequency of the data⁸² and suggests that the larger number of data may have caused an increase in confidence levels, this is true for three of the four cases. Thus, it is tentatively put forward that these results do not significantly alter the interpretation of the results although caution may be called for.

One explanation for Nepalese and Indian monetary base not having a long run relationship, for both monthly and annual data, may be that the money supply plays some role in reducing the short term cost to the economy (for example of a shock consider the level of economic development, which is agricultural based and thus held hostage to the vicissitude's of the weather; explicitly explored in Bajracharya and Maskay (1997) generalizeable to India). Thus, tests are run for

⁸¹ This has been discussed in numerous publications for example Lahiri and Mamingi (1995).

⁸² The data are not deseasonalized as KSWW (1997).

monetary convergence conditional on output shocks where the p-values for running J&J (1990) are:

Table 4.5.7 : P-value of Trace Statistics with Annual Data

	MB cond. On Y
H0:r=0	0.076939
H0:r<=1	0.068272

Using levels of the monetary base conditional on output shocks rejects the null of no cointegrating vectors at the 90% level and fails to reject the null of a cointegrating vector at the 95% level. This finding, albeit at a weak confidence level, is consistent with results from the third chapter that Nepal and India do not face symmetric shocks and the respective money supply's plays some role given the relatively well behaved exchange rate for almost a forty year period. Since the levels of the monetary base are not cointegrated it suggests that the monetary base of either Nepal or India temporarily diverge although over the long run it moves together given that price levels do not diverge. While the exact channels have to be determined, a plausible explanation which is consistent with the policy of the Nepalese monetary authority and from Maskay (1997a), is that the Nepalese monetary authority plays some short term stabilizing role.⁸³

⁸³ Short term stabilization necessitates low capital mobility which does not appear consistent with the open and contiguous border as well as the relative size of both economies. This question has been explicitly explored via estimation of Nepal's offset and sterilization coefficient in the appendix to this Ph.D. dissertation.

4.6 Granger Causality⁸⁴

While seeing if variables move together over the long term is interesting from one perspective, it is also interesting to determine the policy effect of one variable on another. In this vein Granger Causality has been used (in the EMU case see MacDonald and Taylor (1991) and Hafer and Kutan (1994); for Nepal and India case see Bohara and McNown (1989)) and is defined as :

x is a *Granger cause* of *y* (denoted $x \rightarrow y$), if present *y* can be predicted with better accuracy by using *past* values of *x* rather than by not doing so, other information being identical.

The statistics are presented below for Granger Causality tests (Granger,1969)⁸⁵

which are run on the log differences of variables with annual frequency :

Table 4.6.1 : P-value of Granger Causality Tests on Log Changes

	$\log(P_t)$	$\log(MB_t)$	$\log(MBcY_t)$
N->I	0.51640	0.88379	0.99980
I->N	0.81358	0.84283	0.00273

Granger Causality test for inflation suggests no casual relationship between both countries. However, increasing the frequency to monthly data, bi-directional Granger causality is seen for Nepal and India. A similar result occurs in Bohara and McNown (1989), who run Granger Causality tests of inflation between Nepal and India for the period 1969:3 through 1985:3, using quarterly data. The authors

⁸⁴ For a detailed explanation see Appendix 4.4.

⁸⁵ Granger (1969, 429) states : "The definitions have assumed that only stationary series are involved. In the non stationary case,...,will depend on time *t* and, in general, the existence of causality may alter with time."

are skeptical of the results and describe “the relative sizes of the two countries makes a causality interpretation of these results indefensible” which can be attributed to “timing relationships which do not have causality implications” (Bohara and McNown, 1989, p.48); this observation is relevant for the above empirical results. The monetary base level likewise does not suggest any causality relationship although Indian changes in the monetary base Granger Cause Nepalese changes in the monetary base when the frequency is increased to monthly data. The monetary base conditional on output shocks, on the other hand, suggest that Indian monetary base changes Granger Causes Nepalese monetary base changes at the annual level.

Also, statistics are presented below⁸⁶ where Granger Causality tests are taken, as in MacDonald and Taylor (1991), on the log levels of the variables⁸⁷ :

Table 4.6.2 : P-value of Granger Causality Tests on Log Levels

	$\log(P_t)$	$\log(MB_t)$	$\log(MBcY_t)$
N->I	0.61430	0.84283	0.22083
I->N	0.05396	0.88379	0.04001

The results suggest that the Indian price levels Granger Causes Nepalese price levels at the 10% level but not vice versa. This is in line with the open and contiguous border as well as the relative sizes of both countries. However, increasing the frequency to monthly data suggest bi-directional Granger Causality. The monetary base shows no Granger Causality however in monthly

⁸⁶ Durbin *h* or *m* statistic does not detect serial correlation at the 5% level.

data India Granger Causes Nepalese monetary base. Finally, conditioning the monetary base on output shocks allows the Indian monetary base to Granger Cause Nepalese monetary base at the 5% level. While the results for Granger Causality tests change when using levels and log differences as well as different frequencies, the results of the monetary base conditional on output shocks is robust to the presence, or lack of, of a unit root.

4.7 Conclusion

The results indicate, albeit at a weak level of confidence, that the price levels and monetary base levels of Nepal and India conditional on output shocks are cointegrated when lag lengths are limited to a single year for annual data. Taken together with the open and contiguous border, the close relation of prices and the temporary divergence of the monetary base level (which can plausibly be reflected in stabilizing monetary policy (Maskay, 1997a) for Nepal), suggest that Nepalese monetary policy may be endogenous to shocks. This allows a long lived and rigid exchange rate for almost a forty year period by reducing the cost for adjustment of the domestic economy.

These results suggest two closely related points. First, that the monetary policy of both countries have a long run relationship, where the economic size and exchange rate regime imply that the Nepalese monetary authority has little control

⁸⁷ The Granger Causality tests are based on the log levels, as MacDonald and Taylor (1991, 557), where “..the stationary of the error term, implied by cointegration, implies that this is a statistically valid process.”

over monetary policy,⁸⁸ at least in the short run the Nepalese monetary authority may have some control over the money supply. While the specific mechanism has not been identified, the results suggest that in the short run the money supply plays some role in reducing the cost of adjusting the domestic economy to BOP equilibrium. This suggests that the cost of giving up the monetary policy, at least in the short run, for Nepal is not insignificant. Secondly, and more generally, these results suggest that the appropriate concept of monetary convergence for Nepal and India may not be the behavior of the *unconditional* monetary base but rather the *conditional* monetary base which responds endogenously to disturbances in ways that promote long run BOP equilibrium (as with Westbrook (1998) and KSWW (1997)). This suggests that the comparison of monetary policy using simple monetary variables may give misleading results.

⁸⁸ For example consider the small country case with a fixed exchange rate and high capital mobility where the monetary authority has no control over the money supply.

Appendix 4.1

The following is taken from Westbrook (1998) :

Johansen and Juselius (199) extended bivariate cointegration test to multivariate tests of p dimensions (see their paper for the derivation of the test statistics). Estimate here :

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_{k-1} \Delta X_{t-1-k} - \Pi X_{t-k} + e_t$$

where X_t is a sequence of random vectors, and

$$\Gamma_i = -I + \Pi_1 + \dots + \Pi_i \quad (i = 1, \dots, k-1) \quad \text{and}$$

$$\Pi = I - \Pi_1 - \dots - \Pi_k.$$

The term of interest is ΠX_{t-k} . This term indicates whether the variables are cointegrated. If X_t is non-stationary, and elements of the vector are cointegrated, then there exists a long-run relationship among elements of the vector. The actual procedure examines the $p \times p$ Π matrix for its rank. If the matrix is of full rank, p , then all elements of X_t are stationary in levels. If the matrix has zero rank, then all of the elements of Π_i have unit roots, and there are no common stochastic trends. When the rank, r , of Π is between zero and p , then there are r cointegrating relationships among the elements of X_t , and $p-r$ common stochastic trends.

Appendix 4.2

p-value for Chow test at 1989

Nepal Price	India Price	Nepal MB	Indian MB	Nepal Cond. Y	India Cond. Y
0.831	0.864	0.472	0.088	0.838	0.362

Appendix 4.3

#	Variables	Order	p-value
1	MONETARY BASE CONDITIONAL	NEPAL	0.97338
	ON OUTPUT SHOCKS	INDIA	0.99728
2	CHANGE IN MONETARY BASE	NEPAL	0.00001
	COND. ON OUTPUT SHOCKS	INDIA	0.00675
3	MONETARY BASE CONDITIONAL	NEPAL	0.00025
	ON VELOCITY SHOCKS	INDIA	0.41744
4	CHANGE IN MONETARY BASE	NEPAL	0.00013
	COND. ON VELOCITY SHOCKS	INDIA	0.00163
5	PRICE LEVEL	NEPAL	0.97576
		INDIA	0.27032
6	INFLATION	NEPAL	0.00013
		INDIA	0.00163
7	MONETARY BASE	NEPAL	0.95577
		INDIA	0.99979
8	MONETARY BASE GROWTH	NEPAL	0.00010
		INDIA	0.02654

Appendix 4.4

Granger Causality :To implement the granger test, the likelihood ratio test is calculated of the restricted versus the unrestricted framework where the unrestricted model is :

$$Y_t = f(Y_{t-1}, Y_{t-2}, \dots, X_{t-1}, X_{t-1})$$

and restricted model is

$$Y_t = g(Y_{t-1}, Y_{t-2}, \dots)$$

Rejecting the null hypothesis that all the coefficients of the lagged X_t 's are jointly insignificant implies that X_t Granger-cause Y_t . For example, consider the unrestricted hypothesis as :

$$NP_t = NP_{t-1} + \dots + NP_{t-7} + IP_{t-1} + \dots + IP_{t-7}$$

While the restricted hypothesis as :

$$NP_t = NP_{t-1} + \dots + NP_{t-7}$$

Where the restriction that the coefficient of IP_{t-1} to IP_{t-7} is zero is tested using the Likelihood Ratio test.

CHAPTER 5 : The impact of the Indian Monetary Policy and the Official Exchange Rate on Nepalese Monetary Policy

5.1 Introduction

The chapter asks : “What are the impacts of Indian economic variables on Nepalese monetary policy?” There have been many discussions concerning this topic in Nepal (for example see Sharma (1991) and Khatiwada (1994)) as well as an indication from earlier chapters, albeit indirectly from initial data analysis, through a positive coefficient of correlation on the lagged output growth and inflation for both countries. Also, Bohara and McNown (1989) show a uni-directional transmission of inflation from India to Nepal through the channels of price arbitrage and the balance of payments from a VAR analysis.

Two factors should be considered, however. First, the shift in policy stances, from a closed inward focused regime to an open liberalized economy, may have affected the magnitude of influence (i.e. there may be a gradual shift in parameters) with India’s influence somewhat diminishing as Nepal has diversified towards world economies (i.e. 80% of Total Trade with India in 1975 versus only 30% in 1993 (*ES*)). Also, this movement was enhanced by a regime shift in February 1990 from the guided democracy of the partyless panchyat system to the present post democracy assisted by a trade embargo by India on March 1989. Secondly, empirical evidence, as put forward in the third chapter, shows that Nepal and India do not face symmetric output shocks (specifically the coefficient of correlation for real shocks is negative but insignificant). In other words, Nepal

and India, by facing dissimilar shocks, may be forced to take conflicting domestic monetary stances even though this is not reflected in the rigid exchange rate for almost a forty year period (*QEB*). Thus, during the analysis we should keep in mind whether liberalization has caused a shift in parameters and we should see how Nepal's monetary policy has responded to Indian economic variables in a way that allows the observed stability in the exchange rate system. Looking ahead it is found that the Nepalese monetary authority does play some role in stabilization as well as evidence of a structural break in 1989; the prior result is consistent with low capital mobility in the short run.

The outline of this chapter is as follows : the next section discusses the data, the third section discusses the methodology along with some empirical results, the fourth section gives an analysis of the empirical results while the last section concludes.

5.2 Data⁸⁹

Unfortunately, the data of developing countries play a large part in determining an estimation strategy. Data quality and availability for Nepal and India are problematic further constraining the choice of variables (for example of Nepal's cases see Sharma (1989) and Pant (1995)). With these constraints in mind variables were arbitrarily chosen along the line of Burdekin and Burkett (1992) which capture fiscal and monetary policy interactions as well as the foreign policy goals, although the GNP GAP measure was not included since data was

unavailable. The monetary base was chosen as the monetary policy variable (as with B&B (1992) and earlier chapters) where the full set of nine variables comprises :

ZMB = Nepalese monetary base growth

ZDEF = Nepalese Budget deficit as a proportion of Nepalese GDP

ZDP = Nepalese Inflation

ZLR = Change in Nepalese discount rate

ZIMB = Indian monetary base growth

ZIDEF = Indian Budget deficit as a proportion of Indian GDP

ZIDP = Indian Inflation

ZILR = Change in Indian discount rate

ZEX = Change in the Nepali Rupee / Indian Currency exchange rate

ZBP = Nepalese balance of payment deficit on current account as a proportion of
Nepalese GDP

For details of data computation please see the appendix at the end of this chapter.⁹⁰ Also, the use of annual data and limited sample size, 1976 - 1994, reflect data constraints.

5.3 Methodology, Initial Empirical Results along with some Specification

⁸⁹ The data are from the *IFS* of IMF, the *QEB* from the NRB and the *ES* of HMG Ministry of Finance.

⁹⁰ The “Z” preceding each variable indicates variables which are “processed;” for example ZMB = $\log(\text{MB}/\text{MB}(-1))$, or the growth of the monetary base, is “processed data,” while MB, or the monetary base, is “raw” data.

Tests⁹¹

The first step taken was to determine if the variables had a unit root since its presence would lead to spurious results. Consider the general relationship :

$$(5.3.1) \quad y_t = \Gamma y_{t-1} + V_t$$

If $|\Gamma| < 1$ then y is $I(0)$, i.e. stationary, but if $\Gamma = 1$ then y is $I(1)$, i.e. non stationary and has a unit root. There are different tests for unit roots looking at the value of Γ . The Dickey Fuller (DF) test is utilized, from Dickey and Fuller (1979), and the Weighted Symmetric (WS) test, from Pantula, Gonzales-Farias and Fuller (PG-FF, 1994) against the null of a unit root (i.e. $H_0 : \Gamma = 1$). Critical values are given in Davidson and Mackinnon (1993) and PG-FF (1994) where, in this case, we limit the lag length to one since we were using data with annual frequency. Since the power of the WS statistic is greater than the DF statistic (PG-FF, 1994) the p-value given the null of a unit root of WS is put forward; they are :

Table 5.3.1 : P-value of WS Statistic of Lag 1

Variable	p-value
ZMB	0.010696
ZDEF	0.042190
ZNDP	0.012110
ZLR	0.055563
ZIMB	0.088383

⁹¹ For a nice discussion see Godfrey (1988) and McAleer (1994)

ZIDEF	0.032829
ZIDP	0.014343
ZILR	0.023059
ZEX	0.093116
ZBP	0.020711

All variables reject the null of a unit root at the 10% level and half at the 5% level of significance. A greater confidence level is taken given the quality of the data and the developing nature of the countries. Also, serial correlation is determined in the unit root regressions by looking at the Durbin h and the Durbin m statistic (Durbin, 1970).⁹² The statistics, which are normally distributed, are given below :

Table 5.3.2 : Durbin m and h statistics

Variable	Statistic
ZMB	0.988170
ZDEF	0.417350
ZNDP	-0.798465
ZLR	-0.463624
ZIMB	-0.228807
ZDEF	-0.373721
ZIDP	-1.07855
ZILR	-0.528990

⁹² The Durbin h is calculated as $h = \frac{\hat{\rho}}{\sqrt{\frac{T}{1 - TV(\hat{b}_1)}}}$ where $V(\hat{b}_1)$ is the ordinary least squares

estimator of the variance of b_1 and $\hat{\rho}$ is the least squares estimate of ρ . The Durbin m (h alternative) is a two-step procedure which is applicable when $1 - TV(\hat{b}_1)$ is negative and is asymptotically equivalent to the h -test, based on a two-step procedure. Both are asymptotically normally distributed against the null of no serial correlation.

ZEX	-0.90830
ZBP⁹³	-0.193926

All the statistics fail to reject the null of no serial correlation at even the 10% level of significance. In general, the data had been shown to be fairly well behaved and thus proceeded to the estimation.

5.3a General Methodology

Running the full model with all variables included fails due to insufficient degrees of freedom. Therefore, a sequential testing procedure was adopted to test the significance of different sub-sets of the right hand side variables. Initially three regressions were run to determine the significance of either ZMB(-1), ZIMB, or ZIMB(-1) since empirical evidence (from earlier chapters and from Bohara and McNown(1989)) suggests some monetary relationship between both countries. ZIMB(-1) was selected, since it was significant at the 5% level with a p-value of 0.044, and include it in all subsequent regressions. Four pairs of variables were run in three combinations, with ZIMB(-1), thus running twelve regressions in all; the combinations are :

	<u>ZDEF-ZIDEF</u>	<u>ZNDP-ZINDP</u>	<u>ZLR-ZILR</u>	<u>ZEX-ZBP</u>
Current Values (2)	ZDEF-ZIDEF	ZNDP-ZINDP	ZLR-ZILR	ZEX-ZBP
Lagged Values (2)	ZDEF(-1)- ZIDEF(-1)	ZNDP(-1)- ZINDP(-1)	ZLR(-1)- ZILR(-1)	ZEX(-1)- ZBP(-1)

⁹³ The statistic for ZBP is robust to different data sets such as the *World Tables* and *ES*.

Current and	ZDEF-ZIDEF-	ZNDP-ZINDP-	ZLR-ZILR-	ZEX-ZBP-
Lagged Values (4)	ZDEF(-1)-	ZNDP(-1)-	ZLR(-1)-	ZEX(-1)-
	ZIDEF(-1)	ZINDP(-1)	ZILR(-1)	ZBP(-1)

After testing for serial correlation by the Durbin Watson statistic and correcting using Maximum Likelihood (ML) the groups of variables significant at the 5% level or better were chosen in the initial pair-wise regression. From this set regression testing was conducted for parameter stability then commenced trimming variables by Likelihood Ratio (LR) test given the null of zero coefficient restrictions. This process was repeated until the important variables remained. As a final step Hausman tests were run on the remaining variables for exogeneity as well as RESET test for omitted variables on the final equation.

5.3b Initial Empirical Results

The regressions with contemporaneous variables showed some level of serial correlation which was corrected for by using the Cochrane Orcutt technique. The Durbin Watson statistics for the regressions that also include ZIMB(-1) are :

Table 5.3b.1 : Durbin Watson Statistic

	Current/R=2	Lagged/R=2	Current and Lagged/R=4
ZDEF-ZIDEF	1.97261	2.05683	1.56355
ZNDP-ZINDP	-1.56350	1.89001	1.22756
ZLR-ZILR	1.87847	1.88645	1.87651
ZEX-ZBP	1.26514	1.82303	1.28882

In general, the null of no serial correlation is rejected and the null of serial correlation is accepted. The data is corrected using ML and the statistics of the variables are viewed to determine if they are to be included.⁹⁴ The significant variables are ZNDP (p=0.015), ZLR (p=0.051) and ZEX (p=0.010). The new full equation is thus written as :

$$(5.3b.1) ZMB = b_{0i} + b_{1i}ZIMB(-1) + b_{2i}ZNDP + b_{3i}ZLR + b_{4i}ZEX + u_i$$

Equation 5.3b.1 is estimated and it is found that the F statistic of zero slopes is significant at the 5% level (p=0.015) and the Chow statistic of a structural break is significant at the 10% level (p=0.066). The later is in line with the regime shift beginning in 1989 with the transit embargo and the present post democracy. The equation is adjusted as follows :

$$(5.3b.2) ZMB = b_{0i} + b_{1i}ZIMB(-1) + b_{2i}ZNDP + b_{3i}ZLR + b_{4i}ZEX + b_{5i}D1989 + u_i$$

Where D1989 is a dummy variable which is 0 from 1976 till 1988 and 1 from 1989 till 1994. Equation 5.3b.2 is estimated with the significance of coefficients given in parenthesis below their respective variables :

$$(5.3b.3) ZMB = b_{0i} + b_{1i}ZNDP + b_{2i}ZLR + b_{3i}ZIMB(-1) + b_{4i}ZEX + b_{5i}D1989 + u_i$$

(0.000) (0.150) (0.470) (0.000) (0.001) (0.002)

⁹⁴ Surprisingly these regression result does not differ significantly if we do not correct for serial correlation.

As the Durbin Watson statistic (1.62163) is in the indeterminate range, equation 5.3b.2 was run correcting for serial correlation by using ML. Similar results emerge :

$$(5.3b.4) \text{ ZMB} = b_{0i} + b_{1i}\text{ZNDP} + b_{2i}\text{ZLR} + b_{3i}\text{ZIMB}(-1) + b_{4i}\text{ZEX} + b_{5i}\text{D1989} + u_i$$

$$(0.000) \quad (0.064) \quad (0.696) \quad (0.000) \quad (0.000) \quad (0.001)$$

In both 5.3b.3 and 5.3b.4 the F statistic of zero slopes is rejected at the 1% level of significance (p=0.000). The LR tests are then run against the null of each coefficient in 5.3b.3 and 5.3b.4 being zero since the Durbin Watson statistic for the unrestricted regression falls in the indeterminate range. The results are :

Table 5.3b.2 : Durbin Watson statistic

	OLS	ML
ZNDP	X	0.4005
ZLR	0.3583	0.6642
ZIMB(-1)	X	0.0000
ZEX	0.0000	0.0000

The variables ZNDP and ZLR were eliminated since they are shown to be insignificant. The last equation is limited to the variables of ZEX and ZMB(-1) which were chosen by LR. This equation is written as :

$$(5.3b.5) ZMB = b_{0i} + b_{1i}ZIMB(-1) + b_{2i}ZEX + b_{5i}D1989 + u_i$$

The LR statistic is once again used to determine the validity of the variables in equation 5.3b.5. Since the Durbin Watson statistic (1.79701) for 5.3b.5 is in the ambiguous range both OLSQ and ML are used for hypothesis testing :

Table 5.3b.3 : Durbin Watson statistic

	OLSQ	ML
ZEX	0.0000	0.0000
ZIMB(-1)	0.0001	0.0001

The final OLS and ML results follow with the p value of the coefficients given in parenthesis below their respective coefficients :

$$(5.3b.6) ZMB = 0.34502 - (1.2956)ZIMB(-1) + (1.1392)ZEX + (0.5375)D1989 + u_i$$

(0.000) (0.000) (0.000) (0.000)

$$(5.3b.7) ZMB = 0.34719 - (1.3088)ZIMB(-1) + (1.1414)ZEX + (0.5332)D1989 + u_i$$

(0.000) (0.000) (0.000) (0.000)

In both cases the F statistic of zero slopes are rejected at the 1% level of significance.⁹⁵ Also, it is noteworthy that the signs of the coefficients are similar for both estimates.

⁹⁵ Unfortunately for the ML estimation, although convergence was achieved the p-value for rho was not significant (p=0.920).

The importance of each variable is analyzed through Beta coefficients. Beta coefficients (Goldberger, 1964, pp. 197-198),⁹⁶ “measure the importance of the individual regressors by their individual contributions to...y,” are presented in parenthesis below the coefficients of the regressors keeping in mind that the p-value of all the coefficients are p=0.000; the equations are :

$$(5.3b.8)ZMB = 0.34502 - (1.2956)ZIMB(-1) + (1.1392)ZEX + (0.05375)D1989 + u_i$$

$$[0.2310980] \quad [-5.5060516] \quad [4.8415362] \quad [0.0141656]$$

$$(5.3b.9)ZMB = 0.34719 - (1.3088)ZIMB(-1) + (1.1414)ZEX + (0.5332)D1989 + u_i$$

$$[0.2305347] \quad [-5.5001743] \quad [4.5694352] \quad [0.0142637]$$

The beta coefficients for 5.3b.8 and 5.3b.9 for ZIMB(-1) and ZEX are fairly similar in absolute magnitude and outweigh the effects of the dummy.

Hausman exogeneity⁹⁷ tests are run on the variables. If a variable is exogenous then it should be not correlated with the error terms. The results for each variable are :

⁹⁶ Since variation in the sample provides an objective measure of typical changes in the form of the sample deviation, the Beta coefficients are calculated by : $S_j = b_j \frac{s_{jj}}{s_{yy}}$ where

$s_{jj} = \sqrt{\sum (x_{ij} - \bar{x}_h)^2} = \sqrt{T}$ times the standard deviation of x_j , and similarly for s_{yy} .

⁹⁷ The Hausman exogeneity test looks at the statistic $\frac{B^{IV} - B^{OLS}}{\sqrt{\hat{V}(B^{IV}) - \hat{V}(B^{OLS})}}$ which is distributed

as a t statistic with n-2 degrees of freed where for IV we use lagged variables and the null is that the error are uncorrelated or that we have a null of exogeneity.

Table 5.3b.4 : Hausman Exogeneity

Variable	p-value
ZEX	0.98939
ZIMB(-1)	0.67221

Both variables fail to reject the null of exogeneity. This is understandable since the first variable is an official rate determined by the government while the latter is determined by the Indian government.

Lastly, Ramsey's (1969) RESET procedure was utilized to test for the possible omission of relevant explanatory variables in which the final equation 5.3b.6 was augmented by additional test variables. If these additional test variables are found to be jointly insignificant then we fail to reject the null hypothesis of no specification error. Following Thursby and Schmidt (1977), squares, cubes and fourth powers of the right-hand-side variables are included in equation 5.3b.6 which are used to form the test variables. Since serial correlation was detected by Durbin Watson in the indeterminate range the OLSQ and the ML estimation is put forward :

Table 5.3b.5 : RESET Test Statistic

	OLSQ	ML
$t^2(2)$	0.86267	0.6088
$t^2(4)$	0.4492	0.3404
$t^2(6)$	0.0156	0.0122

The data fail to reject the null of no specification error even at the 30% level for adding squared and cubed powers however we reject the hypothesis for fourth powers of the right hand side variables at the 5% level of significance. Less weight should be put for the variables of the fourth power due to low power of the statistic brought about by the degree of freedom problem.

5.3c The Derived Black Market Rate : A Consideration

The derived Black Market Rate (BMR) for Nepal and India⁹⁸ was also considered by adding it in equation 5.3b.5, although it decreases the sample size and adds to the degree of freedom problem, as an additional specification check :

$$(5.3c.1) ZMB = b_{0i} + b_{1i}ZIMB(-1) + b_{2i}ZEX + b_{5i}ZBMR + b_{4i}D1989 + u_i$$

Running this equation, given a smaller sample size, results in no significant coefficient for ZBMR; the equation is given below with respective p-values under the variables after correcting for serial correlation along with finding ZBMR well behaved⁹⁹ :

$$(5.3c.2) ZMB = b_{0i} + b_{1i}ZIMB(-1) + b_{2i}ZEX + b_{5i}ZBMR + b_{4i}D1989 + u_i$$

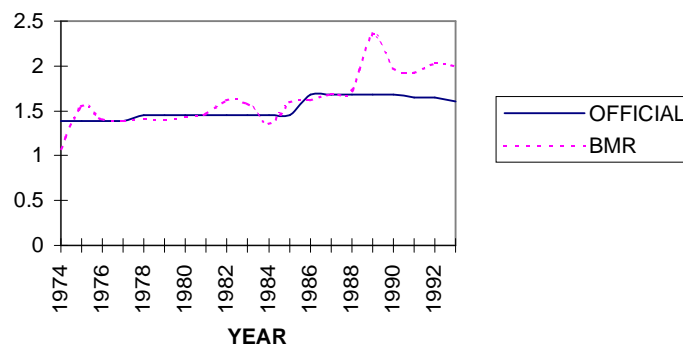
(0.000) (0.000) (0.602) (0.000)

⁹⁸ Where the BMR is measured indirectly as a ratio of the Nepalese BMR to the USD and the Indian BMR to the USD.

⁹⁹ ZBMR rejected the null of a unit root (p=0.010723) with no serial correlation (m-statistic=-1.2169)

The insignificant result may be due to low power from a smaller sample size, however, it happens that the information which is added by ZBMR only occurs near the tail end of the sample. This can be seen in the graph with the official exchange rate :

Figure 5.3c.1 : Plots of the Official Exchange Rate and the Black Market Rate of the Nepalese Rupee to the Indian Rupee

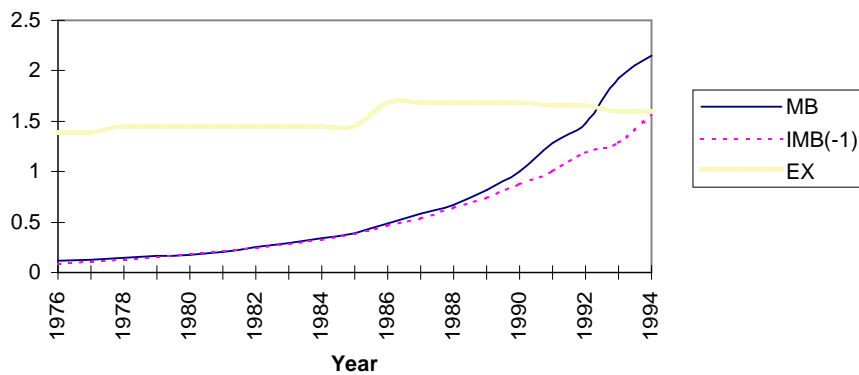


Prior to 1989, the guided democracy period, the ratio of the official exchange rate to BMR was 1.004. Information was conveyed after the democracy period where BMR was over 40% greater than the official exchange rate and stabilized after 1990 to the end of the sample at a 20% average “discount” for the NC against the IC (1.2025). In other words, there is evidence of a structural break. Also, it appears that market confidence in democracy was lacking where people were willing to pay more to hold the IC. Thus, the results are consistent with our finding of an insignificant relationship between MB and BMR.

5.3d Properties of the selected variables

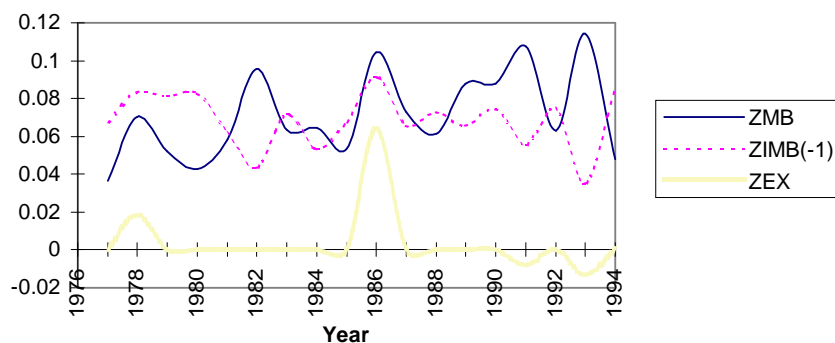
The plots of the “raw” data and the “processed” data of some variables are put forward which were determined to be significant during the course of the testing although plots of all the data are also available on request. Also, the variables are given with base 1990, where appropriate, for ease of comparison. The raw data for the monetary base, lagged Indian monetary base, and the exchange rate are :

Figure 5.3d.1 : Plot for MB IMB(-1) and EX



It is difficult to observe a relationship between MB and EX, since the latter is government controlled with minimal changes, although MB and IMB(-1) shows distinct breaks in 1989. Prior to democracy both variables appear to share a common trend, after democracy they appear to have different trends with the level of MB end at a higher level than IMB(-1). This is consistent with the empirical evidence of a structural break noted above. Plots of the growth rates are then given :

Figure 5.3d.2 : Plot of ZMB ZIMB(-1) and ZEX



Looking at the growth rates, the movement of both ZMB and ZIMB(-1) tend upward; also there is more negative movement in ZEX after the advent of democracy although there are large (positive) spike at 1978 and 1986¹⁰⁰ although they are incorporated by ZEX.

The correlation tables are also calculated of the relevant data and their calculated significance (Romano, 1977, pp. 156 - 160), where *,**,*** represent significance at the 1%,5%,10% level :

Table 5.3d.1 : Variable relationships and Coefficient of Correlation

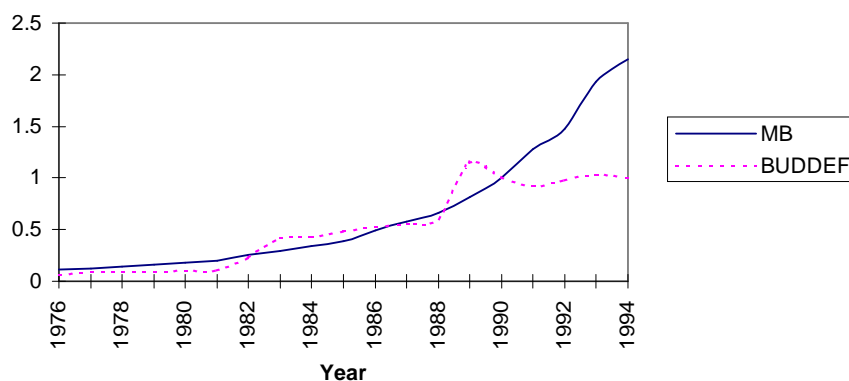
Variable	Statistic
MB-IMB(-1)	0.99042*
MB-EX	0.60766*
ZMB-ZIMB(-1)	-0.49472**
ZMB-ZEX	0.19110

¹⁰⁰The changes in the exchange rate reflect adjustments along the lines of policy objectives (i.e. “fine tuning”). For example, in 1986 India revalued against all major currencies; Nepal followed suit but revalued to a larger extent due to BOP considerations.

The coefficients of correlation for the raw data on MB vs. $IMB(-1)$ and MB vs. EX are highly significant at the 1% level and shows a positive relationship. The relationship for ZMB and ZEX has the same sign as the level data but is insignificant. Surprisingly the relationship between ZMB and $ZIMB(-1)$ changes sign and shows a negative coefficient of correlation which is significant at the 5% level. This result is consistent with the negative sign of the coefficient for $ZIMB(-1)$. Both significant results may be accounted for as stabilizing flow to maintain a trend where the flows are minuscule.

Finally, the Nepalese budget deficit and monetary base may have a positive relationship, due to monetization, thus the plots of their “raw” and “processed” data are viewed. The plot of their “raw” data are :

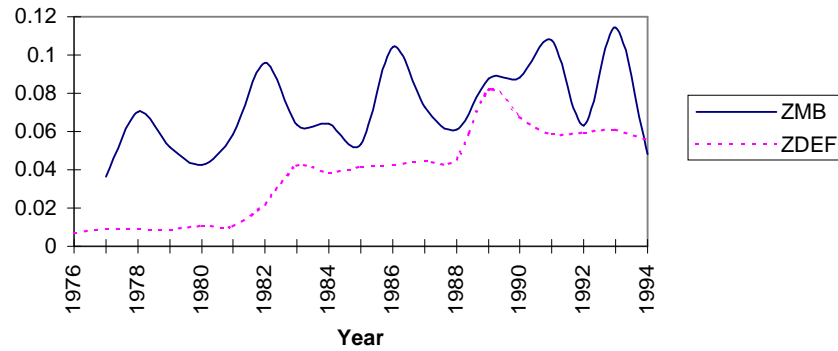
Figure 5.3d.3 : Plot of MB and BUDDEF



Once again the BUDDEF series shows evidence of a break occurring at about 1989. Prior to the democracy period both BUDDEF and MB appear to share a common trend. Surprisingly enough, the level of BUDDEF after democracy appears to stabilize; this observation suggests that the new democracy did not

increase **BUDDEF** to maintain popularity of the constituents.¹⁰¹ The plots of the growth data are :

Figure 5.3d.4 : Plot of ZMB and ZDEF



The plots of **ZMB** and **ZDEF** show little obvious pattern between the two variables. This observation is consistent with an insignificant coefficient of correlation :

Table 5.3d.2 : Variable relationship and Coefficient of Correlation

Variable	Statistic
MB-BUDDEF	-0.88758*
ZMB-ZDEF	-0.14039

The finding is consistent with the result of the regression which does not find a significant relationship between **ZMB** and **ZDEF**.¹⁰²

¹⁰¹ Indeed *ES* (p. 76) shows the last budget's receipt growth to be larger than expenditure growth and this is in line with financial discipline imposed externally by organizations such as the IMF during Nepal's initial majority government.

5.4 Analysis

Based on the signs of the coefficient estimates from equations 5.3b.6 and 5.3b.7, the Nepalese monetary authority seems to react negatively to lagged Indian monetary policy and react positively to the contemporaneous official exchange rate. The latter relationship¹⁰³ appears to be a coordination problem since the exchange rate corrects for a misalignment while the monetary base increases the misalignment leading into a depreciation-inflation cycle. However, this scenario does not hold up given the stability of the exchange rate over a thirty six year period. Rather, it appears that the authority is simultaneously using both tools in her arsenal to correct for a misalignment and achieve stability. On the one hand the Nepalese depreciation of the exchange rate can be interpreted as an adjustment to a perceived *permanent* misalignment of both economies by the domestic authorities by virtue of the stability of the exchange rate over the observed period (that is, “fine-tuning” the exchange rate and allow both the economies to once again share a common trend). On the other hand, the monetary base can be interpreted as adjusting to a perceived *temporary* misalignment since both countries do not face symmetrical real shocks. Thus the positive relationship can reflect a simultaneous adjustment to misalignment, using both the exchange rate and the monetary base tools by the domestic authority and this is consistent with the policy of the Nepalese monetary authority.

¹⁰² There is suggestive evidence that the monetary base is more correlated with net foreign exchange reserves (i.e. aid) than with government monetary operations (see Sharma (1984) and Poudya (1991)).

¹⁰³ The results are in line with those obtained by Bohara and McNown (1989) although the earlier study uses narrow money, as the policy variable, instead of the monetary base as above.

The sign of the coefficient on Indian monetary base growth is, at first instance, somewhat paradoxical since our prior, given the contiguous border and the stability of the exchange rate, would be of a positive relationship between Nepal and (lagged) Indian monetary base. However the negative relationship between ZMB and ZIMB(-1) is found perhaps because the Nepalese monetary authority may well be responding to real shocks with stabilizing monetary policy.¹⁰⁴ This is consistent both with the negative coefficient of correlation (-0.26309), although not significant at the 5% level, between one period lagged output and contemporaneous monetary base as well as with the observation of low short term capital mobility between both countries where the Nepalese monetary authority has some effectiveness. This explanation is also in line with the empirical results from the third chapter, which show that Nepal and India do not face symmetric real shocks and the fourth chapter, that contemporaneous monetary base conditional on output shocks was cointegrated at the first lag for annual data given similar price targets, of this Ph.D. dissertation.

Consider an example where Nepal faces a negative output shock. If this happened in a Mundell-Fleming world of flexible exchange rates and low short run capital mobility then Nepal's currency would appreciate vis-à-vis the Indian currency due to a balance of payments surplus. Since Nepal has a hard pegged exchange rate with India, the Nepalese monetary authority must increase the monetary base to maintain this exchange rate regime. In other words, by virtue of

¹⁰⁴ The results of Bohara and McNown (1989, p.50) are generalized, where they found strong seasonality in the data which "...may be a source of monetary instability which is correctable

not facing symmetric shocks while maintaining a rigid exchange rate regime, non-symmetric monetary policy between both countries is required. This result, from an interpretation of low short run capital mobility, is consistent with the policy response of the Nepalese monetary authority to unexpected real shocks with stabilizing policy (such as an accommodative stance if there is a negative agricultural shock etc..).

Another interesting point is the apparent dichotomy between the real and the monetary sector (also seen in earlier chapters). A striking example is that of the budget deficit was expected to have a positive relation between ZMB and ZDEF (or MB and BUDDF) since the budget deficit was monetized by the NRB.¹⁰⁵ No such a relationship is found in the data however. Rather, a leveling of the BUDDF was found after the advent of democracy. This is contrary to anecdotal evidence since the democracy period of Nepal has been marked by great political uncertainty and thus that expenditures are fast outpacing revenues. In part this non-relationship may be due to missing numbers since governments in developing countries tend to different accounting techniques. Also, since the advent of democracy in Nepal there has been a confusion about the validity of deficit figures given by each government. However, it appears that the initial stage of democracy, up to 1994, has improved discipline due to higher accountability, from a majority government, and through external discipline and this is consistent

through counter seasonal policies.” thus allowing for the observed stabilizing policy of the monetary authority and the resulting well behaved exchange rate.

¹⁰⁵ While a large government deficit (*IFS* code = f80a/f99ba) would be costly for Nepal to pursue a fixed exchange rate policy, a similar pattern of government expenditures in India, as suggested by the significant coefficient of correlation at the one percent level for budget deficit figures over the

with the data as well as government policy which has contributed to the stability of the pegged exchange rate.

5.5 Conclusion

This chapter provides a simple equation for Nepalese monetary base growth showing a positive relationship with the exchange rate and a negative relationship with lagged Indian monetary base. There is also empirical support for a regime shift after 1989. The results for the negative Nepalese response to lagged Indian money supply growth appear to be consistent with the third chapter which found that the two countries do not face symmetric shocks. Also, the stabilizing policy of the Nepalese monetary authority is consistent with empirical results of the regression analysis given the assumption of low capital mobility. This interpretation is explicitly tested for in the appendix to this dissertation for Nepal's offset and sterilization coefficient.

period 1964 - 1994, suggest that a similar level of government deficit between both countries allowed for the stability of the exchange rate.

5.6 DATA APPENDIX

1. $ZMB = \log (MB / MB (-1))$,

IFS # = **f14a** ; 1957 - 1994

MB is the Nepalese reserve money which is the sum of currency outside bank; frequently referred to as high-powered money and monetary base.

2. $ZDEF = (-1 \times BUDDDEF)/GDP$

IFS # = **f80a** ; 1957 - 1995

BUDDEF is the Nepalese Government deficit which is the difference between revenue, and if applicable, grants received on one hand and expenditure and lending minus repayments

IFS # = **f99ba** ; 1964 - 1994

GDP is the Nepalese Gross Domestic Product which is the sum of household consumption expenditure, government consumption expenditure, gross fixed capital formation, changes in inventories, exports of goods and services and imports of goods and services

3. $ZNDP = \log (CPI / CPI (-1))$

IFS # = **f64a** ; 1964 - 1994

DP is the Nepalese inflation rate which is measured by the changes in CPI, the cost of acquiring a fixed basket of goods and services by the average consumer.

4. $ZLR = LR - LR(-1)$

IFS # = **f60a** ; 1976 - 1994

LR is the Central Bank Discount rate which is the rate at which the monetary authority lend or discount eligible paper for deposit money banks.

5. ZIMB = Indian monetary base growth

Same as for MB where IMB (1957-1994)

6. ZIDEF = Indian Government deficit as a proportion of Indian GDP

Same as for NDEF where IDEF (1950 -1994) and IGDP (1950 - 1994) are defined as above.

7. ZIDP = Indian Inflation

Same as for NDP where IDP (1963 - 1994) is defined as above.

8. ZILR = Indian Lending Rate

Same as for LR where ILR (1963 - 1994) is defined as above.

9. $ZEX = \log (EX/EX(-1))$

EX = Official exchange rate to IC from Nepal Rastra Bank *Quarterly Economic Bulletin*; 1960 - 96.

10. $ZBP = \log (NBP*USD/GDP)$

IFS # = **f78al_da**; 1976 - 1995

USD = Official exchange rate to USD from Nepal Rastra Bank *Quarterly Economic Bulletin* for 1965 - 1996.

NBP is the credit minus the debit of goods, services, income and current transfers.

GDP is same as above.

11. $ZBMR = \log (BMR/BMR(-1))$

BMR = ratio of Nepal BMR to USD against Indian BMR to USD from various issues of World Currency Yearbook.

CHAPTER 6 : Summary of Empirical Results and Some Reflections

6.1 Introduction

How much has Nepal's peg with India constrained Nepal's monetary policy and whether Nepal's peg with India makes sense are the questions which are addressed in this dissertation. One objective of this chapter is to give a summary of the empirical results from this dissertation. Looking ahead, the evidence, while mixed, suggests that up to 1994 the current exchange rate and monetary policy, with respect to India, has not been bad.

One possible short coming of this dissertation is that the 1990 political regime shift in Nepal, from the guided democracy of the partyless panchayat system to the present post democracy period, had not been explicitly considered. In part this choice is justified since the effects of the regime shift had not shown up in the available data series and is consistent with some discipline in the fiscal authority up to 1994. However, Nepal's past political performance does not appear to be a good indicator of future political performance since after 1994 there have been a number of governments, with different ideologies, affecting the stability and consistency of economic policy. Thus another objective of this chapter is to show how the cost of maintaining the present exchange rate regime has changed after 1994. Looking ahead the costs are increasing and suggest that Nepal may not be gaining the full benefit of credibility from the present exchange rate regime. Additionally a possible scenario is explored where the 1990 political

regime shift increases political instability with spill over into economic policy. A quasi currency board is proposed since it signals commitment to monetary discipline.

The rest of this chapter is as follows : the next section gives a summary of empirical results for this dissertation, the third section discusses some effects of Nepal's 1990 political regime shift, the fourth section discusses some areas for further research while the last section ends with some reflections and concluding thoughts.

6.2 Summary of Empirical Results

On the whole, the evidence of this dissertation, while mixed, suggests that up to 1994 the current exchange rate and monetary policy of Nepal, with respect to India, has not been bad.

Looking at Nepal's exchange rate performance from the perspective of OCA criteria for the period up to 1994 it is safe to say that, while it has not been optimal, by many measures it has done well. On one hand Nepal was found to have low labor mobility, a closed and diversified economy with a large agricultural contribution relative to HK and Austria. This information points to a flexible exchange rate as less costly than having domestic macro economic adjustment. On the other hand Nepal's exchange rate experience to India was examined and found to be rigid and long lived, free from speculative attacks and financial crisis. This paradox is resolved when examining Nepal's relationship with India which, due to her open and contiguous border as well as many cultural

and historical ties, where the Nepal-India exchange rate has not performed so badly in relation to HK-USA and Austria-Germany from the perspective of trade share, inflation differentials, labor mobility, stability of RER and currency substitution suggest that a fixed exchange rate may be less costly.

One criteria which had been examined in detail, the patterns of shocks, suggests that Nepal and India are not suitable candidates for a currency area since they do not face symmetric patterns of shocks. However, this contrasts with the rigid and long lived exchange rate between both countries and the evidence given above. This suggests that some caution should be drawn from using a single OCA criteria to determine if the exchange rate policy makes sense.

These information on Nepal's exchange rate performance with India point to some mixed results although they suggest, on the whole, that Nepal's exchange rate policy with India has not done badly for almost a forty year period.

Nepal's monetary policy is examined through a monetary reaction function which suggests little relationship between the Nepalese and Indian monetary base; this conclusion is consistent with the VAR and cointegration analysis mentioned above. While these evidences point to the Nepalese and Indian monetary policy being independent of each other, this conclusion is hard to reconcile with an open and contiguous border, no capital controls as well as the large size of the Indian economy vis-à-vis the Nepalese economy. Further examination suggests that the agricultural economies of Nepal and India are influenced by the vicissitudes of the weather which add some noise into the analysis of monetary policy. When their respective economic structures are explicitly considered, the conditional Nepalese

and Indian monetary base show a long term relationship. This description of monetary policy is consistent with both the policy of the Nepalese monetary authority as well as with onsite discussions at the Nepal Rastra Bank. In other words, this finding may be generalized to say that comparing monetary policy via simple monetary variables may give misleading results.

While looking at Nepalese monetary policy, the mobility of short run capital was brought into question since it seemed that the NRB exercised some role in the short term. In other words, in my judgment, a plausible explanation for the relative stability of the pegged exchange rate between both countries is that the short term stabilization of the Nepalese monetary authority for output shocks,¹⁰⁶ given low capital mobility in the short run and both countries not facing symmetric patterns of shocks, may have contributed to the long term relative stability in the pegged exchange rate.¹⁰⁷ This suggests that the Nepalese monetary policy, in the context of the exchange rate regime, has performed well.

6.3 Some Effects of Nepal's Political Regime Shift

Although the analysis from this dissertation suggest that Nepal's exchange rate and monetary policy up to 1994 as a whole had done well, this conclusion may change when the effects of the 1990 political regime shift are finally felt in the economy. That is, in 1990 there was a political regime shift from the guided

¹⁰⁶ This has been given some indirect support in the fifth chapter by the negative, but insignificant, coefficient of correlation (-0.26309) between contemporaneous monetary base and lagged output as well as consistent with the policy of the NRB.

¹⁰⁷ This aspect is explicitly explored by calculating Nepal's sterilization and offset coefficient in the appendix to this dissertation.

democracy of the partyless panchyat to the present post democracy period which had a fundamental effect in economic policy, with a greater emphasis on trade liberalization and privatization whose effects can be seen in the sharply increasing trend toward openness after 1990,¹⁰⁸ as well as on society. While little effect is seen up to 1994, corresponding to the end of the majority government, looking ahead the cost of the pegged exchange rate regime are increasing. Also, an objective of this section is to put forward some policy prescriptions for Nepal taking into account the effects of the political regime shift on the economy and society. Looking ahead, a quasi-currency board is proposed since it both signals commitment to monetary discipline as well as increases the supervisory role for the nascent financial markets.

The sub-sections proceeds as follows : the next sub-section discusses the effects of the 1990 political regime shift on Nepal, the second sub-section presents a flow chart of how problems may occur, the third sub-section tentatively puts forward a quasi-currency board for Nepal while the last section concludes with some reflections on this proposal.

6.3a The Effects of the 1990 Political Regime Shift

As mentioned earlier, the results of data analysis, while mixed, point to no significant effect of the political regime shift on both real and monetary variables up to 1994. For example, Bajracharya and Maskay (1997) did not find a structural break in the aggregate supply response function of agriculture using standard

¹⁰⁸ The graph of openness over time for Nepal is given in Figure 2.4.1.

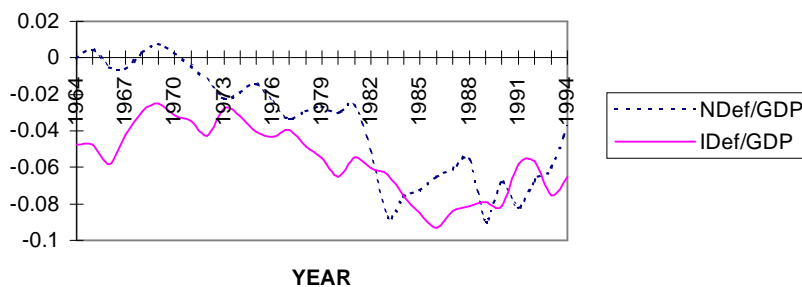
Chow tests¹⁰⁹ and this is consistent with the results for some chapters of this Ph.D. dissertation where standard Chow tests on output and inflation as well as recursive residuals up to 1994 for annual data were unable to find evidence of a structural break. On the other hand Maskay (1997a) found a structural break, albeit at the 10% level of confidence, in the monetary reaction function in 1989 corresponding to the transit dispute with India which preceded the 1990 political regime shift.¹¹⁰ Likewise some evidence of a structural change are suggested by Nepal's increasing level of openness after 1990 and the diversification of trade away from India. While the results, in balance, imply little or no effect on the economy, this conclusion must be tempered with the low power of the tests given that the expected break occurs near the tail end of the sample period. Also, the period up to 1994 saw a majority government who had assistance from external sources (such as the IMF) to maintain discipline (Maskay, 1997a) suggesting that the effects on government finances were delayed till after 1994. This later observation, of increased discipline via external sources, is given some support when government finance for Nepal and India, relative to their GDP, are "eyeballed" for the period 1964 till 1994 in the graph below :¹¹¹

¹⁰⁹ In Bajracharya and Maskay (1997) it was found that agricultural policy, where agriculture is over 40% of GDP at factor cost (preliminary estimate for 1995/96 from *ES*, Table 1.1), was least affected by the political regime change.

¹¹⁰ The 1989 transit dispute with India resulted in India closing most trade routes. Since most, if not all, traded goods have to go through India, the closure led to much hardship. It was finally resolved with the new government which was a result of the 1990 political regime shift.

¹¹¹ The statistics are calculated as the ratio of Government Finances to GDP (that is f80a/f99ba).

Figure 6.3A.1 : Budget Deficit to GDP for Nepal and India



“Eye-balling” the graphs suggest no break around 1990 although the Nepalese budget deficit, as a proportion of GDP, is sharply decreasing after 1991 up to 1994 which is consistent with the above analysis. Also, both graphs appear to move together, especially over the last twenty years, this is supported by statistics where the coefficient of correlation is 0.789 which is significant at the 1% level of confidence. In other words, while there is some suggestive evidence of a structural break in the economy, the data as a whole do not suggest that a significant effect on the economy could be found four years after the political regime shift in Nepal and this is in line with the results of this dissertation.

While no significant changes could be found in the data up to 1994 one perspective may be to look at the derived Black Market Rate (BMR), obtained from the ratio of the BMR for both the NC and the IC to the USD, which suggests at the market confidence towards both economies. This information, discussed in 5.3c, gives suggestive evidence of a structural break in 1990, whose graph is shown in Figure 5.3c.1, where the market was unwilling to hold the NC after 1989 except at a discount and may imply a lack of confidence in the new government

up to 1993.¹¹² While confidence may have been shaky towards the new Nepalese government for the initial years up to 1993, reflected in the discount of the NC BMR to the IC BMR, how has Nepal performed up to the present? Although hard data is not available, anecdotal evidence suggests an insignificant premium on the IC to the USD on the BMR, while a significant premium on the NC to the USD on the BMR indicating that the NC is sharply discounted against the IC; in other words, the evidence suggests falling confidence in the Nepalese currency.

This decline in confidence has a rough correspondence to the level of political instability, proxied by the number of governments, where great uncertainty was introduced into the political system given roughly one government a year (the past few have been coalitions) and the last government having fallen in late October 1997.¹¹³ The result has had an extremely negative effect on the civil service, with politicization of appointments and “brain drain” to other sectors of the economy (many anecdotal evidence as well as articles such as that recently in *The Kathmandu Post* (September 18, 1997)), as well as the shortening the time horizons of policy makers. A characteristic of the last coalition governments have been the need to put forward compromising agendas. In Nepal this has resulted in unrealistic agendas which are costly since they have no clear direction. Consider the Chand coalition government where the then Finance Minister Sharma was forced to walk a “tight rope,” for the proposed

¹¹² Another suggestive evidence of a regime shift in 1990 is that the nominal exchange rate for the NC to IC was undervalued against the RER prior to 1990, making imports of Indian goods cheaper and exports of Nepalese goods to India more expensive, however after 1990 there is suggestive evidence that the nominal exchange rate is slightly over valued vis-à-vis the RER.

government budget between, on one hand, the Communist Party who desired a populist budget to focus on poverty alleviation, and on the other hand, the policies of his party who desired a continuation of the previous programs of liberalization and economic reforms. In sum, while the budget grew by a modest 7.74%, the tax rate decreased “..in order to encourage businessmen and business organizations to increase and declare their real income” (Article 136, Budget Speech of the Fiscal Year 1997/1998; to be called BSFY 97/98).¹¹⁴ If revenue does not meet projections, as seems likely looking at both the past Nepalese revenue collection experience and the experience of other countries, then there is the potential for a larger budget deficit (than projected) and resulting higher inflation (Sargent and Wallace, 1985).

Also a characteristic of Nepal’s budget worth noting is its dependence on foreign aid; for example 35% of Nepal’s 1997/98 total budget relies on foreign aid (BSFY 97/98). While a growing foreign debt is problematic (i.e. dependence of foreign money (Joshi, 1997)), the changing composition of the aid is of more immediate concern. In 1960-61 100% of total aid was in grants while only 28% were so in 1997 (from Joshi (1997) and BSFY 97/98). The rest were in the form of loans which had to be paid back although most can be considered “soft loans.” Consider that the portion of “Loan Repayment and Interest” has been steadily

¹¹³ As the Nepalese parliament heads into the 1998 winter session, two of the largest parties, the Communists and the RPP, have split pushing the Nepal Congress to be, at present, the largest party in parliament.

¹¹⁴ The stratagem of Sharma was describes as gambling with the “Reagan-Thatcher strategy of low rates-higher tax collection” (from *Spotlight*, p.20).

increasing to encompass 13.2% of the governments total budget (BSFY 97/98).¹¹⁵

While this pattern does not appear to be due to the political regime shift since it had started in the 80's, this trend of debt servicing will be a growing additional expense on future budgets which will be problematic for the next government(s). Also, while the composition appears to be mostly in long term debt, rising interest rate may make it more costly to refinance the loans. In other words, there is an additional expense for the government which is growing over time.

Thus, all information points to the potential growth in Nepal's government deficit where Nepal's coalition governments appear to have forced expenditure to outpace revenue growth. Is this a problem for the exchange rate and monetary policy? Not necessarily so¹¹⁶ if either India faces the same pattern of government deficit growth or this is a short term fluctuation for Nepal from long term equilibrium. However, the argument is put forward that the 1990 regime shift has long term consequences where the present circumstances of Nepal's government make it more concerned with domestic political matters suggesting that the potential for divergence of government finances with India has increased. In other words, the growth in Nepal's government deficit is a problem both in the present and also, most probably, in the future.

6.3b Some Problems and Potential Results : A Flow Chart

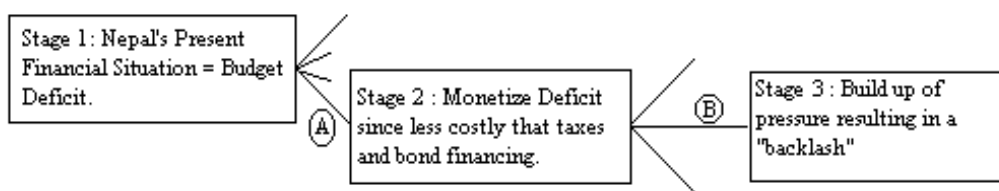
¹¹⁵ However these figures should be taken with a grain of salt, given the present controversy with the data in Nepal (from many sources; consider "Data Wars : Question of Legitimacy" from *Spotlight*), and it would not be surprising if actual figures were even larger.

¹¹⁶ Of course this situation would not be good for Nepal's economic development.

While the previous chapters have suggested that the Nepalese exchange rate and monetary policy has done well up to 1994, the last sub-section suggests that, at present, Nepal may not be gaining the full benefit of the exchange rate regime since a growing government deficit may make it relatively less costly for changes in the exchange rate. Should Nepal be worried by the effects of the 1990 political regime shift? Simply put, YES! The purpose of this sub-section is to put forward and elaborate a chain of events which show how problems may develop as a result of the 1990 political regime shift, why this scenario is plausible and finally a possible solution in breaking this chain of events in context of the exchange rate regime.

Consider Figure 6.3b.1 which show three stages for Nepal to move from her deficit to what is described as a public backlash where focus is narrowed to government finances and decisions concerning it :

Figure 6.3b.1 : Flow Chart of Potential Result of Larger Budget Deficit in Nepal



NOTE : Lines after each rectangular box denotes potential channels where circuled capital letters denote one particular channel discussed in the text below.

The first stage of the flow chart corresponds to Nepal's present situation discussed in the previous sub-section. Specifically, Nepal's situation can be described by the left hand side of the government Budget Constraint given below :

$$(6.3b.1) \quad G - T + rB = \frac{dB}{dt} + \frac{dM}{dt}$$

where G is the level of government spending (excluding interest payments on the government debt), T is the tax revenue, r is the interest rate on the government debt, B , and M is the level of the monetary base. That is, the left side of the equation shows that the government budget deficit consists primarily of the budget deficit ($G-T$) and the interest payment on the government debt rB . As previously stated in the last sub-section, G is increasing due to the need for compromising agendas reflected in Nepal's (coalition) post-democracy government(s), T is increasing but at a slower rate than G , and rB is also increasing, in part, due to the changing composition of foreign aid. The overall results suggest that the Nepalese government deficit is increasing over time. There are a number of ways to finance the government deficit shown in the right hand side of equation (6.3b.1). That is, the government deficit can be financed by issuing debt (i.e. bonds etc.) or by printing money. Since Nepal's bond market is developing, and thus easily saturated, it shall be less costly for the Nepalese government to address an increasing government deficit by increasing the money supply which is shown as channel (A),¹¹⁷ which follows from Sargent and Wallace (1985). This brings Nepal to the second stage where the budget deficit is monetized by the monetary authority by money creation. The effect of increasing the money supply, shown in channel (B),¹¹⁸ are numerous, however, it has been shown, for Nepal, through structural bottlenecks and through the monetarist

¹¹⁷ Also since money creation is the last source of revenue for a government it should be expected if other sources of financing are ruled out. However, Nepal has not reached this stage although monetary creation may be less costly to the government than other sources.

hypothesis, to result in inflation (Khatiwada, 1994). This, off course, leads to a number of problems such as a decrease in the efficiency of the pricing mechanism (Lucas, 1973) etc. although the significant pressure on the exchange rate will only occur if there is a divergence from inflation trends with India. However, as previously argued, the inflation trends are likely to diverge given that the new (coalition) government(s) are more focused on domestic political survival. Thus, leading to exchange rate and BOP disequilibrium vis-à-vis India. Channel (B) leads to the last stage of the chain which is termed a backlash from society; if the backlash is significant enough a reversion to a conservative regime may occur.

While the first and second stage as well as both the channels (A) and (B) seem plausible, is the third stage realistic? Since many countries experience double digit inflation and economic difficulties without going through a backlash, questioning the magnitude of the backlash is understandable. However, it is argued that stage three is likely given both the nature and the timing of the economic difficulties. That is, while justice cannot be given to the breadth of the 1990 regime shift, suffice it to say that, in addition to the policy changes in economics already mentioned, it brought about changes which forced a feudalistic society to meet modern times in a period of a couple of years. Of course, it goes without saying that it affected the maturity level of the political and economic scene where anecdotal evidence suggests that both are quite fragile. However, the timing is also crucial since there is growing resentment to the effects of

¹¹⁸ Actually, channel (B) has two parts which lead to the third stage. That is, inflation which results from an increase in the money supply and the effect of inflation which leads to cost in the Nepalese economy.

democracy. For example, the cities are urbanizing without direction leading to an increase in crime and pollution, something which was foreign to Nepal. Also, the growth and politicization of government has resulted in salient examples of corruption and inefficiency which are not meeting the people's expectation of democracy.¹¹⁹ In other words, while the economic cost from increasing the money supply may be relatively small, taking in context, they are the reflection of the failings of people's expectations of the new democracy. Thus, it does not seem far fetched that the economic difficulties are the proverbial straw that broke the camel's back.

While this chapter does not elaborate on the contribution of the present political regime an interesting question asks if this rather pessimistic scenario is really inevitable. Looking at the flow chart in Figure 6.3b.1, each stage is dependent of the successful completion of the past stage suggesting that if any one of the "chains" are broken a new, hopefully less pessimistic result, would occur. This therefore necessitates further elaboration on each stage in the "chain" to produce a possible solution. As mentioned earlier, stage one presently describes Nepal's situation; can the "chain" be broken here before it occurs? That is, can an increase in revenue or a decrease in government expenditure prevent a significant government deficit? Revenue growth, on one hand, can be increased in a number of ways such as collection efficiency, the state of the economy, etc. This suggests that there are limits to how fast revenue can grow and thus may make the

¹¹⁹ Likewise, this scenario is not unrealistic since such a situation occurred unsuccessfully, experienced first hand, in the Philippines after the Marcos regime was toppled and may be occurring in Russia and some of the FSU countries.

assumption, for simplicity's sake, that revenue growth is limited, reasonable. On the other hand one way of decreasing government expenditures may be to change the incentives for politicians to spend more. However, the desire to consume without bounds is a problem present all over the world, to various extents, and suggests that a solution for Nepal may be difficult to obtain especially with new government(s) whose position is not strong. This suggests that a solution is not forthcoming in the first stage of the above mentioned chain of events. Likewise, the third stage simply relates the results of increasing the money supply thus it appears that a solution, if any, must only be found in stage two only.

As mentioned earlier, stage two results as the monetary authority agrees to finance the government deficit through money creation. However, what happens if the monetary authority does not monetize the deficit? Then the government may have to discipline expenditure or face greater cost to the economy with increasing interest rates.¹²⁰ One avenue which may prevent the politicians from monetizing the deficit is to imbue some internal discipline to the monetary authority through, for example, a more independent central bank (Rogoff, 1985).¹²¹ This potential has been recognized by His Majesty's Government (HMG) when they state that the "autonomy of the Central Bank is necessary to orient the economy in the right direction." (Article 32 in BSFY 97/98); HMG goes on to say (Article 49 in BSFY 97/98) :

¹²⁰ Of course, an increase in the interest rate allows the deficit to be financed by an inflow of capital although it may increase the interest repayment for the debt.

¹²¹ It is interesting that prior to the 1990 regime shift the structure of the central bank worked to the benefit of the economy however at preset its structure may be more of a liability since it cannot credibly stand up to the pressure from the government to monetize the deficit.

“Due to the reason that His Majesty’s Government itself being not able to adhere to fiscal discipline, overdrafts taken unrestrictedly in the past years have caused negative impact on national economy. Therefore, the necessary bill limiting His Majesty’s Government’s authority to issue overdraft not exceeding one billion rupees from Nepal Rastra Bank will be soon introduced to this august House. Ministry of Finance will adhere to this principle from the very beginning of the next fiscal year.”

However, this avenue, while valid, is outside the scope of the paper. Another solution presents itself by developing an external source of discipline in the form of the exchange rate regime where the government tries to “tie-their hands” by credibly fixing their exchange rate.¹²² In the limit with perfect capital mobility in the Mundell-Fleming world, monetary policy is completely ineffective in a fixed exchange rate regime (Tower and Willett, 1976). Since the Nepalese exchange rate regime at present can change without cost it is easy for the government to finance the deficit via a monetary expansion. Thus, the question arises, what type of fixed exchange rate will increase the cost to government of having a deficit and break the “chain of events” discussed in the last sub-section?

6.3c Exchange Rate Regimes and Quasi Currency Boards : A Digression

This sub-section considers various fixed exchange rate regimes to break the “chain of events” assuming that its implementation is a viable possibility. Since the objective is to use the exchange rate regime to discipline the actions of the monetary authority, the choice is limited to two forms of the fixed exchange rate

¹²² One way is to credibly “tie the hands” of the government via an external source such as an exchange rate peg (see Giazvazzi and Pagano (1988)).

regime.¹²³ First, the (hard) pegged exchange rate of Austria-Germany is similar to Nepal's current exchange rate regime; however for Nepal, with small internal discipline and the relatively small cost for revaluation, makes this regime essentially flexible. A stronger form of fixed exchange rate, the currency board,¹²⁴ is considered, which has a statutory obligation to exchange on demand local currency for the foreign money and foreign money for local currency at the fixed exchange rate stipulated in the legislation establishing boards. In other words, a currency board passively supplies the demand for currency and, in the process, provides the country's monetary base making the cost to changing the exchange rate quite large thus eliminating the need, and therefore effectiveness, of monetary policy. Thus, the currency board experience of HK-USA is reviewed as a mechanism to enforce some external discipline with some application to Nepal-India.

In 1983 Hong Kong applied a currency board against the US Dollar where the Hong Kong Exchange Fund held all the reserves of the county (i.e. gold, silver and hard currency such) and then issued certificates of Indebtedness to banks which issued notes. The HK-USA exchange rate has been quite stable with a variation of 5% against the period average although if limited to the period to 1984 - 1996, then variation decreases to 0.8%.¹²⁵ How does this exchange rate performance compare with past Nepal-India exchange rate performance? There was a 9% exchange rate variation for Nepal-India from 1983 to 1996 however if

¹²³ The last section discusses how realistic this suggestion may be.

¹²⁴ For reviews see Fieleke (1992), Liviatan (1993), Schwartz (1993) and Williamson (1995).

¹²⁵ This statistic is simply the ratio of the period standard deviation to the period average.

limited to the period 1986 to 1996 (limited due to a depreciation in 1986 to correct a reserve imbalance; see Maskay (1997a)) the variation drops to 2%. While the later figure is low, it is much larger than that of HK-USA exchange rate variation suggesting that for Nepal some exchange rate flexibility is necessary vis-à-vis India. If a currency board is applied with the IC as the reserve currency, and past performance is taken as an indicator of future performance, then some adjustment will have to come from the Nepalese economy. On the other hand, application of a currency board may increase the level of economic integration decreasing the need for adjustment of the domestic economy vis-à-vis India. However, it is likely, given the political regime shift, that there will be increasing short term cost necessitating relatively large domestic adjustments. However if the government can credibly signal their commitment for the currency board, this may decrease the amount of adjustment in the medium and long term from BOP disequilibrium by favorable affecting expectations.

Also, as the third chapter has shown, while the developing structure of both economies are similar, both Nepal and India do not face symmetric shocks. This suggests, *ceteris paribus* with low short run capital mobility, that some short-term stabilizing policy is necessary and is consistent with the policy and actions of the Nepalese monetary authority (Maskay, 1997a). However a currency board eliminates the creation of money. This may force the domestic economy to bear the full burden of adjustment. However, recent cases such as the Hong Kong

Currency Board, have moved away from the classic currency boards,¹²⁶ and may present some insight into this problem and is certainly an avenue for further research.

Also, the stage of economic development should be considered which suggest that the interaction of the monetary authority should not end simply with stabilizing policy. Rather, the Nepal Rastra bank should act as “..a natural leader in the efforts to improve a nations financial system.” (Meek, 1991, p.22; also Chhibber, 1997). This is true for developing countries in general and Nepal in particular. Since the advent of democracy in Nepal there has seen a boom to the consumer industry¹²⁷ and a growth in the financial sector with many finance companies and joint venture banks to cater to the new middle class and rich. With over fifty such institutions over a five year span and at present funds idle (there are no loan candidates although they have a cost to holding the funds leading them to take more risk) suggests a crisis in the making.¹²⁸ Thus, a supervisory role of the central bank may head off a potential crisis. Unfortunately, the possibility of financial collapse in Nepal, at this stage of their financial development, is very real. This is especially true in the current situation where financial institutions are presently facing both an oversupply of funds (anecdotal and from discussions) as

¹²⁶ The Hong Kong Exchange Fund has acquire the power to conduct open market operations, issue three month treasury bills and open a discount window. These changes move the Exchange Fund away from a classic Currency Board with a more discretionary role although not to the extent of other currency boards such as Singapore and Estonia (Bennett (1994) and Williamson (1995)).

¹²⁷ In this case a “boom” is characterized by an increase in land price (over 1,000 fold) which supports the consumer goods sector (by using land as collateral for loans) with minimal direction of funds into productivity; keeping in mind that the nominal per capita of Nepal is roughly USD 200 and land price are in the range of USD 200,000 for a small plot of land.

¹²⁸ Conversing with the World Bank Resident Representative in Kathmandu he conveyed concern at the fragile nature of the financial sector in Nepal.

well as some questionable loans.¹²⁹ Since financial institutions depend on the confidence to return funds, problems with perception can be very volatile; this is especially so in Nepal with no insurance on deposits. Liquidity problems are made more difficult in a pure currency board since the monetary authority cannot act as a lender of last resort due to its inability to issue domestic currency. This may magnify the effect of one company failing since a collapse of even one company could have a domino effect on the whole fledgling sector. Thus the developing Nepalese financial markets may necessitate the provision for the currency board to assist financial institutions given a liquidity problem. Such a case would be similar to Estonia and Singapore (Bennett (1994) and Williamson (1995)) which allows the “central bank” to lend up to the limit of their holding in foreign currency.

In other words the monetary authority of Nepal can be structured in line with a classical currency board although with some mandate for supervision as well as, in the worst case, to act as a banker of last resort. While a quasi-currency board is put forward to limit the government deficit, some of its shortcomings are noted. On one hand, applying a currency board simply “reinforces a commitment to fiscal discipline, but it is not clear that it could create such a commitment where it does not already exist.”¹³⁰ Thus, a quote about Singapore’s situation by Dr. Goh

¹²⁹ This would be along the lines of the recent article in *the Wall Street Journal* of October 6, 1997 entitled “Caveat Lender : Southeast Asian Banks Contribute to a Bust in the Economic Boom” by Darren McDermott and David Wosell.

¹³⁰ This implies the need for political will (Tower and Willett (1970)) and has been given recent empirical support from Cohen (1993) for the sustainability of six currency union.

Keng Swee, Deputy Chairman of the Monetary Authority of Singapore and former Deputy Prime Minister, nicely illustrates this point (from Fielieke pp. 22 -23) :

“..when the Monetary Authority of Singapore (MAS) was set up, the Chairman was by law the Finance Minister. World Bank experts advised us against this...The World Bank believed that putting the Finance Minister in charge would be like asking a cat to look after fish. But Singapore has always worked on the principle that government expenditure...must be paid for out of government revenues...Successive Finance Minister have been doing just this. They do not need an independent Central Bank Governor to persuade them not to run budget deficit. But if the electorate...persists in wanting the good life without working for it, constitutional safeguards cannot stop foolish behavior.”

In other words, a currency board does not prevent a government deficit, but it simply increases the cost for having a budget deficit. Likewise another shortcoming is the belief that the currency board addresses for external confidence. While this may have been the case of Hong Kong, who was able to utilize the currency board in 1983 to weather the confidence crisis from fear of Beijing's intentions,¹³¹ the present speculative attacks on Hong Kong do not appear to have a base when viewing the economic fundamentals as well the significant reserves of Hong Kong.¹³² On the whole the choice of a currency board is mixed, while it may not be a panacea for discipline and problems, it does signal the commitment by the government to limit the cost and may bring some positive benefits.

6.3d Conclusion and Some Reflections

¹³¹ Also more recently for Argentina and Estonia (Bennett (1994) and Williamson (1995).

¹³² This would increase significantly if China should lend a hand.

Looking back, the evidence from this dissertation suggests that Nepal's exchange rate and monetary policy has not been bad up to 1994. Also, the 1990 political regime shift, while showing no effect till 1994, has been suggested to make the maintenance of the present exchange rate regime quite costly. The later part of this sub-section discusses a chain of events whose end result may well be a backlash against the present democracy. A solution is put forward within this framework and two observations result. First, that the vehicle put forward results in larger short term cost (i.e. having the domestic economy adjust rather than the exchange rate) vis-à-vis a more flexible exchange rate. That is, the proposal is contrary to the direction put forward by OCA since it would be less costly for exchange rate movements vis-à-vis changes in the domestic economy. However, if some truth is given to the argument above, there may be a net benefit over the long term to balance the higher short term costs. Thus the short term choice may not correspond to the simple direction put forward by OCA if a longer perspective is taken.

Secondly, one important step has not been adequately discussed in the previous sub-section. That is, a quasi-currency board had been put forward for Nepal although the crucial step of, say passing it through parliament etc., was assumed away. While this step is important, does it detract from the analysis? This question is important since a quasi-currency board, or any such mechanism to enforce discipline, may be unrealistic given that the present state of politics in Nepal which may make the legislative branch too weak to both consider any such bill and bear any such (short term) costs which result from it. However, the core

of this section still stands, that is, the 1990 political regime shift has changed the result of the cost benefit analysis of the dissertation making it more costly for Nepal to maintain her present exchange rate and monetary policy. Also, if nothing is done to limit the costs then a back lash is likely which may force a reversion to a more conservative regime.

6.4 Some Directions for Future Research

Looking back, some areas of Nepal's monetary and exchange rate policy have been made clearer, however, this clarity has shown additional areas which are murky. This section comments on areas for further research and extension.

One area is exploring in greater detail the channel which has reduced the cost of the pegged exchange rate. On one hand, the small open economy with a relatively stable exchange rate would suggest that Nepalese monetary policy is impotent in both the short and long run although in the short run there may be a possibility for sterilization if capital mobility is high but not perfect. On the other hand, a plausible case was made for stabilizing monetary policy however this would only be effective if in the short run there is low capital mobility. As stated, there are mixed results and this dissertation was not able to come to some definitive answers even though estimation of the sterilization and offset coefficients were, unsuccessfully, attempted.

Another extension is to keep track of the political developments and how they affect Nepalese monetary and exchange rate policy with respect to India; in many ways, the present problems Nepal faces are similar to those faced by

emerging market economies. For example, consider that Nepal's plans to liberalize her Capital Account, are similar to those of the former Soviet Union nations. In other words, many insights may result from this development since the pace of change in Nepal is quite high.

While this is by no means a comprehensive series some insight is possible. However there are difficulties associated with developing countries in large part due to data considerations which will only be addressed in time.

6.5 Some Concluding Thoughts

The findings from this dissertation suggest that both Nepal's exchange rate and monetary policy has done well up to 1994.

However, the question still remains, does Nepal's peg with India make sense? One way to answer this is to look at the performance of the peg which seems to suggest, by the relative stability, that it does make sense. However, more difficult to quantify is to ask whether Nepal's economic development would have moved differently if the peg had not been in place due to, for example, spill over of Indian inflation etc. It seems that before the 1990 political regime shift Nepal would have benefited from a more flexible exchange rate since there was more instability, proxied by the number of assassinations, wars etc., in India than in Nepal leading to a higher level of inflation than should have been. In other words it seems that before democracy the peg with India did not make sense. However after democracy it would seem that the peg, at least in the early stages, had introduced some discipline to the Nepalese government. Likewise a scenario and

implication of increased instability were discussed where a quasi-currency board was tentatively proposed as a credible commitment mechanism to discipline. Thus, the peg may not have made so much sense prior to democracy and its present form may similarly make limited sense although the concept of a credible fixed exchange rate to import discipline seems to make more sense. In some ways the transition to democracy has made the need for discipline more important than the, at present, negative effects of inflation spill over from India.

Also Nepal's pegged exchange rate seems to have allowed the potential for some role to the monetary authority, with caveats noted, to meet the short term noise from a developing, agricultural based, economy. However, the actual mechanism, via sterilization or changes in the monetary base etc., have to be explicitly determined. Thus, the peg does not seem to have significantly constrained the effectiveness of short run monetary policy.

Recalling Mundell's (1961) definition of a currency area, Nepal may, in a sense, be in a quasi-currency area since Nepal's pegged exchange rate with India is relatively rigid. That is, Nepal's exchange rate policy has allowed both the flexibility from India's exchange rate movement to maintain some level of long term balance vis-à-vis the rest of the world and the peg has allowed flexibility to maintain some level of long term balance of payment equilibrium vis-à-vis India. Likewise, the monetary authority appears to play some role in reducing the short run cost of maintaining the peg given the developing nature of both countries. However the future may not be so kind to the present exchange rate regime. Rather, one plausible scenario given some of the preceding arguments, is to

adhere more closely to a currency area that not, as an avenue to limit the long term
cost and allow the present political regime to

APPENDIX 1 : Estimation of Nepal's Offset and Sterilization

Coefficient

The results from this dissertation are mixed on the independence of Nepalese monetary policy. One way to test this is to estimate the offset and sterilization coefficient for Nepal. A method is proposed, heavily drawn from Sarjito (1996), where two equations are put forward to take into account simultaneity effect.¹³³

The Capital Flow Equation is taken from Sarjito (1996) where :

- Net private flows is replaced by net foreign assets due to data constraints.
- Domestic component of the monetary base is replace by the monetary base, for consistent with the monetary reaction function obtained in Maskay (1997a).
- The foreign interest rate is proxied by the Indian call money rate.

Thus, the capital flow equation, where data definitions and sources are given in the data appendix, is :

$$ZNFA = a_0 + a_1ZMB + a_2ZNNY + a_3ZNCA + a_4ZILR + e$$

where the offset coefficient, a_1 , takes a value between 0 and -1 where the magnitude indicates the fraction of the change in the monetary base that is offset by capital inflow. The Monetary Policy Reaction Function, on the other hand, is

¹³³ The data set accept the null of a unit root at the 20% level and reject the null of a unit root in the log differences at the 10% level (p=0.06048) which is consistent with Maskay (1997a) for annual data; also, Chow test for structural breaks are run but accept the null of no structural break at the 20% level for 1989, 1990 and 1991.

taken from Maskay (1997a), where the final equation is supplemented by net foreign assets to take into account pressures from the external sector; it is :

$$ZNMB = b_0 + b_1ZNFA + b_2ZIMB(-1) + b_3ZER + b_4D1989 + e$$

where b_1 is the sterilization coefficient which takes a value of -1 if complete sterilization is present and 0 if sterilization is not practiced. 3SLS is run for simultaneous estimation (Sarjito, 1997). The results, using annual data, are :

$$ZNFA = (-0.036) + (0.694) ZNMB + (-1.746) ZNNY + (-2.706) ZNCA + (0.020) ZILR$$

$$(0.870) \quad (0.564) \quad (0.078) \quad (0.095) \quad (0.187)$$

$$R^2 = 0.266 \quad DW = 1.593$$

$$ZNMB = (0.280) + (0.105) ZNFA + (-0.864) ZIMB(-1) + (1.019) ZER + (0.038) D1989$$

$$(0.000) \quad (0.079) \quad (0.000) \quad (0.000) \quad (0.001)$$

$$R^2 = 0.844 \quad DW = 2.150$$

The regression results are mixed. On one hand the Nepalese monetary authority sterilizes. On the other hand the insignificant offset coefficient is not consistent with the open border, no restrictions on capital and labor mobility as well as Nepal's economic size relative to India although these results may be reflected in the low R^2 of the capital flow equation. ¹³⁴

¹³⁴ These results contrast with Khatiwada (1994, p. 122 - 123) who found both the sterilization and offset coefficient large and significant by looking at changes in both the net foreign assets and net domestic assets as a proportion of disposable high powered money.

There are other possible avenues to address the poor performance in the capital flow equation. One avenue is to increase the frequency of the data from annual to quarterly as in Sarjito (1997), however, this necessitates that all the real data will have to be left out of the regression. Running the regression with only monetary data leads to almost all the coefficients being insignificant as well having a low fit for both equations. This suggests that real sector data are important and introduces some essential information. Other combinations were attempted :

- Replacing ZNCA with ZNCAI which simply considers Nepal's trade balance vis-à-vis India given in data appendix.
- Including an output variable in the monetary reaction function.

The regression results were similar to the results given in the prior equations in terms of which variables were significant and which were not. In other words ZIMB(-1), ZER and D1989 were significant at the 1% level while all the other variables were not significant at the 5% level. While many avenues have been covered this is by no means a comprehensive analysis and thus is simply flagged for future researchers.

Appendix 1 : DATA APPENDIX

The variables are as in 5.6 unless otherwise noted :

1. $ZNRY = \log(NRY / NRY(-1))$

IFS # = **f99b_pa**

GDP at 1990 prices.

2. $ZILR = \log(ILR)$

IFS # = **f60ba** ; 1948 - 1995

ZILR = the India Call Money Rate at which short-term borrowings are effected between financial institutions.

3. $ZNCA = \log(NCA * USD / NNY)$

IFS # = **f78al_da**; 1976 - 1995

NCA is the credit minus the debit of goods, services, income and current transfers.

USD is official exchange rate of NC to USD from *Quarterly Economic Bulletin* for 1960 - 1996.

NNY is same as above.

4. $ZNCAI = \log(NCAI * USD / NNY)$

NCAI = Trade Balance with India from Table 6.1 of 95/96 *Economic Review* of Nepal's Ministry of Finance

5. $ZNFA = \log(NFA / NFA(-1))$

IFS # = **f31n**; 1957 - 1994

NFA is foreign assets (net) which equals the sum off foreign assets less the sum of foreign liabilities.

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