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Botswana's External Sector Performance: 2007 to 2010

Geoffrey S. Ncube[1]

Abstract

This paper discusses the consequences of the recent economic recession emanating from the persistent financial crisis that resulted from the bursting of the United States of America's housing market bubble. The main focus is on the effects of the recession on Botswana, especially focusing on the balance of payments outturn, and other external sector variables. In that regard, the Botswana economy was not spared the negative impact of the economic recession. Several areas of the economy were adversely affected, especially the external sector as shown by the deteriorating balance of payments accounts. Exports of major commodities were seen to be declining, while imports remained high and rising due to the continued need for inputs in some of the key sectors of the economy, as such worsening the balances in the account. Foreign exchange earnings were also affected as witnessed by the decrease in investment income, largely due to the poor performance by global capital markets. There was also a general decline in the global economy following the recession, with many primary commodity export dependent African countries being affected. The paper has attempted to give a picture of the developments following the recession in the form of charts, graphs and tables, which help to analyse the extent of the recession.

1. Introduction

The purpose of this paper is to review Botswana's external sector performance, focusing primarily on the period 2007 to 2010, when the credit crunch hit the world economies, which was followed by the global recession. The paper is based on data mainly published by Bank of Botswana (BoB), Statistics Botswana (SB), the Ministry of Finance and Development Planning (MFDP) and a few other sources.

The paper reviews Botswana's key balance of payments components. Box 1 presents the general structure of balance of payments. The paper also touches on other aspects, such as the country's International Investment Position (IIP), external debt, external assets and recent exchange rate developments. There are six sections: Section 1 – Introduction, Section 2 – Global Trends, Section 3 – Botswana's Balance of Payments Performance, Section 4 – External Asset and Liability Developments, Section 5 – External Debt, and finally Section 6 – the Conclusion.

2. Global Trends in Brief during the Recession

This section focuses on some key indicators of global trends, among them Gross Domestic Product (GDP), which will then be compared to the national trends. The mechanisms through which countries were affected by the recession include, among others, the contraction in global trade and the related collapse in the primary commodity exports, on which developing countries are dependent for their foreign exchange earnings. The global economy was also affected negatively in the areas of foreign direct investment and migrant worker remittances, which form a substantial amount of capital inflows for some developing countries. There were also visible cuts in foreign aid globally, with Africa proving to be more vulnerable to the downturn in this area. Aid levels to Africa are also expected to drop in 2011 and 2012, as the developed nations experience continued fiscal strains and political pressures to balance their budgets.[2] African economies are among the least exposed to the global financial system and thus held less of the 'toxic assets' that helped spark the crisis. Despite this positive stance, African economies were not spared the wrath of the crisis which deepened into a global economic recession, affecting export of primary commodities.

African economies are the least diversified of all the developing countries, with many of them reliant on primary commodity exports, which make them highly susceptible to external shocks. According to the World Trade Organisation press release of March 2010, world trade contracted by 12.2 percent in 2009, with African economies suffering the most from the decrease in global demand. Exports from countries falling under the African Growth and Opportunity Act (AGOA)[3] declined by over 60 percent in the first half of 2009, in comparison to the same period in 2008. Botswana, which also benefited marginally from AGOA, was generally affected, with textile exports declining from P2.8 billion in 2007 to P1.1 billion

1 G. S. Ncube is a Principal Economist in charge of the Statistics and Information Services (SIS) Unit, which oversees the Balance of Payments, Monetary Statistics, and Information and Database Services Sections of the Research Department of the Bank of Botswana. The views expressed in this paper are those of the author and do not necessarily reflect those of the Bank of Botswana.

2 AfDB / Committee of African Finance Ministers and Central Bank Governors Established to Monitor the Crisis, *Impact of the Crisis on African Economies-Sustaining Growth and Poverty Reduction: African Perspectives and Recommendations to the G20, March 21, 2009.*

3 The African Growth and Opportunity Act is a United States of America (USA) trade preference programme that provides certain goods from Sub-Saharan Africa duty-free access to the US market.

Box 1: Balance of Payments[1]

A Balance of Payments account is a statistical statement of a double entry system of record of all economic transactions (involving foreign payments) between residents of a country and the rest of the world carried out over a specific period of time, usually a year. As stated in the Balance of Payments Manual Sixth Edition (BPM6), the principle of double entry bookkeeping in the balance of payments implies that the sum of all international transactions – current, capital and financial – is in principle equal to zero. As such, it is expected that debits and credits in balance of payments should net out to zero. The balance of payments statement comprises three key accounts, namely, the Current, Capital and Financial Accounts. At the end they are balanced by an important item in balance of payments known as 'net errors and omissions' (E&Os).

1. The Current Account records transactions relating to goods, services, income and transfers. This balance shows the difference between the sum of exports and income receivable and sum of imports and income payable, where exports and imports refer to goods and services.

Goods – These are movable and physical in nature, and in order for a transaction to be recorded under "goods", a change of ownership from/to a resident (of the local country) to/from a non-resident (in a foreign country) has to take place. Movable goods include general merchandise, intermediate good and non-monetary gold. An export is marked as a credit (money coming in) and an import is noted as a debit (money going out).

Services – These transactions result from an intangible action such as transportation, business services, tourism, royalties or licensing. If money is being paid for a service, it is recorded as an import (a debit); and if money is received**,** it is recorded like an export (credit).

Income – Income is money going into (credit) or out of (debit) a country from salaries, and portfolio investments (in the form of dividends, for example). Together, goods, services and income provide an economy with fuel to function. This means that items under these categories are actual resources that are transferred to and from a country for economic production**.**

Current Transfers – Current transfers are unilateral transfers with nothing received in return. These include workers' remittances, donations, grants and official development assistance, among others. By their nature, current transfers directly affect the level of disposable income and influence the consumption of goods and services.

2. The Capital Account – this account covers transactions between residents and non-residents regarding acquisitions and disposals of non-produced, non-financial assets such as land, leases, patents and licenses. It also includes capital transfers, such as grants for investment purposes.

3. The Financial Account records transactions that involve financial assets and liabilities, and that take place between residents and non-residents. As such, it shows the net acquisition and disposal of financial assets and liabilities. Financial account transactions appear in the balance of payments; and because of their effect on the stock of assets and liabilities, they also appear in the integrated International Investment Position (IIP) statement. Entries in the financial account can be corresponding entries to goods, services, income, capital account, or any other financial account entries. For example, a corresponding entry for an export of goods would be an increase in the currency and deposits in the financial account. Like other balance of payments accounts, the financial account can be in surplus or deficit. When in surplus it means that the economy is supplying funds to the rest of the world, hence net lending, while a deficit signifies the opposite, i.e., net borrower.

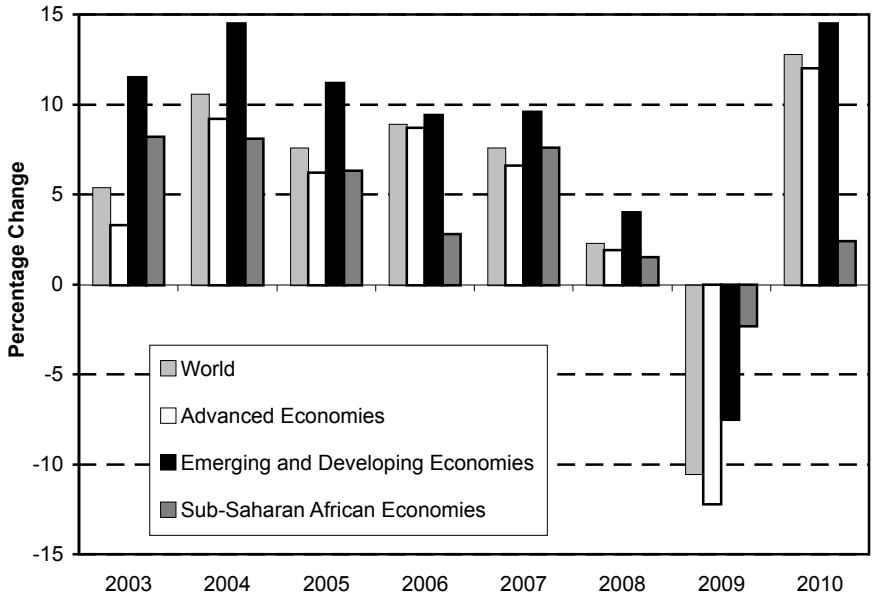
4. Net Errors and Omissions (E&Os) record the statistical discrepancies that arise in collecting balance of payments data. When all actual balance of payments entries are totalled, the resulting balance will almost inevitably show a net credit or a net debit. That balance is the result of errors and omissions in compilation of statements. In the balance of payments, the standard practice is to show separately an item for net errors and omissions. Some compilers label this as a balancing item or statistical discrepancy, which, put differently, is an item intended to offset the overstatement or understatement of the recorded components.

1 The bulk of the explanations on the balance of payments concepts are based on the Balance of Payments Manual Six Edition (BPM6).

in 2010. However, the IMFs World Economic Outlook (WEO) publication of September 2011 indicated that in 2010 the world economy grew by over 5 percent, with recovery in some of the key export markets.

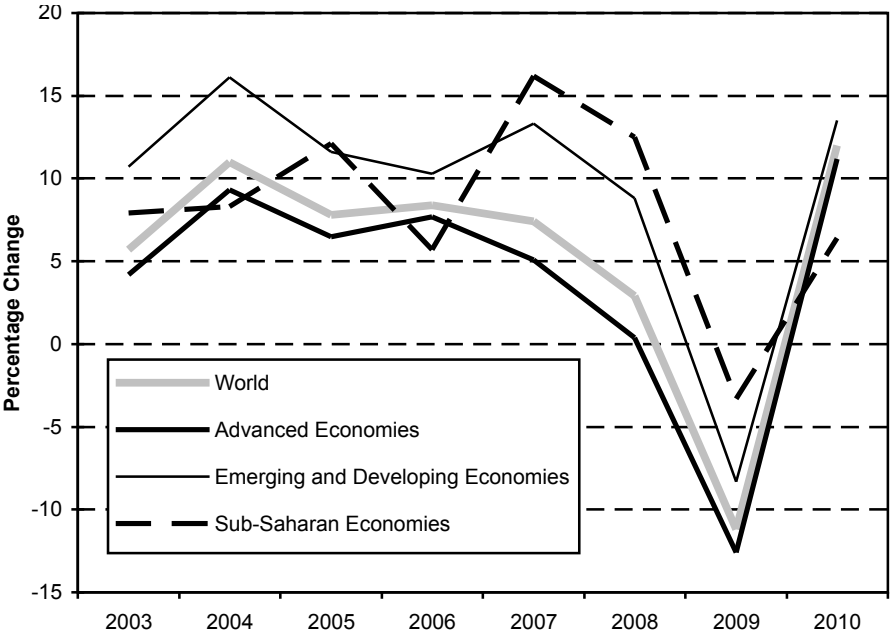
In Botswana, the recession was considerably milder than had been expected, with growth resuming in the second quarter of 2009. Imports by Botswana did not decline as much as exports did during the period 2008 to 2010, with a growth rate averaging 17 percent (including growing by 42 percent in 2008 alone),[4] as opposed to average export growth of 2 percent (see Table 1). Figures 1 and 2 show trends in volumes of exports and imports of goods and services for the world and selected regions, in percentage changes. It would be observed from the two figures that for both exports and imports of goods and services, emerging and developing economies performed relatively better than advanced economies. The decline in both exports and imports of commodities and services for the Sub-Saharan Africa (SSA) region was not as severe as the other regions. They also rebounded earlier, but at a slower pace. In fact, in 2010 it was observed in the WEO report that SSA was showing solid macroeconomic performance, with many economies growing at rates close to their pre-crisis average.

FIGURE 1: EXPORT VOLUME OF GOODS AND SERVICES



Source: World Economic Outlook, IMF (September 2011)

FIGURE 2: IMPORT VOLUME OF GOODS AND SERVICES



Source: World Economic Outlook, IMF (September 2011)

However, by 2010 many economies were recovering from the recession, helped in some cases by the implementation of some economic stimulus packages, with international financial institutions such as the International Monetary Fund intervening with rescue packages where necessary. Countries with solid macroeconomic governance, such as Botswana, also chose to seek international financial assistance to cope with the impact of the crisis. Among some of the financial assistance packages provided to Botswana, was the African Development Bank's (AfDB) budgetary support loan of USD1.5 billion. As was the case with other IMF member countries, Botswana was also allocated SDRs by the IMF as a way of providing funds to lessen the effects of the recession.

Annual GDP growth in Botswana has out-per-

TABLE 1: BOTSWANA'S EXPORTS AND IMPORTS (AVERAGE GROWTH RATES)

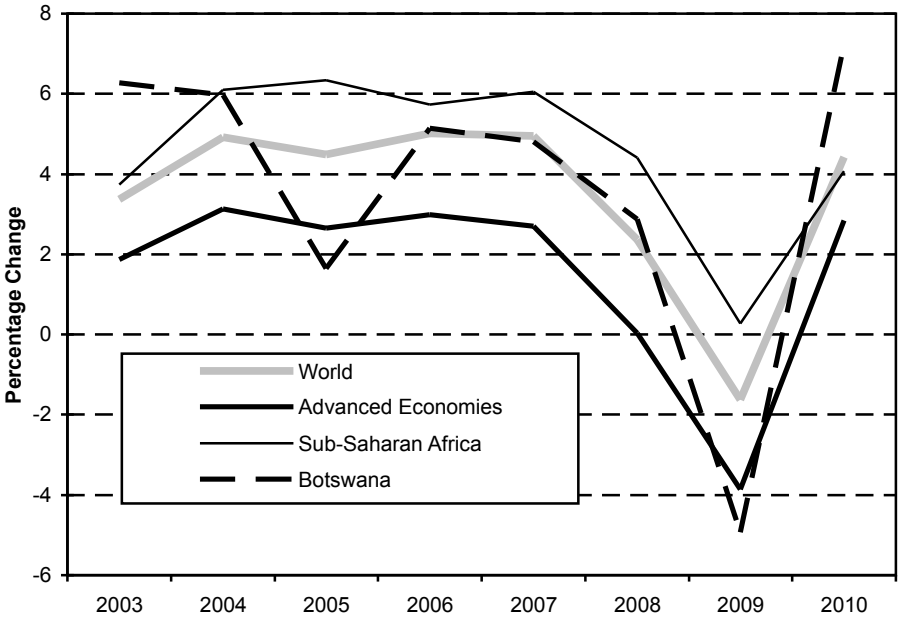
	2003 – 2007 (percentage change)	2008 – 2010 (percentage change)
Exports	16.8	2.1
Imports	16.3	17.0

Source: Bank of Botswana

4 This is as a result of growth across various commodities, amongst them diamonds, fuel and machinery and electric equipment, which registered significant growth rates.

formed that of advanced economies, averaging 3.6 percent over the period 2003 – 2010, compared to 1.5 percent for the latter. It is evident from Figure 3 that economies throughout the world were adversely affected by the recession, with GDP growth rates declining from late 2007 and worsening in 2009. Although contracting by over 4 percent in 2009, the GDP growth rate in Botswana recovered going into 2010, thanks to recovery in mining activity.

Figure 3: Real Gross Domestic Product (2003 – 2010) Annual Percentage Change



Source: International Financial Statistics and Statistics Botswana

lower than expected exports, while others slowed or temporarily shut down their operations, with one mining operation going out of business. Notably, Debswana (the joint diamond mining venture between the Botswana Government and De Beers) suspended production between mid-December 2008 to mid-April 2009. Also, some new inward investments in mining were put on hold due to the recession. The 2009 and 2010 deficits are largely explained by the current account deficit, stemming from weak performance by the country's exports in comparison to imports.

Briefly looking at the BoP performance for five years (2003 – 2008) prior to the recession, it is evident (Table 2) that the country was running healthy BoP surpluses in the current account. The overall balance during this period averaged a surplus of P6.0 billion, with the current account balances recording surpluses averaging P5.8 billion. During this period, the country's exports were doing very well, in some years growth surpassed imports almost two-fold. Foreign exchange reserves were also performing well, growing by 189 percent between December 2003 and December 2008.

The positive outcome in

Table 2: Balance of Payments Accounts Balances (P million)

	2003	2004	2005	2006	2007	2008
Current Account	3 350	1 623	8 288	11 363	10 147	269
Capital Account	–42	–39	–44	–48	–51	1
Financial Account	–1 889	–1 107	–1 879	–826	–1 475	4 914
Net Errors & Omissions[1]	–622	–801	671	–233	2 072	2 270
Overall Balance	*797*	*–324*	*7 036*	*10 256*	*10 694*	*7 452*

Source: Bank of Botswana

Note:1. Net Errors and Omissions vary significantly over the period, especially in 2008 where the implication is that the size of surpluses in other accounts is seriously overestimated.

3. Balance of Payments (BoP) Performance

Botswana's BoP has been negatively affected by the recent global recession. This adverse development is reflected in the overall balance, which recorded a large surplus of P10.7 billion in 2007, moving to a slightly reduced P7.5 billion surplus in 2008. This trend worsened as the economy moved into 2009 and 2010, when the overall balance registered deficits of P4.6 billion and P6.5 billion, respectively. Botswana started to experience the effects of the recession from the last quarter of 2008, when some businesses recorded

the BoP, especially the current account, was due to the growing global economy, associated with countries with rapidly growing demand for mineral resources. These countries provided a market for the country's exports, especially diamonds and copper-nickel (Table 3). Diamond exports grew by 78 percent between 2003 and 2008, from P11.7 billion to P20.8 billion, while copper-nickel exports grew by over 700 percent in the same period. It should be noted that during this period growth in imports was relatively subdued, only taking off in 2007, largely reflecting patterns in government spending. Other factors were also at play, including Southern African Customs Union (SACU)

receipts, which more than tripled between 2003 and 2008, and also the financial outflows arising from the build-up of offshore investments by local pension funds. The financial account was in deficit between 2003 and 2007**,** suggesting the nation was increasing its claims on foreign assets. The main source of the accumulation of foreign assets claims continued to be the outflow of portfolio investment assets. These flows were reversed to a surplus in 2008, suggesting a combination of asset sales and borrowings.[5]

Figure 4 shows the impact of the recession on the cumulative overall balance on a quarterly basis. It is apparent that the recession began to be felt in 2008. Although, it was technically over by mid-2009, its effects continued to be felt throughout the year. However, there were signs that the economy was on a recovery path in 2010, i.e., positive trend in GDP growth. On the other hand, between 2009 and 2010, there was a significant decline in the foreign exchange earnings, which by-and-large explains the deficit in the overall balance. The overall balance of payments surplus in the third quarter of 2009 was due to the AfDB loan drawdown.

A. Current Account

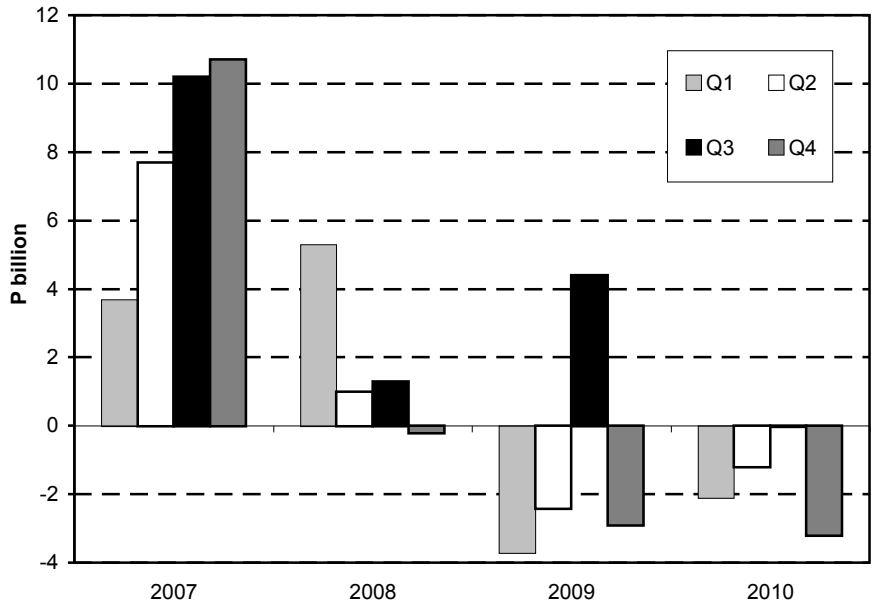
Indications of the recession's adverse impact were very much visible in the current account. As at 2007, the current account balance was in surplus to the tune of P10.1 billion, and started deteriorating sharply from 2008 to 2010. Between 2007 and 2008, the current account deteriorated by 97 percent, recording a far lower surplus of P269 million in 2008. In 2009, the current account balance swung to a deficit of P7.4 billion; and this reduced in 2010 to a deficit of P5 billion. The deterioration in 2009 and 2010 compared to the earlier period is largely attributed to the trade deficit, which offset surpluses in the current transfers of P6 billion and P8 billion, respectively. This was despite the notable increases in the credit component of Government current transfers, namely SACU receipts and grants. The quarterly trend of the current account is depicted in Figure 5.

TABLE 3: BOTSWANA'S MAJOR EXPORT COMMODITIES (P MILLION)

Commodity	2003	2004	2005	2006	2007	2008
Diamonds	11 707	13 133	16 982	19 713	20 483	20 793
Copper–nickel	695	758	2 301	3 823	5 522	5 924
Beef	260	284	310	363	592	530
Soda Ash	230	251	332	463	474	505
Textiles	227	561	1 117	916	2 788	1 819
Vehicles	443	556	570	184	219	414
*Gold**	–	–	183	206	239	382

** Exports of Gold started to be reported separately from 'Other Exports' category in 2005.*

FIGURE 4: OVERALL BALANCE OF PAYMENTS 2007 – 2010



Source: Bank of Botswana

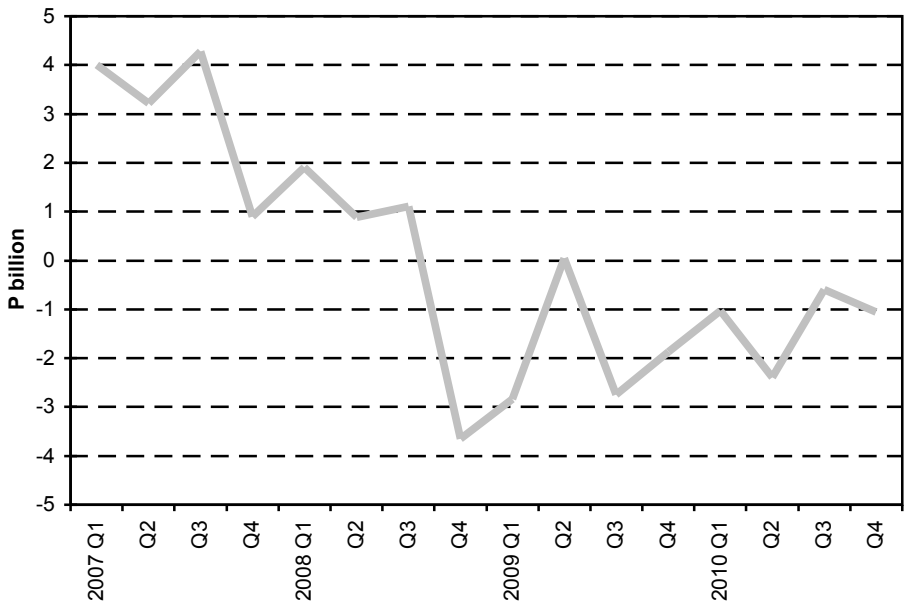
(i) Trade Balance

Due to the recession, the trade account worsened because of the reduced demand for exports, especially diamonds, which prior to the recession had typically been making up about 70 percent of Botswana's exports (see Figure 6). However, another contributing factor to the worsening trade balance was the steady rise in imports, which, in turn, was largely fuelled by the Government's decision to continue public spending in specific projects, which required high-value imports during the economic slowdown.

On a quarterly basis, the trade balance deteriorated sharply during the last quarter of 2008 (to a

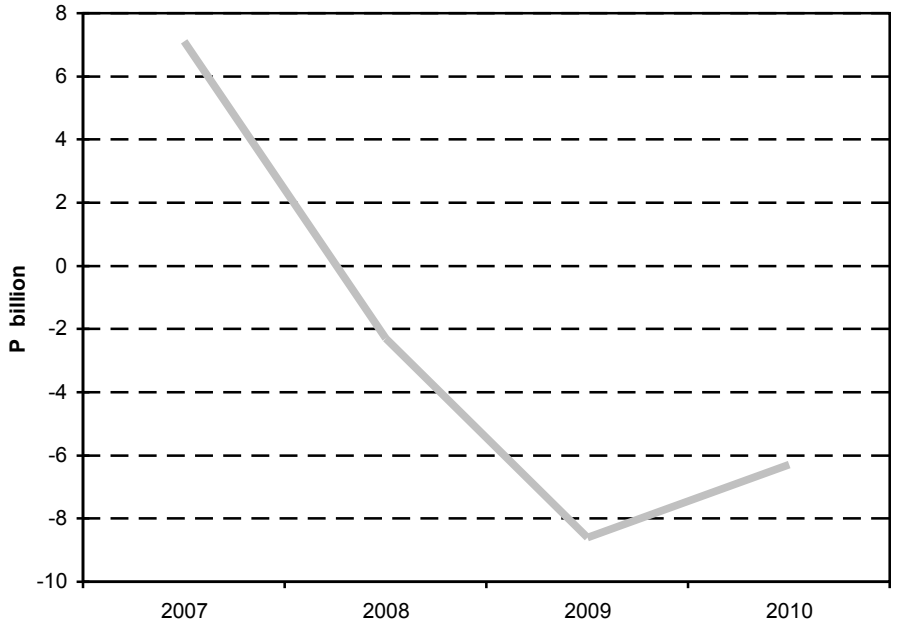
5 However, this may not fully take into account valuation changes in stocks of assets which were volatile during this period. To the extent that this is the case reported BoP flows are distorted, which may be part of the explanation for large errors and omissions in some years.

Figure 5: Quarterly Current Account Balance 2007 – 2010



Source: Bank of Botswana

Figure 6: Trade Balance 2007 – 2010



Source: Bank of Botswana

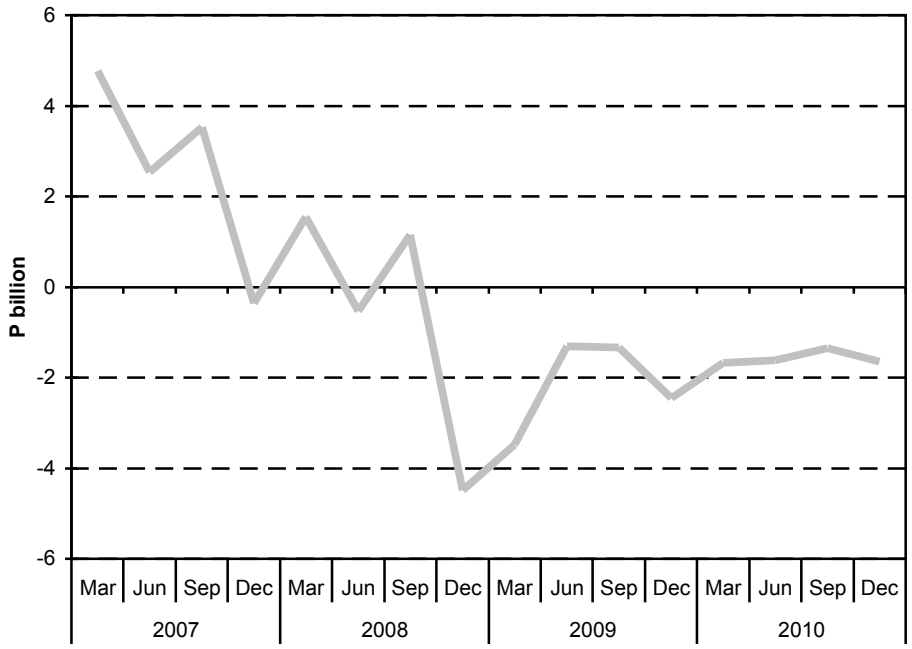
deficit of P4.5 billion), when the effects of the recession began to be felt. This situation continued into 2009 and 2010, with deficits recorded throughout all the quarters. After the fourth quarter of 2008, the worst hit period was quarter one of 2009, with a deficit of P3.5 billion, due to the combined effect of a decrease in exports (–11 percent) and an increase in the services import bill (33 percent), quarter-on-quarter (Figure 7). However, this should be interpreted with caution, as from 2009 onwards a revised methodology was adopted for estimating data on trade in services. Exports were particularly affected by the change in methodology, so the reported decline between the two periods should be interpreted with caution.[6]

Between 2008 and 2009, exports of diamonds declined by 27 percent due to reduced demand in global markets as a consequence of the recession. In the last quarter of 2008, diamond exports alone declined by 73 percent, hence the huge plunge in the trade balance in this quarter. Table 4 shows the movements in major exports from 2007 to 2010 and it is evident that the economy was not spared the wrath of the recession, especially in the period from late 2008 to mid-2009, when the recession was felt strongly. The top foreign exchange earners were the most affected, diamonds, copper-nickel and textiles to be specific, declining by 26.7 percent, 38.9 percent and 22.2 percent, respectively (Table 4). It should, however, be noted that the fall in textile exports was due to a combination of factors, among them the changes to SACU rules on procurement. The change to the rules made sourcing of inputs from suppliers outside SACU expensive for local manufacturers, who to some extent depended on government subsidies. Local textile manufacturers sourced most of their materials from Asia, and the change in rules did not favour them as they were not entitled to some benefits pertaining to the rules, under the Duty Credit Certificate Scheme (DCCS).[7]

6 The Bank of Botswana currently relies mainly on the International Transactions Reporting System (ITRS), which is the foreign exchange data reported through financial institutions. However, this source is also problematic in terms of both coverage and classification. For imports of transportation services, which are the main component of service imports, a fixed fraction of merchandise imports is used, and this was not affected by the revised methodology.

7 Duty Credit Certificate Scheme (DCCS): The objective of the DCCS is to encourage textile and clothing manufacturers to compete internationally, independent of government subsidies. The Scheme has been extended

FIGURE 7: QUARTERLY TRADE BALANCE 2007 – 2010



Source: Bank of Botswana

2005 and 2010. The biggest contributors to this drop in imports in 2009 were diamonds (–17 percent), fuel (-25 percent) and metals and metal products (-16.7 percent). The downturn in diamond imports can be explained by the low global demand, which resulted in the contraction of imports by the cutting and polishing companies in Botswana. On the other hand, the decline in fuel imports is mainly due to the lower price of fuel over the course of 2009, while the contraction in imports of metals and metal products reflects the negative effects of the recession in general on industries in the economy. Figure 8 shows the movement of these three selected commodities between 2007 and 2010.

TABLE 4: MAJOR EXPORT COMMODITIES

Commodity	2007	2008	Percent change	2008	2009	Percent change	2009	2010	Percent change
	Pula million			Pula million			Pula million		
Diamonds	20 483	20 793	1.5	20 793	15 234	–26.7	15 234	21 707	42.5
Copper–nickel	5 522	5 924	7.3	5 924	3 620	–38.9	3 620	4 153	14.7
Beef	592	530	–10.5	530	480	–9.4	480	869	81.0
Soda Ash	474	505	6.5	505	526	4.2	526	506	–3.8
Textiles	2 788	1 819	–34.8	1 819	1 415	–22.2	1 415	1 108	–21.7
Gold	239	382	59.8	382	270	–29.3	270	461	70.7

Source: Bank of Botswana and Statistics Botswana

Merchandise imports (f.o.b.)[8] increased by 43 percent between 2007 and 2008, from P24.6 billion to P35.1 billion, respectively, in what is considered to be a pre-recession period. However, imports declined marginally by 5.4 percent from P35.1 billion in 2008 to P33.2 billion in 2009. This marginal decline indicates the continued reliance on imports by the economy, and these have more than doubled in value between

The export-import ratio dropped from 172 percent in 2007 to 101 percent in 2008. This deterioration in the ratio was due to weak export performance versus strong import performance over the period. Figure 9 graphically depicts the export-import ratio from 2007 to 2010, with evidence showing the ratio declining significantly in the two years following 2007. However, there was rapid improvement in 2010 in line with signs of recovery from the recession. Exports were growing to almost pre-crisis levels, with imports on the other hand continuing to grow, thereby holding back full recovery in the trade balance.

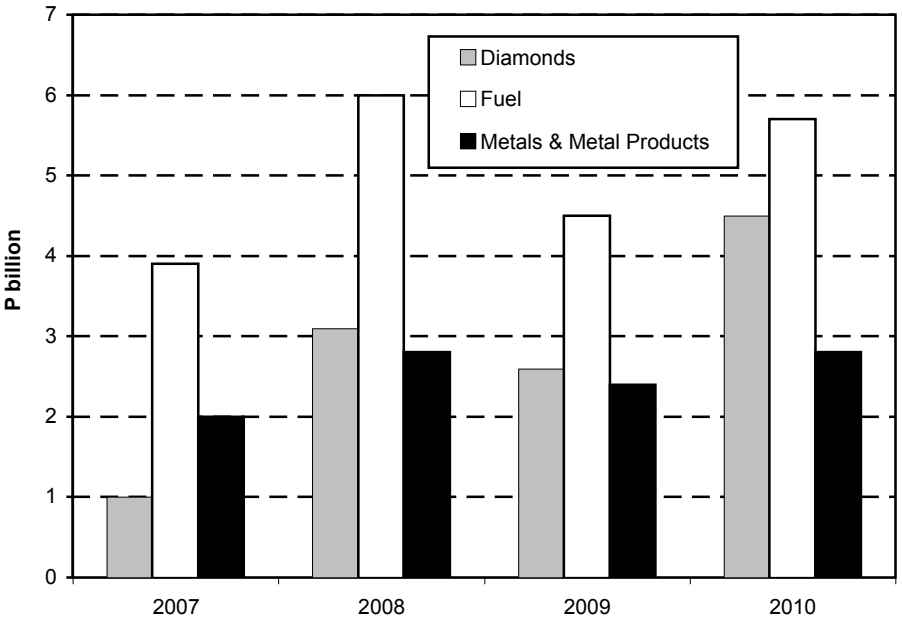
The terms of trade (ToT), which indicate the quantity of imports that could be bought with the sale of a given quantity of exports (average price of exports/average price of imports)[9] deteriorated between 2007

for the fourth time to March 2005. In terms of the DCCS, exporters of certain prescribed textile and clothing products can earn duty credits based on exports of these products during the 12 month periods ending 31 March 2001, 31 March 2002, 31 March 2003, 31 March 2004 and 31 March 2005. A duty credit certificate indicating the value of the duty credits will grant the participant credit to this value on duties payable by him on the importation of certain prescribed textile and clothing products. Benefits are granted subject to participation in the Performance Measurement Programme (PMP) and the achievement of certain Performance, Training and Export targets.

8 'f.o.b.' means free on board. The sender or exporter pays the shipping to the destination port.

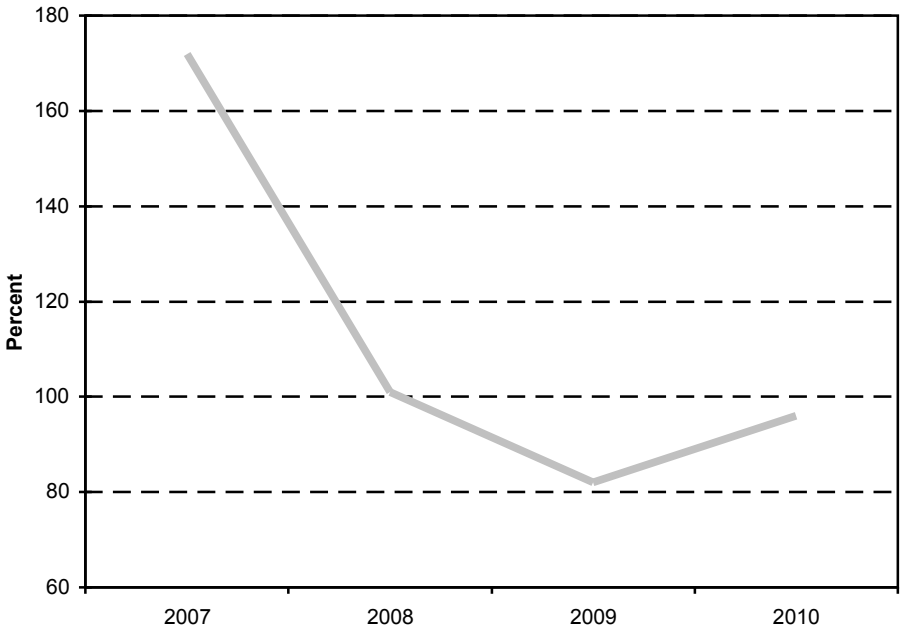
9 In this paper, the price ratio of exports (X) was calculated by taking (Xt at current prices/Xt at constant prices) to get Pxt, and the same was applied for price ratio of imports (M) to get Pmt. Hence the terms of trade were calculated as [(Pxt/Pmt)*100]. Estimates of gross domestic product by expenditure were used to source

Figure 8: Selected Import Commodities 2007 – 2010



Source: Statistics Botswana

Figure 9: Export–Import Ratio 2007 – 2010



Source: Bank of Botswana and Statistics Botswana

and 2010. This further highlighted the adverse effect of the weak global performance on the domestic economy.

From Table 5, it is evident that the ToT ratio deteriorated between 2007 and 2009, with marginal recovery in 2010, reflecting both rising import prices (e.g., fuel, in 2008) and falling commodity prices (e.g., diamonds in 2009).

constant and current price data.

(ii) Balance on Services, Income and Transfers Accounts

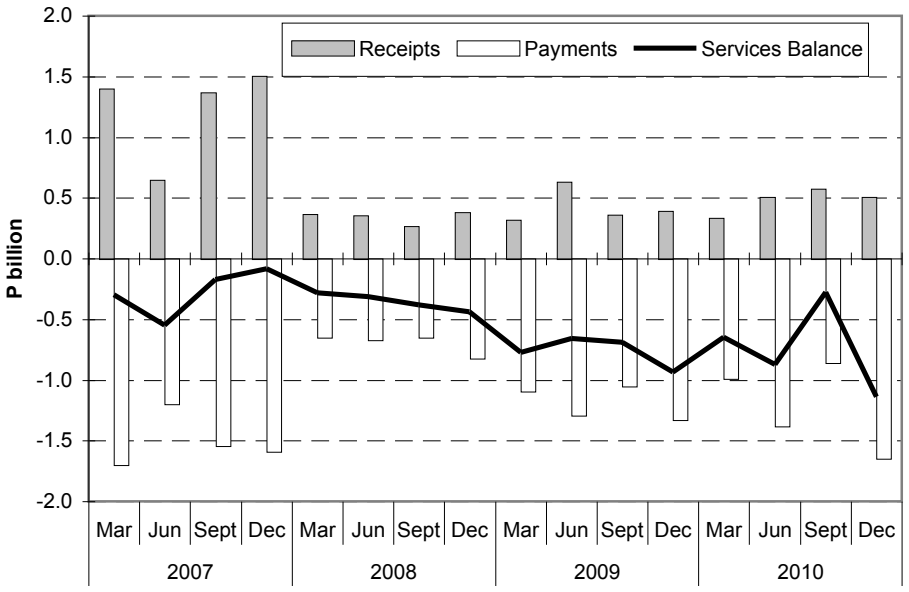
For most of the 2007 to 2010 period, the services account continued to remain in deficit, with huge deficits in 2009 and 2010 following the revised methodology adopted in 2008 in compiling services data, which now relies on the commercial banks' reporting forms, commonly known as the International Transactions Reporting System (ITRS). Further, movements in the services account are explained by the following items: Transportation debits averaged P606 million between 2007 and 2010, with an average growth rate of 10 percent over the four years, emphasising the importance of imports in the Botswana economy, as this component grows in line with imports. Travel credits and debits, which are mainly indicators of inward and outward tourism, showed signs of slowing down between 2008 and 2010, reflecting the impact on the receipts and payments. Other services have generally recorded deficits over time, with deficits of P2.3 billion and P2.6 billion, in 2009 and 2010, respectively. Figure 10 shows quarterly magnitudes of services receipts, payments and balance.

The income account recorded deficits ranging between P2 billion and P5 billion in the period 2007 to 2010. This account is made up of two components, namely, 'compensation of employees' and 'investment income', both of which recorded significant deficits over the period from 2007 to 2010. On the credit side, 'investment income' decreased by 49 percent between 2007 and 2010 (P3.1 billion to P1.6 billion), an indication of downward pressure on the country's foreign exchange earnings, as well as other

Table 5: Terms of Trade

Year	2007	2008	2009	2010
Terms of Trade Ratio	112	105	96	99

FIGURE 10: SERVICES ACCOUNT: RECEIPTS, PAYMENTS AND SERVICES BALANCE 2007 – 2010



Source: Bank of Botswana

offshore investments by pension funds, which declined in 2010 to record a deficit of P1.5 billion. The debit side of 'investment income' is mainly comprised of retained earnings (which are imputed flows), dividends and profits remitted, and these have more than offset the credits resulting in the net deficit.

Current transfers decreased by 27 percent between 2008 and 2009 (from P8.3 billion to P6.1 billion), and increased by 30 percent between 2009 and 2010 (from P6.1 billion to P7.9 billion. Despite the decline between 2008 and 2009, there were substantial surpluses in the subsequent years in current transfers, mainly accounted for by Botswana's share of SACU pool revenues. However, the SACU inflows were lower in 2010 as a result of the reimbursement to the pool, to correct an overpayment made in the past.

B. Capital and Financial Account

(i) Capital Account

The capital account records transactions relating to capital grants, the transfer of goods and financial assets by migrants leaving or entering a country, the transfer of ownership of fixed assets, the transfer of funds received relating to the sale or acquisition of fixed assets, gifts and inheritance taxes, death levies, patents, copyrights, royalties and uninsured damage to fixed assets. However, this account for Botswana only records transfers of assets by migrants. There has been a reclassification of grants received by government to current transfers. As a result of this move, transfers by migrants were not significant.

(ii) Financial Account

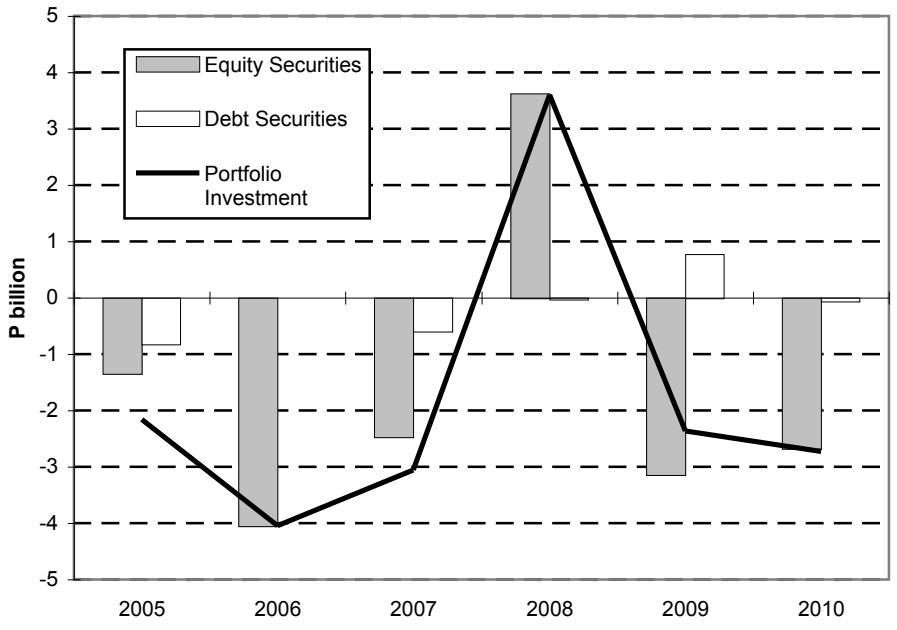
Detailed in the financial account are the government-owned assets (i.e., Special Drawing Rights at the International Monetary Fund or foreign reserves), private sector assets held in other countries, local assets held by foreigners (government and private), foreign direct investment, and global monetary flows related to investment in business, real estate, bonds and stocks. In 2008, this account registered a surplus of P5 billion, compared to a deficit of P1.5 billion the previous year. After completion of the 2008 balance of payments survey,[10] and as it is usually the case in Botswana, some foreign companies continued to plough back their profits in the form of retained earnings. These amounted to about P3 billion and were reinvested, hence explaining the bulk of the surplus in this account, as well as explaining the large deficit on the income account. In 2009, the Government approached the AfDB for a budget support loan of USD1.5 billion. The Government drew down USD1 billion (equivalent to P6.7 billion) of the loan in the third quarter of 2009. This helped the financial account, which ended in a surplus of P8.1 billion. Total net *direct investment* has been estimated at P880 million for 2009, which is information obtained from the Balance of Payments Survey. The bulk of this surplus is explained by equity investment in Botswana, mainly through retained earnings, as has generally been the case. In 2010, the financial account is estimated to have recorded a deficit of P2.8 billion.

A key development since 2002 has been a surge in portfolio outflows from Botswana, mostly influenced by pension funds' related investments. In 2008, these flows were interrupted by external market developments due to the global financial crisis, leading to the reversal of these outflows, with the data showing Botswana with *portfolio investment* inflows of P3.6 billion in 2008.[11] This trend was reversed again to outflows in 2009 (P2.4 billion) and 2010 (P2.7 billion), as a result of some improvement in international equity markets (Figure 11). On the other hand, growth of the local bond market potentially provides opportunities for portfolio investment in Botswana, but so far only to a limited extent.

10 It is important to be aware that the BoP survey is not comprehensive enough and it is possible that some foreign direct investment and related data are being missed.

11 However, this observation should also be treated with caution since the current practice of compiling such data involves simply using changes in the pension funds' offshore assets. Using this information to approximate flows means that no account is taken of valuation changes.

Figure 11: Net Portfolio Flows 2005 – 2010



Source: Bank of Botswana

account data on foreign direct investment is derived from a sample survey of enterprises in Botswana, which does not cover all entities involved in foreign direct investment activities. On the services account, the use of the International Transactions Reporting System (ITRS) as the main source of services data is also not sufficient, in the sense that, on its own, ITRS is not a reliable source, but another way of estimating based on actual data. The combination of these two problematic sources and other factors leads to large net errors and omissions, which Botswana has experienced in the recent past.

Other investment is another category with components including loans, trade credits and deposits – for both assets and liabilities. According to the results of the 2008 Balance of Payments Survey, the financial sector dominated net external loans, with total loan liabilities amounting to P707 million compared to P659 million in 2009. Positions of deposits abroad by banks also explains their activities in managing their liquidity, with asset deposits amounting to over P5 billion recorded in 2008 as opposed to P284 million recorded in the opposite direction. Finally, trade credits, which are driven mainly by financing requirements and business decisions of the non-bank private sector, registered a liability of P1.4 billion in 2008 as opposed to P1.1 billion in 2009, indicating a slight reduction of credit to investors in Botswana by their foreign counterparts over the recession period.

C. Net Errors and Omissions

As indicated in Box 1, the total of all the balance of payments entries will almost inevitably show a net credit or a net debit. The entry for net errors and omissions reflects unreported flows covering components of the current, capital and financial accounts. However, various conclusions can be drawn from them, from country to country, and even in the same country from time to time, depending on the reliability of the reported data. Developing countries, in particular, usually experience great difficulty in providing reliable information. Botswana has also, in recent years, experienced some of the largest imbalances in this area, mainly due to data deficiencies. For most of Botswana's balance of payments, there is reliance in the use of sample surveys and estimates, which inevitably result in net errors and omissions. As an example, financial

4. External Asset and Liability Developments

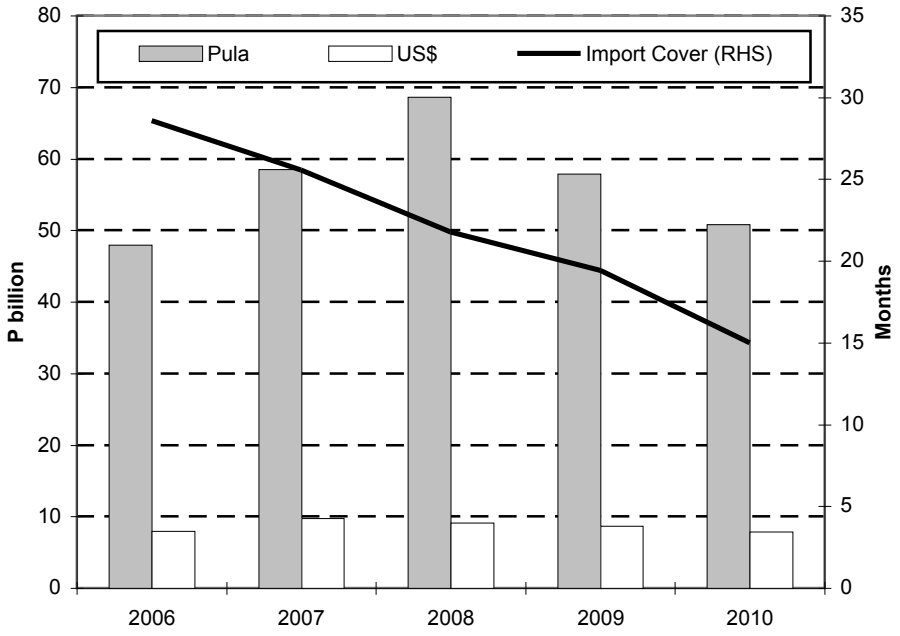
International Reserves

As at December 2010, international reserves amounted to P51 billion, as compared to P58 billion recorded in December 2009, a decrease of P7 billion. Foreign reserves expressed in months of import cover stood at 15, compared to 19 months recorded the previous year (Figure 12). The change in the level of reserves indicates, in part, the negative effect on investments brought by the recession, which began in 2008, whose effects spilled over to 2009. The decline in the reserves was offset somewhat by the increase in Botswana's SDR holdings of P500 million, which were allocated by the IMF in the third quarter of 2009. The SDR allocation to IMF members (totaling US$ 283 billion) was made in proportion to their respective quotas, following rebalancing of shareholding by members.

Foreign Assets and Liabilities of Commercial Banks

Net foreign assets of other depository corporations (ODCs) were on the rise between 2006 (P2.9 billion) and 2008 (P6.1 billion), increasing by 112 percent over the period (Figure 13). However, in 2009 they decreased from the 2008 position to P3.8 billion. This reduction is largely explained by the fall in the commercial banks' foreign currency deposits, which declined by 38 percent, from P5.6 billion to P3.5 billion in the same period. However, there was resurgence in 2010 of holdings of foreign deposits, which grew from P3.5 billion in 2009 to P5.3 billion. Foreign liabilities of banks are primarily made up of deposits, which amounted to P1.6 billion, P1.6

FIGURE 12: FOREIGN EXCHANGE RESERVES AND IMPORT COVER 2006 – 2010



Source: Bank of Botswana

billion, P1.4 billion and P2.9 billion as at the end of 2007, 2008, 2009 and 2010, respectively.

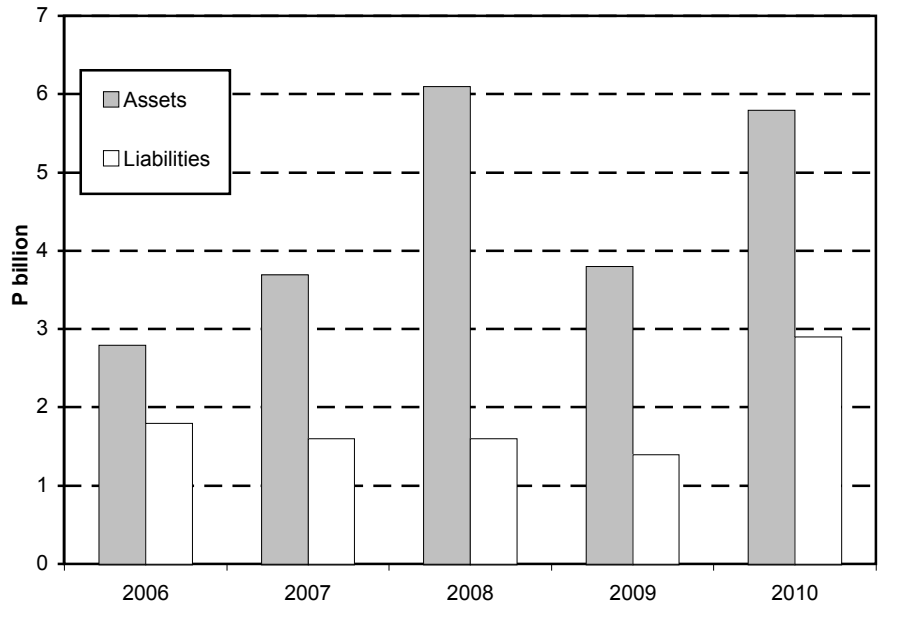
5. EXTERNAL DEBT

This is the total debt owed to creditors outside the country. The debtors can be government, corporations or private households. The debt may include money owed to private commercial banks, other governments, or international financial institutions, such as the IMF, World Bank and African Development Bank.

Data on private external debt, as compiled by Bank of Botswana, is sourced from the annual Balance of Payments Survey, conducted by the Bank. It is primarily long-term and short-term loans, as well as trade credits of private sector entities, i.e., enterprises, banks and individuals (Figure 14 overleaf). However, it is noted that the survey may not cover all entities; and, as such, the data may not present the private debt situation in full. For the period 2007 to 2010, short-term loans averaged P633 million, while trade credits declined, especially in 2009, during the time when the recession gripped global economies, indicating the difficulty faced by suppliers to extend credit.

Total public external debt stood at P9.3 billion as at the end of March 2010, as compared to P2.3 billion at the end of March 2009. As a percentage of GDP, these were 9.2 percent and 2.8 percent, respectively. This debt outstanding was substantially increased because of the drawing down of USD1 billion out of the AfDB budget support loan. The remaining USD500 million from AfDB loan was drawn down in March 2011. This loan from AfDB was for budgetary support, while other loans from both the AfDB and organisations and countries were used for specific government projects across a variety of sectors, such as transport, agriculture and energy.

FIGURE 13: OTHER DEPOSITORY CORPORATIONS (ODCS) ASSETS AND LIABILITIES 2006 – 2010



Source: Bank of Botswana

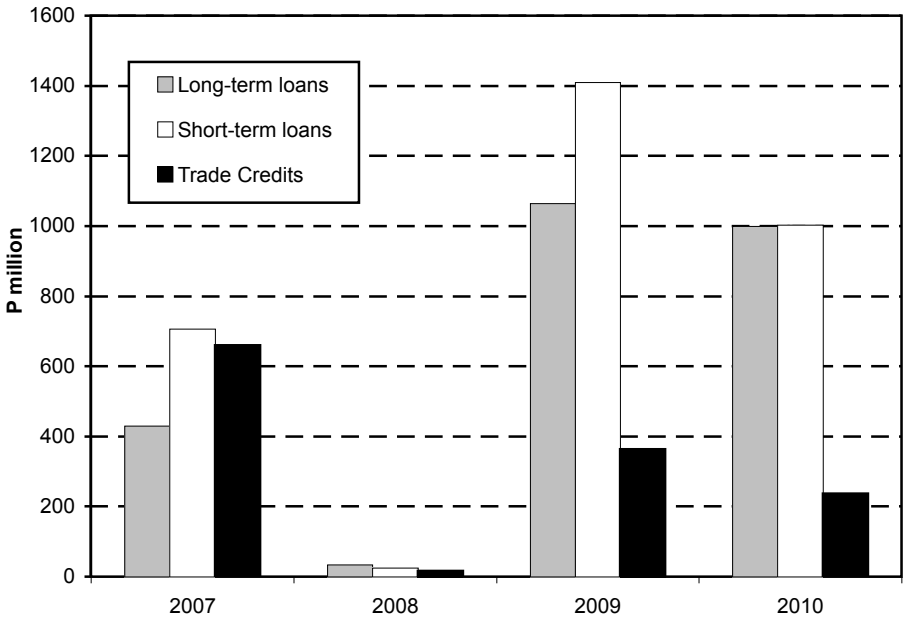
6. CONCLUSION

The paper focuses on key external developments that transpired during 2007 to 2010, especially covering the recent global financial recession. The deterioration of the overall balance of payments illustrates the negative impact of the global economic slow down. The adverse effect was largely reflected in movements in the current account, which recorded deficits in both 2009 and 2010 due to negative shift in the trade balance. While exports fell markedly, imports

remained quite high, taking only a slight dip of 4 percent in 2009. In particular, commodity exports fell significantly in 2008 and 2009 and only recovered in 2010.

The decrease in investment income indicates the downward pressure on the country's foreign exchange accumulation, as well as the poor outturns in the global capital markets. The balance on the financial account fluctuated, but recorded a significant surplus in 2009 due to the AfDB loan drawdown. Foreign exchange reserves were adversely affected, reducing by P10.7 billion between 2007 and 2008, and declining by P7.1 billion between 2009 and 2010. The banking sector also showed signs of the adverse impact of the recession during 2009, when their foreign currency deposits declined by close to 40 percent.

FIGURE 14: LIABILITIES BY INSTRUMENTS 2007 – 2009



Source: Bank of Botswana

REFERENCES

Annual Statement of Accounts (31st March 2010), Ministry of Finance and Development Planning,

Arieff, A., Weiss, M. and Jones, M. (April 6, 2010), "The Global Economic Crisis: Impact on Sub-Saharan Africa and Global Policy Responses", Congressional Research Service.

Balance of Payments Manual, Fifth and Sixth Editions.

Bank of Botswana Annual Reports, Various Issues.

Botswana Financial Statistics, Various Issues.

Ratha, D. and Mohapatra S. (March 23, 2009), "World Bank Revised Outlook for Remittance Flows 2009 – 2011".

Gwartney, J., Skipton, C. and Lawson, R. (11/2000), "Trade, Openness, and Economic Growth", Working paper presented at the 2000 Southern Economics Association annual meeting.

http://www.agoa.info

IMF, World Economic Outlook Update (July, 2009).

IMF, World Economic Outlook Update (April, 2011).

IMF, World Economic Outlook Update (September, 2011).

World Bank,"Migration and Remittances" data.

World Bank (2008), World Trade Indicators.

World Trade Organisation, Press Release – Press/598 (March 2010).

Appendix: Data used in the analysis

Figure 1: Export Volume of Goods and Services – Percentage change

	2003	2004	2005	2006	2007	2008	2009	2010
World	5.4	10.6	7.6	8.9	7.6	2.3	–10.5	12.8
Advanced Economies	3.3	9.2	6.2	8.7	6.6	1.9	–12.2	12
Emerging and Developing Economies	11.5	14.5	11.2	9.4	9.6	4	–7.5	14.5
Sub–Saharan Economies	8.2	8.1	6.3	2.8	7.6	1.5	–2.3	2.4

Figure 2: Import Volume of Goods and Services – Percentage change

	2003	2004	2005	2006	2007	2008	2009	2010
World	5.7	11.0	7.8	8.4	7.4	2.9	–11.2	12.0
Advanced Economies	4.2	9.3	6.5	7.7	5.1	0.4	–12.6	11.2
Emerging and Developing Economies	10.7	16.1	11.6	10.3	13.3	8.8	–8.3	13.5
Sub–Saharan Economies	7.9	8.3	12.1	5.7	16.2	12.5	–3.3	6.4

Figure 3: Real Gross Domestic Product – Percentage Change

	2003	2004	2005	2006	2007	2008	2009	2010
World	3.4	4.9	4.5	5.0	5.0	2.4	–1.6	4.4
Advanced Economies	1.9	3.1	2.6	3.0	2.7	0.0	–3.9	2.8
Sub–Saharan Africa	3.7	6.1	6.3	5.7	6.1	4.4	0.3	4.1
Botswana	6.3	6.0	1.6	5.1	4.8	2.9	–4.9	7.2

Figure 4: Overall Balance of Payments (Quarterly Totals) – P billion

	2007	2008	2009	2010
q1	3.7	5.3	–3.7	–2.1
q2	7.7	1.0	–2.4	–1.2
q3	10.2	1.3	4.4	0.0
q4	10.7	–0.2	–2.9	–3.2

Figure 5: Quarterly Current Account Balance – P billion

		Current Account Balance
2007	*q1*	3.998
	q2	3.218
	q3	4.274
	q4	0.899
2008	*q1*	1.913
	q2	0.889
	q3	1.113
	q4	–3.646
2009	*q1*	–2.837
	q2	0.047
	q3	–2.750
	q4	–1.871
2010	*q1*	–1.024
	q2	–2.387
	q3	–0.590
	q4	–1.053

Figure 6: Trade Balance – P billion

	Trade Balance
2007	7.1
2008	–2.3
2009	–8.6
2010	–6.3

Figure 7: Quarterly Trade Balance – P billion

		Trade Balance
2007	*Mar*	4.767
	Jun	2.533
	Sep	3.527
	Dec	–0.361
2008	*Mar*	1.550
	Jun	–0.524
	Sep	1.157
	Dec	–4.487
2009	*Mar*	–3.479
	Jun	–1.313
	Sep	–1.341
	Dec	–2.457
2010	*Mar*	–1.677
	Jun	–1.614
	Sep	–1.356
	Dec	–1.647

Figure 8: Selected Import Commodities – P billion

	2007	2008	2009	2010
Diamonds	1.0	3.1	2.6	4.5
Fuel	3.9	6.0	4.5	5.7
Metals & metal products	2.0	2.8	2.4	2.8

Figure 9: Export–Import Ratio – Percent

	Export–Import Ratio
2007	172
2008	101
2009	82
2010	96

Figure 10: Services Account: Receipts, Payments and Services Balance (P million)

		Receipts	Payments	Services balance
2007	*Mar*	1 397	–1 697	–300
	Jun	649	–1 197	–549
	Sept	1 369	–1 542	–172
	Dec	1 502	–1 585	–82
2008	*Mar*	367	–646	–280
	Jun	357	–671	–314
	Sept	265	–647	–382
	Dec	382	–821	–439
2009	*Mar*	318	–1 091	–773
	Jun	633	–1 291	–658
	Sept	359	–1 047	–687
	Dec	390	–1 324	–934
2010	*Mar*	336	–985	–649
	Jun	509	–1 380	–870
	Sept	576	–855	–278
	Dec	504	–1 644	–1 140

Figure 11: Net Portfolio Flows – P million

	Equity Securities	Debt Securities	Portfolio investment
2005	–1 340	–820	–2 160
2006	–4 045	1	–4 044
2007	–2 463	–590	–3 053
2008	3 625	–22	3 602
2009	–3 140	778	–2 362
2010	–2 675	–57	–2 732

Figure 12: Foreign Exchange Reserves and Import Cover

	Pula (Billion)	US$ (Billion)	Import cover
2006	48	8	29
2007	59	10	26
2008	69	9	22
2009	58	9	19
2010	81	8	15

Figure 13: ODC's Assets and Liabilities – P million

	Assets	Liabilities
2006	2 863	1 771
2007	3 749	1 580
2008	6 059	1 642
2009	3 750	1 366
2010	5 838	2 873

Figure 14: Liabilities by Instruments – P million

	2007	2008	2009
Long–term loans	431	34	1 065
Short–term loans	707	26	1 411
Trade credits	659	17	364

Equilibrium Values in the Quarterly Projection Model of the Bank of Botswana: The Multivariate Kalman Filter Approach

Moemedi Phetwe[1]

Abstract

The equilibrium values for output, real exchange rates and real interest rates provide benchmarks for the description of a "neutral" monetary policy stance, in which monetary policy does not contribute to changes in inflation. The equilibrium values and any deviations are, therefore, important for the appropriate setting of monetary policy. This paper presents the estimates of the equilibrium values and their associated gaps derived by the Kalman filtration method used in the Bank's "Forecasting and Policy Analysis System (FPAS)". The derived equilibrium values and trends of deviations tend to be realistic representations of economic developments in Botswana, especially at the end of the sample. However, these estimates are supplemented by professional judgment when formulating monetary policy.

1. Introduction

As in other central banks, one of the main objectives of the Bank of Botswana is that of price stability, which, in the case of Botswana, is defined as a sustainable, low and predictable level of inflation, within the 3 – 6 percent medium-term inflation objective range. In order to attain price stability, the Bank uses, amongst others, interest rates and open market operations to affect demand conditions in the economy and ultimately the level of inflation. The process also entails stabilisation of the economy, and, therefore, keeping output around its equilibrium value. As a result, the Bank needs to have a reliable gauge of the inflationary pressures and the equilibrium[2] values of other important macroeconomic variables, such as output, the real interest rates and the real exchange rates, that are likely to prevail in the future, in order that it can formulate and implement the appropriate monetary policy in the current period. The equilibrium or non-inflationary values for output, the real interest rate and the real exchange rate also provide benchmarks for the description of a "neutral" monetary policy stance in which policy does not contribute to excess demand and increase in prices. The equilibrium values for output (i.e., potential output), the real interest rate and the real exchange rate are used to determine the stance of monetary policy and overall economic prospects and, therefore, are important in the formulation of monetary policy. Accordingly, this paper estimates such equilibrium values and their respective gap[3] measures for Botswana. The equilibrium values are inferred from an empirical macroeconomic model[4] fitted to Botswana data from 1998 through 2010, employing the Kalman-filtration technique.

In the literature, various methods are used for modelling and estimating unobserved trends and fluctuations in the economy.[5] These include the statistical detrending methods: the Hodrick-Prescott filters (see Hodrick and Prescott (1997), the Beveridge-Nelson (1981) method, the Band-Pass filter proposed by Baxter and King (1995); while the structural (economic) approaches include: the Structural Vector Autoregressive (SVAR) method based on the work of Blanchard and Quah (1989) and the Production Function Approach used by Adams et al. (1987). The main limitations cited for the statistical approaches has been that they are purely statistical and have no economic content, since they do not exploit any additional information other than the time series to be detrended. As a result, the statistical methods do not help in highlighting the economic constraints and the role of policies in enhancing variables such as potential output; nor do they help in identifying the macroeconomic benefits of structural reforms. In addition, the statistical methods are subject to severe end-of-sample problems, as estimates of equilibrium values tend to rely excessively on the latest developments in actual values of the variables. On the one hand, the structural approaches, while useful in that they integrate economic relations and, therefore, are less mechanical than the statistical approaches, nevertheless, do not provide more accurate estimates due to specification and identification problems.[6] Furthermore, particularly for the production function approach, there is need for accurate and comprehensive data for capital, labour and productivity, which in most cases are not read-

1 Acting Deputy Director, responsible for Monetary Policy and Forecasting, Research Department. The views expressed in the paper are those of the author and do not necessarily reflect those of the Bank of Botswana.

2 However, in reality, these equilibrium values are in essence unobserved and therefore must be estimated. Therefore, in most cases, the trend values are used as an approximation of the equilibrium values of the variables in question.

3 A gap is defined as the difference between the actual (observed) variable and its equilibrium (unobserved) component. For example, the output gap is the difference between actual output and its equilibrium or potential value.

4 Interested readers can refer to the Bank of Botswana Monetary Policy Statement (2008), Bank of Botswana Annual Report (2008), and James et al. (2011) for the narrative and technical details on the model and its properties. This is the same model used for forecasting and policy analysis in the Bank.

5 An extensive review and discussions of the methods may be seen in Bukhari and Khan (2008) and Basdevat (2003).

6 This means that they do not provide guidance on the variables to be included in the models and how the models model should be specified.

ily and timeously available in small emerging economies such as Botswana. Therefore, the statistical approaches remain a practical choice for estimation of equilibrium (permanent) values and business cycle (transitory or gap) components of the data.

This paper uses a modern methodology for estimating unobserved trends and cyclical components in the data known as the Kalman filter. According to Basdevant (2003), both the statistical and structural approaches can be enriched by the use of a state-space model[7] in the form of the Kalman filter, where it is possible to improve on the other approaches mentioned, and to specify how far to rely on the other sources of information when estimating the equilibrium values such as potential output. Specifically, the Kalman filter supplements the statistical approaches by incorporating the established macroeconomic relationships of the economy and its structural changes. In particular, as an example, in the estimation of potential output, because the link between inflation and output is known (through the Philips curve equation), it may be useful to exploit information about the degree of excess demand in the product market.[8]

The objective of this paper is, therefore, to describe the estimation of the cyclical and trend components of the economic variables in the "core" medium-term model, such as potential output, equilibrium real interest rates and equilibrium real exchange rates and their respective gaps.[9] Section 2 explains in brief the concepts of the equilibrium output (i.e., potential output), the equilibrium real interest rate (i.e., natural real interest rate) and the equilibrium real exchange rate and their linkages to monetary policy. Section 3 briefly describes the general structure of the multivariate (Kalman) filter used to derive the equilibrium values in the "core" medium-term inflation forecasting model of the Bank. Section 4 presents estimates of the equilibrium (or permanent) and cyclical (or transitory) components and describes their historical evolution and implications for policy. Section 5 concludes.

2. Equilibrium[10] Output, the Real Interest Rate and the Real Exchange Rate and Linkages to Monetary Policy

The concepts of equilibrium values (e.g., potential output, natural real interest rate and equilibrium real exchange rate) and the gaps (e.g., output gap, real interest rate gap and real exchange rate gap) in macroeconomics have received a lot of attention in the New-Keynesian literature[11] widely used for theoretical analysis of monetary policy. These models have become popular in several countries, with central banks increasingly developing and using them for simulation and forecasting purposes. The New-Keynesian models are also covered in Clarida et al. (1999), Gali (2003) and Woodford (2003). Within these classes of models, the equilibrium values and associated gaps, both of which are unobserved, are key macroeconomic variables in the design of monetary policy. Accordingly, "potential output" is defined as the output that would have prevailed if prices were completely flexible. In other words, potential output is the economy's production if there were no nominal rigidities; while all other real frictions and shocks remain unchanged. This level of output is also consistent with stable inflation. The "output gap" is, therefore, defined as the deviation of actual output from potential output and is the key variable in determining the evolution of inflation. If the output gap is positive, this creates pressure for an increase in the rate of growth in prices and, therefore, a rise in inflation. When the output gap is negative, the rate of growth of prices and, therefore, inflation has a tendency to fall. Consequently, when the output gap is zero (i.e., is closed) and the economy is in equilibrium, stability in the rate of inflation is achieved.

The New-Keynesian theory defines the natural rate of interest (which is related to structural factors) as the real interest rate that would prevail if prices are fully flexible. The natural real interest rate is also consistent with stable inflation and potential output. The real interest rate gap, defined as the difference between the real short-term interest rate and estimates of the natural real interest rate is, therefore, related to the business cycle and reflects the existence of nominal rigidities in the economy. In the New-Keynesian models, the real interest rate is central to the determination of output and inflation. In theory, real interest rates above the natural real interest rate

7 A state-space model consists of a measurement (observation) equation that describes the relationship between observed and unobserved variables and a transition equation that describes the dynamics of the unobserved variables. Section 3 briefly describes these kinds of models.

8 There are other factors influencing inflation which have no particular relationship with the state of excess demand in the economy. Nevertheless, all else being equal, an observation that there are upward pressures on inflation should lead to more weight being given to the possibility of excess demand in the product market.

9 The deviation of the actual variable from its equilibrium value.

10 It is important to indicate that, in referring to these values as "equilibrium" values, it is the perspective of the effect on inflation which is used. It is not the case that, for example, the measure of "potential" output means that this is the best that could be done with the best possible uses of all resources without constraints. What this means is that time-series techniques are used to fit trends through the data, and these trends provide the measures of the underlying "equilibrium" values.

11 A key feature of these models (compared to other models like the real business cycle models based on the notion of dynamically optimising agents in a world characterised by stochastic shocks) is the explicit incorporation of frictions such as nominal rigidities and the assumption of rational expectations that are needed to make the models suitable for the evaluation of monetary policy. The models are Keynesian in that, in the determination of national income, the business cycle arises from the changes in aggregate demand because of wage and price stickiness.

(positive real interest rate gap) are expected to lower inflation, whereas real interest rates below the natural real interest rate (negative real interest rate gap) are expected to increase inflation.

Similarly, and in line with the New-Keynesian theory, Driver and Westaway (2004) argue that since it is assumed that, in the medium term, any nominal rigidities will have been eliminated, this implies that the medium term equilibrium real exchange rate can be thought of as a "flexible price equilibrium value" which is independent of monetary policy. The explanation being that the equilibrium is defined in real terms by variables (such as potential output) that monetary policy cannot influence, at least on the assumption that super neutrality holds.[12]

The real exchange rate gap is also defined as the deviation of the actual real exchange rate from the equilibrium real exchange rate. An actual real exchange rate below (above) the equilibrium level, which is a negative (positive) real exchange rate gap, implies a positive (negative) value of the output gap which tends to increase (decrease) inflation.[13]

It is important to note that the equilibrium dynamics of output, the real interest rate and the real exchange rate are determined independently of monetary policy. In other words, monetary policy is neutral with respect to those real variables. As indicated earlier, these equilibrium values are important benchmarks when the assumption of flexible prices does not hold. As a result, both the real exchange rate gap and real interest rate gap can be viewed as providing some indication of the monetary policy stance. The main policy implication, therefore, is that for central banks concerned with stabilising the economy, hence maintaining output close to its potential level, they should set their policy rates in order to minimize these gaps. This simple policy prescription would, in the absence of a trade-off between stabilsing output and inflation, result in completely stabilising inflation.[14]

For small open economies such as Botswana, both the interest rates and exchange rates are important channels through which monetary policy affects the economy and, therefore, inflation. As a result, a combination of the developments in the interest rates and the exchange rates can provide a better indicator of the policy stance than either variable alone (e.g., Freedman, 1995). The appropriate combination of the real interest rate and the real exchange rate into a single policy indicator is called the Real Monetary Conditions Index (RMCI)[15] which provides a better indication of the overall monetary policy stance. A change in the RMCI can indicate either the degree of tightening or easing of monetary conditions. Therefore, the RMCI provides a metric that captures the degree of pressure that monetary policy is placing on output and inflation.

Some central banks and other international organisations use the RMCI to interpret the stance of monetary policy and its effect on the economy and inflation. As indicated by Freedman (1995), the Bank of Canada has published indicators of the monetary conditions. Both Sweden and Norway also use the monetary conditions index in interpreting the monetary policy stance (Hansson and Lindberg (1994)). Similar indicators have been published by the IMF (1996) for the evaluation of policy in individual countries such as Italy, Germany, France, the United Kingdom, Japan and the United States. Similarly, RMCI estimates have also been made for some developing and emerging market economies. For example: Peng and Leung (2005) estimated the RMCI for mainland China to assess its monetary and financial conditions; Hyder and Khan (2006) constructed the RMCI for Pakistan and indicated that it could serve as an important indicator of the country's monetary policy stance if used with caution alongside other relevant indicators; Jing-Lung (1999) compiled the RMCI for Taiwan and showed that variants of the RMCI are capable of indicating the monetary policy stance in the country; Hataiseree (1998) estimated the RMCI for Thailand and noted that focusing on the interest rate and exchange rate was important given that the exchange rate may be a primary channel through which monetary policy affects the economy and inflation. In general, cross country experience reveals that central banks use the RMCI to provide summary information on monetary conditions prevailing in a given economy.

3. ESTIMATION OF THE BUSINESS CYCLE – A MULTIVARIATE FILTER[16]

Following the publication of the Bank's Forecasting and Policy Analysis System (Bank of Botswana (2008), this paper presents another model, the multivariate filter with unobserved components. The multivariate filter is essentially a component of the "core" medium-term forecasting model used for the production of the

12 Super neutrality holds when the rates of growth of real variables such as potential output, the equilibrium real exchange rate and the natural real interest rate are independent of the rate of growth in the money supply in the long run.

13 Note that the assumption here is that an increase in value of the real exchange rate represents an appreciation, while a decrease represents a depreciation of the real exchange rate. The real exchange rate definition can also be a bilateral or effective exchange rate. The model uses the effective exchange rate of the Pula.

14 However, according to Clarida et al. (1999), such a trade off between stabilising output and inflation may exist in practice as a result of exogenous variations in the desired markups.

15 Extensive review of the methods and technical details of building the RMCI are covered in Freedman (1995), Eika et al. (1996) and Reserve Bank of New Zealand Bulletin (1996).

16 This sub-section draws on the work of the Technical Assistance Mission on Modeling and Forecasting at the Bank of Botswana. The program that implements the Kalman filter has been written using the IRIS toolbox in the Matlab environment.

medium–term projections, which are an input into monetary policy formulation and implementation. The role of the multivariate filter is to separate the cyclical and equilibrium components of economic variables from the historical data. Essentially, the core model consists of many variables that are directly unobserved and, therefore, have to be estimated. These variables include all the equilibrium and gap values in the model, namely: equilibrium values for non-mining GDP, the domestic real interest rate, the foreign real interest rates and the real exchange rate and all their respective gaps. The gaps are defined as the difference between the observed values of the real variables and their estimated equilibrium values. Generally, it implies that the "gaps" or deviations of the actual observed real values from their equilibrium estimates indicate the positions of the economy in the business cycle and are, therefore, of primary importance in the generation of the forecasts.

The multivariate filter is used to estimate the position of the economy in the business cycle, and is based on the model that is used for forecasting and policy analysis, which captures the Bank's view of the monetary policy transmission mechanism. Therefore, the filter is designed so that it embodies the same basic philosophy and specification of relevant equations as the "core" medium-term forecasting model.[17]

The simplest example below (output = gap + equilibrium) illustrates how the Kalman Filtration is done.

$$y_t = \hat{y}_t + \bar{y}_t \quad (1)$$

$$\hat{y}_t = v\,\hat{y}_{t-1} + \mu_t \qquad v < 1, \quad \mu_t \approx N(0, \sigma_\mu) \quad (2)$$

$$\bar{y}_t = \bar{y}_{t-1} + \Delta\bar{y} + \eta_t, \qquad \eta_t \approx N(0, \sigma_\eta) \quad (3)$$

where: y_t are observed (measurement) variables in levels.

$\hat{y}_t$ and $\bar{y}_t$ are unobserved (state) variables to be estimated and they represent the gap and equilibrium components, respectively.

$\Delta\bar{y}$ is a drift (or trend value) and v is a parameter.

σ_μ and σ_η are variances.

The basic rule is that there must be as many observed variables in levels as there are independent equilibrium values in the model. That is, the number of equilibrium values should be equal to the number of observed variables in the model. The model, representing the economic structure, can then be written in the following form:

$$a_t = Tb_t + \rho_t \quad (4)$$

$$b_t = Zb_{t-1} + \theta_t \quad (5)$$

where: a is a vector of observed variables and b is a vector of state (unobserved) variables.

T and Z are matrices filled with parameters.

ρ is a vector of shocks related to the observed variables and θ is a vector of shocks related to unobserved variables.

Equation 4 relates measurement variables to the unobserved variables, while equation 5 depicts how unobserved variables evolve over time. Estimation is then done in three steps:

(a) Unobserved variables are predicted based on their values in the previous period and matrix Z Parameters and variances are often calibrated based on economic intuition.

(b) Filtration for Equation 4 is done such that the predicted values of the unobserved variables are adjusted according to values of the measurement variables and matrix T.

(c) Finally, the filtered values of the unobserved variables are smoothed given the information over the whole sample.

Further details of the estimation process using the Kalman filter and other requirements can be found in Harvey (1989) or Hamilton (1994).

4. Results from the model estimations

Figures 1a to 4b show the results of the estimates of potential or equilibrium non-mining output, actual non-mining output and the non-mining output gap, the actual and equilibrium real interest rate and its gap, the actual and equilibrium real effective exchange rate and its gap and the estimate of the real monetary conditions index and its components.

The estimated movements of potential or equilibrium non-mining output appear to be relatively smooth (Figure 1(a)), such that the gap accounts for most of the short-term fluctuations in the actual non-mining output. Similarly, Figure 1(b) shows the estimated non-mining output gap, which shows larger cyclical fluctuations with more pronounced volatility. Nevertheless, the series is consistent in the sense that it captures the fact that from 2009, the economy was experiencing a recession, in that there generally was a negative output gap since that period.

The estimates in Figure 2(a) indicate that, in general, the real effective exchange rate has been generally stable over the period. However, there was some period of real appreciations from 2001 to 2004, and this was offset by the 7.5 percent nominal devaluations of 2004 and the 12 percent devaluation and adoption of the crawling band exchange rate regime in 2005. The results are consistent with studies by Imi (2004) and the IMF (2005), which concluded that the real exchange rate overvaluation during the year 2000 to 2003 appeared to have been corrected by the devaluations.

In Figure 3(a), the estimate for the equilibrium real interest rate indicates that it has generally been stable around two and half percent during the pe-

17 The narrative and technical details of the model and properties can be found in Bank of Botswana Monetary Policy Statement (2008), Bank of Botswana Annual Report (2008) and James et al. (2011).

FIGURE 1A: ACTUAL & EQUILIBRIUM REAL NON-MINING GDP

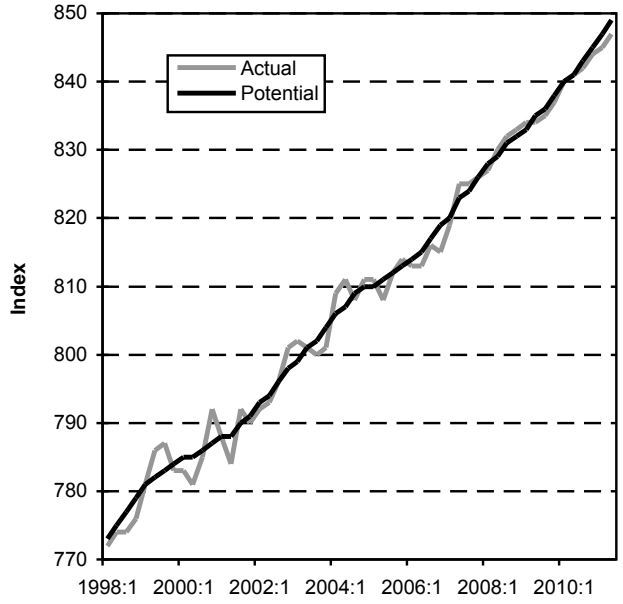


FIGURE 1B NON-MINING OUTPUT GAP

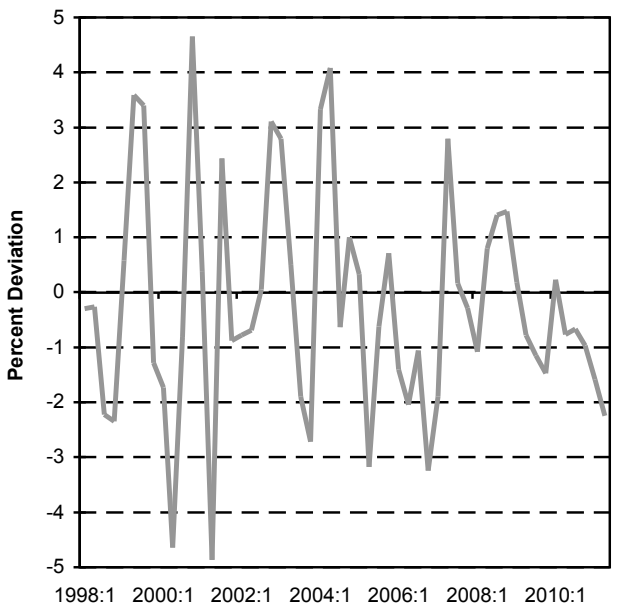


FIGURE 2A: ACTUAL & EQUILIBRIUM REAL EXCHANGE RATE

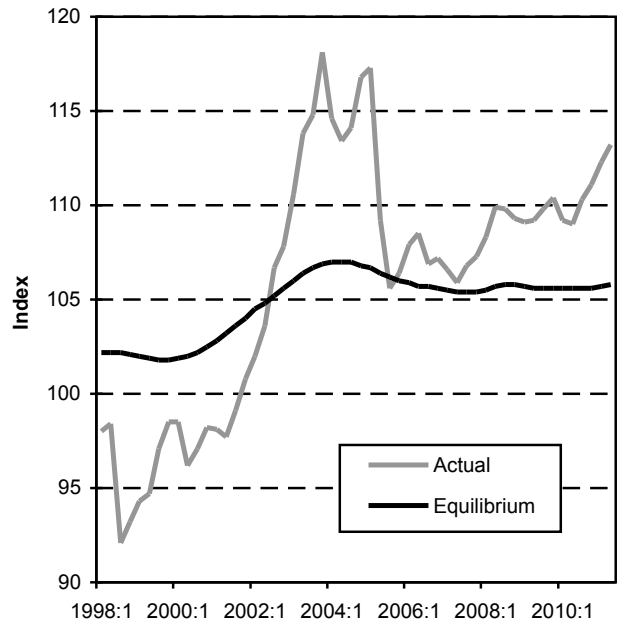
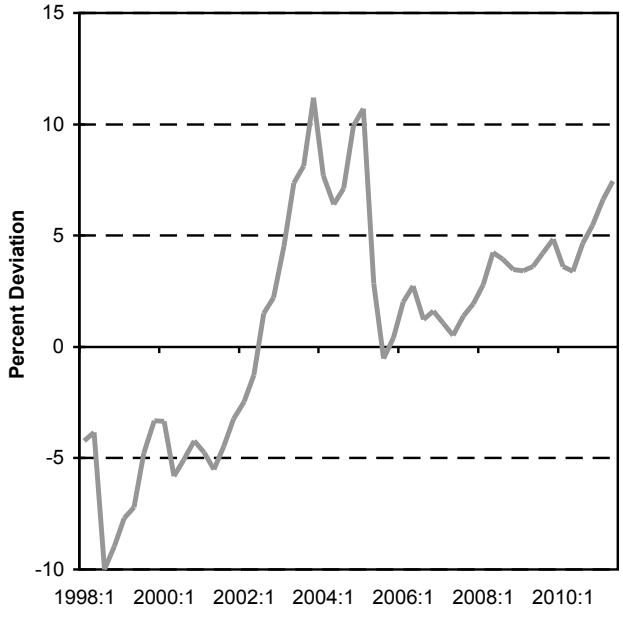


FIGURE 2B: REAL EXCHANGE RATE GAP



riod of study. The real interest rate gap (Figure 3(b)), defined as the deviation of the actual real interest rate from the equilibrium, indicates that policy was relatively tight from late 1990's until 2008 period, which preceeded the recent economic downturn. This is illustrated by the actual interest rate being above its equilibrium in Figure 3(a) and the positive real interest rate gap in Figure 3 (b). It is also notable that for most of the period, real interest rates were very volatile, due largely to high and volatile inflation rates from the spikes caused by the introduction of value added tax (VAT) in 2002, the 2004 and 2005 devaluations of the Pula and several significant increases in some administered prices in 2005 and 2006. Furthermore, the estimated negative real interest rate gap, particularly during the latest recession (from 2008), is consistent with an accommodative monetary policy stance adopted during the recent economic slowdown.

An idea of how monetary conditions have evolved over time, based on the monetary conditions index, is given in Figure 4(a). The monetary conditions index shown is based on a weighted combination of the real interest rate and the real exchange rate gaps (Figure 4b). The monetary conditions index was rising rapidly through 2005 before falling in early 2006. The firming of conditions in the period from 2002 to 2005 is attributed to the impact of both the positive real exchange rate gap and the positive real interest rate gap. From the late 2007, the monetary conditions index indicated a relative softening in the policy stance brought about by the negative real interest rate gap, while the real effective exchange rate gap was

Figure 3a: Actual & Equilibrium Real Interest Rate

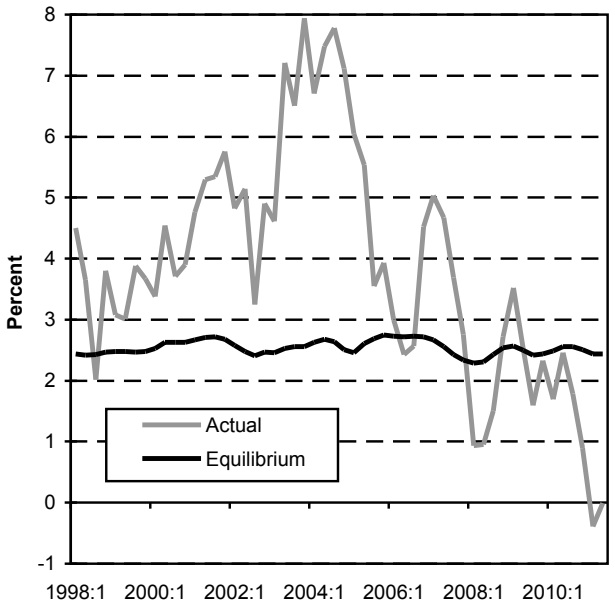


Figure 3b Real Interest Rate Gap

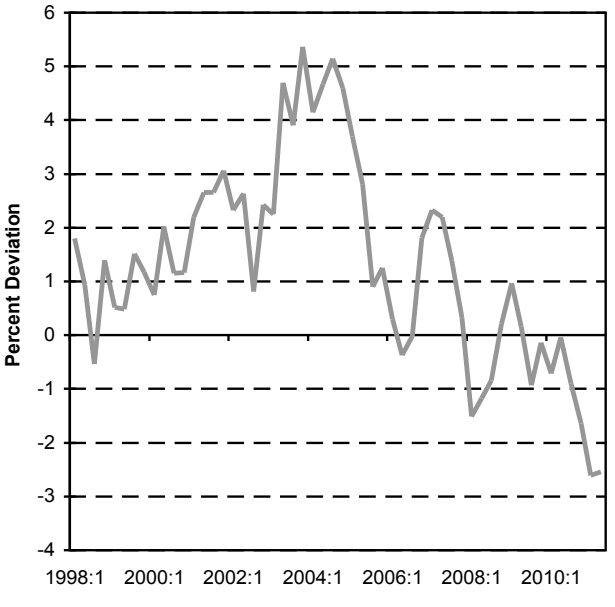


Figure 4a: Real Monetary Condition Index

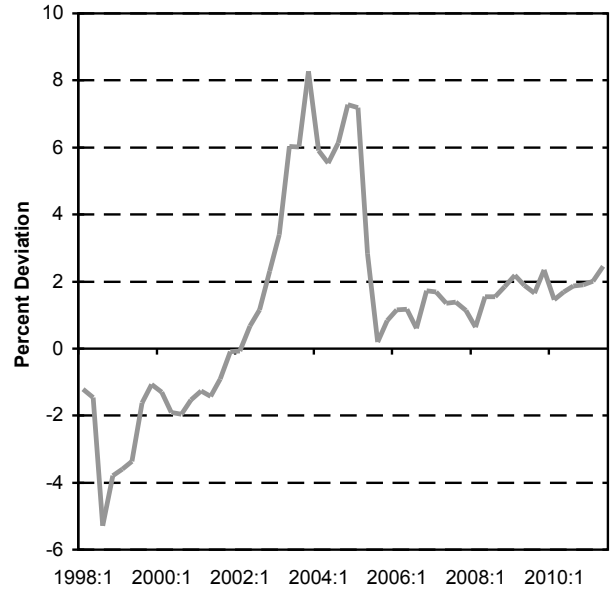
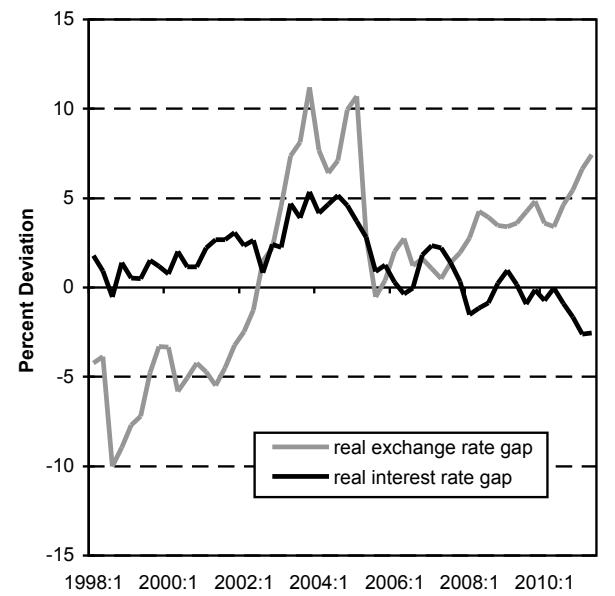


Figure 4b: Components of RMCI



still positive. At that point, the Bank began to lower the interest rate significantly due to the onset of the global economic crisis and the prospects of inflation converging within the Bank's 3-6 percent medium term inflation objective.

5. Conclusion

The determination of equilibrium values for output, the real interest rate and the real exchange rate is crucial for policy formulation. The equilibrium values provide a basis for measuring any gaps or deviations vis-à-vis the actual values. As such, the output gap, real interest rate gap and the real exchange rate gap help policymakers form a view with respect to the economic outlook and the stance of macroeconomic policies. Consequently, economic modellers and policy makers have developed various techniques to estimate the equilibrium values for these important macroeconomic variables in order to facilitate discussion and improve efficacy of monetary policy. In this paper, the multivariate Kalman filter approach is used to derive the estimates of the equilibrium values for output, the real interest rate and real exchange rate.

The advantage of the Kalman filter is that it is less data demanding than the economic (structural) methods, and is relatively intuitive in economic terms compared to the statistical detrending methods. It is noted, however, that this approach can be somewhat technical and the results can be fairly sensitive to the econometric specification that is adopted. Implementing this technique properly, therefore, requires a fair amount of *a priori* understanding of the transmission mechanism and economic relationships. Thus, the technique often imposes restrictions in defining the relationships between the key macroeconomic vari-

ables. For example, it is assumed that the relationships that govern the dynamics of the economy stay intact over the sample period. As a result, although the approach improves upon the criticism made for other methods, there is still room for improvement, especially for economies experiencing frequent structural changes.

The results of the Kalman filter procedure appears to provide realistic estimates of the equilibrium and corresponding gap values (deviations of the actual from their equilibrium values) for key variables, especially at the end of the sample period. Therefore, the use of the Kalman filter is largely justifiable as a basis for the production of the inflation forecast and as a guide to formulation of monetary policy. However, the results also indicate that the business cycle for Botswana displays sharp turning points, rather than exhibiting smooth patterns that are typical of more developed economies. In this regard, the study confirms the importance of supplementing information on gaps from equilibrium with professional judgment and other intermediate indicators in both the determination of the economic outlook and policy stance.

REFERENCES

Adams, C., Fenton, P.R. and Larsen, F. (1987). Potential Output in Major Industrial Countries, Staff Studies for the World Economic Outlook, World Economic and Financial Surveys, International Monetary Fund, 1 – 38.

Bank of Botswana (2008). Bank of Botswana Annual Report, Gaborone.

Blanchard, O. and Quah, D. (1989). The Dynamic Effects of Aggregate Supply and Demand Disturbances, American Economic Review 79, 655 – 673.

Basdevant, O. (2003). On application of state-space modeling in macroeconomics, Reserve Bank of New Zealand, Discussion paper No. 2.

Baxter, M. and King, R.G. (1995). Measuring business cycles: approximate band-pass filters for economic series. NBER Working paper no. 5022. Massachusetts: NBER.

Beveridge, S. and Nelson, C.R. (1981). A new approach to the decomposition of economic time series into permanent and transient components with particular attention to measurement of the business cycle, Journal of Monetary Economics, 7: 151-174.

Bukhari, S.A. and Khan, S.U. (2008). Structural and statistical approaches to estimating the output gap: First attempt to Pakistan. State Bank of Pakistan.

Clarida, R., Gali, J. and Gertler, M. (1999). The Science of Monetary Policy: A New Keynesian Perspective, Journal of Economic Literature, Vol. XXXVII, 1661 – 1707.

Coats, W., Laxton, D. and Rose, D. (2003). The Czech National Bank's Forecasting and Policy Analysis System. The Czech National Bank, Prague.

Driver, L.R. and Westaway, P. F. (2004). Concepts of equilibrium exchange rates, Bank of England, Working Paper no. 248.

Eika, K.H., Ericsson, N.R. and Ragnar Nymoen (1996). Hazards in Implementing a Monetary Conditions Index, Oxford Bulletin of Economics and Statistics 58, 765–790.

Freedman, C. (1995). The role of monetary conditions and the monetary conditions index in the conduct of policy, Bank of Canada Review, Autumn.

Gali, J. (2003). New Perspectives on Monetary Policy, Inflation, and the Business Cycle, in: Dewatripont, Hansen and Turnovsky, eds. Advances in Economics and Econometrics, Cambridge University Press.

Hataiseree, R. (1998). The Roles of Monetary Conditions and Monetary Conditions Index in the Conduct of Monetary Policy: The case of Thailand under Floating Rate Regime. Bank of Thailand Quarterly Bulletin, September.

Hyder, Z. and Khan, M.M. (2006). Monetary Conditions Index for Pakistan. State Bank of Pakistan Working Paper No. 11/06, May.

Gaertner, M. and Detechat, C. (2007). Assessing External Stability in a Resource Dependent Developing Economy: The Case of Botswana, IMF Country Report, Selected Issues, Washington: International Monetary Fund.

Harvey, A.C. (1989). Forecasting Structural Time Series Models and the Kalman Filter, Cambridge University Press, New York.

Hamilton, J.D. (1994). Time Series Analysis, Princeton University Press.

Hodrick, R. and Prescott, E.C. (1997). Post-War US Business Cycles: An Empirical Investigation, Journal of Money, Credit and Banking, 29:1-16.

Iimi, A. (2006). Exchange Rate Misalignment: An Application of the Behavioral Equilibrium Exchange Rate (BEER) to Botswana, IMF Working Paper no. 06/140, Washington: International Monetary Fund.

International Monetary Fund (1996). World Economic Outlook, May 1996.

James, L.V., Kganetsano, T.A. and Powder, B. (September, 2011). Macroeconomic Modeling at the Bank of Botswana, Bank of Botswana Research Bulletin, Volume 25 No. 1, 12-26.

Jing-Lung Lin (1999). Monetary Condition Index in Taiwan. Discussion Paper No. 9908, Central Bank of the Republic of Turkey.

Peng, W. and Leung, F. (1999). A Monetary Conditions Index for Mainland China. Hong Kong Monetary Authority Quarterly Bulletin, June.

Reserve Bank of New Zealand (1996). Summary Indicators of Monetary Conditions, Reserve Bank of New Zealand Bulletin, 223-228.

Woodford, M. (2003). Interest and Prices: Foundations of a theory of monetary policy, Princeton University Press.

An Assessment of Economic Diversification in Botswana

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Abstract

Despite robust expansion in the past two decades, Botswana's economic growth is not diversified, with continuing dominance of the mining sector. Even after employing resources to promote economic diversification, only moderate success has been registered. The low rate of success is confirmed by several methods used in this paper to measure the extent and trends in diversification. It appears that the major constraints to progress have been on the supply side, notably weak entrepreneurship and low productivity, as well as a restrictive regulatory environment, as highlighted by several studies and surveys on the country. Efforts to expedite economic diversification should continue to address supply side bottlenecks and strengthen the role of the private sector; thus, skills and entrepreneurship development and easing administrative burden on business. Continuing efforts towards trade facilitation would improve market access while maintenance of a conducive environment for inward investment would also support economic diversification.

Introduction

The spectacular growth rates registered by Botswana from the mid-1970s until recently were a direct result of performance of the mining sector and, over time, there has only been modest diversification of the economy (Siwawa-Ndai, 1997: 342-347, Maipose and Matsheka, 2004:60, Hillbom, 2008). Fluctuating commodity prices, volatile terms of trade and slow productivity growth are common features for primary goods producing countries. Diversification into other sectors not only reduces the overall negative impact of these factors on the economy, but also leads to the promotion of knowledge spillovers, improvement in production processes and overall productivity, balanced growth, a wider export base and increased competitiveness with an overall positive impact on employment and higher living standards (Gylfason, 2005).

Botswana is similar to several other African countries with undiversified economies. Hammouda et al. (2006) found that there are few successes of deepened diversification in Africa, notably, Mauritius and South Africa, while lack of diversification has slowed growth prospects for many other African countries. In general, weak economic performance and modest gains in economic diversification are attributed to the absence of fundamentals such as political and economic stability, well-functioning institutions, adequate investments, as well as over-reliance on primary commodities. As a result, developing countries are not able to benefit fully from globalisation mainly because of an economic environment that lacks the sophistication to accommodate changes resulting from rapid international development and competitiveness pressures.

Despite the fact that Botswana has prioritised economic diversification as a development strategy for over 20 years,[2] the economic base remains narrow and overly dependent on the diamond industry. The mining sector continues to account for a large share of total output, which fluctuated between 30 percent and 50 percent since the 1980s. While other sectors grew at a modest pace, the sustained rapid expansion of the mining sector during the 1980s up to the 2000s contributed to the dominance of the sector's contribution to total output. Support programmes for specific non-mining sectors were largely unsuccessful in improving sectoral performance and contribution to growth. For example, the share of the manufacturing sector to GDP declined significantly from 6.5 percent in 1974/75 to 3.8 percent in 2010, despite several targeted support programmes. Similarly, the contribution by the agriculture and construction sectors to total output also dwindled from 24.2 percent and 15 percent in 1974/75 to 2.3 percent and 5.1 percent in 2010, respectively. It is worth noting that the early part of the period (1970s) was when the balance was shifting from a larger contribution of the agriculture sector to the mining sector; while any significant construction activity (construction of mines) would have a large impact on the still small economy. However, weak performance of the agriculture sector is inconsistent with the extensive support provided by the government in the form of mineral generated revenues into agricultural subsidies.

Meanwhile, the trade, hotels and restaurants sec-

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2 The need to diversify the economy away from the mineral sector into non-mining sectors was emphasised in the National Development Plan (NDP) 7 (from 1991 to 1997), following a downward projection of mineral revenues for the NDP 7. The importance of diversification has since then been accentuated in various forums. For example, the former President of Botswana, Mr. Festus Mogae presented a speech at the Biennial National Business Conference in 2003 themed 'Economic Diversification: Which Way To Go?' (Mogae, 2003). The 2002 theme for the same conference was 'Towards Meaningful Economic Diversification'. The theme for NDP 9 was 'Towards Realisation of Vision 2016: Sustainable and Diversified Development through Competitiveness in Global Markets'. It is inscribed in the long term national goals that by the year 2016, "Botswana will have diversified its economy, with mining, agriculture, industry, manufacturing, services and tourism all making a substantial contribution" (Republic of Botswana, 1997:6).

tor improved its contribution from 9.1 percent of GDP in 1974/75 to 13 percent in 2010, while the share of banks, insurance and business services sector grew from 5 percent to 11.5 percent in the same period. However, the performance of the non-mining sectors (despite good performance especially by the trade, hotels and restaurants, and banks, insurance and business services sectors) has not been sufficient to reduce significantly the relative contribution of the mining sector.

While there is need for improvement to attain sustainable growth in the long run, it is apparent that progress in economic diversification has been slow. Moreover, with the diamond revenues projected to start declining in 2021 due to depletion in diamond deposits, economic diversification is more than ever an urgent need for Botswana (UNCTAD 2007, IMF 2007:10). There is, therefore, need to re-assess the effectiveness of the diversification strategy and associated initiatives. Notably, it has been suggested that, "various government initiatives, including those of the Botswana Export Development and Investment Authority (BEDIA), have failed to spur diversification" (AfDB, 2007:4). Some of the impediments to economic diversification include high costs of production, high relative expense of accessing international markets as Botswana is landlocked, and an inadequate investment environment. This paper uses alternative approaches to measure the degree of economic diversification in Botswana.

The following section, therefore, outlines the methodology applied in determining the extent of economic diversification. Section three presents the results of various, albeit largely similar statistical measures. Section four summarises some of the diversification initiatives and section five outlines constraints to the diversification effort and policy issues. The concluding observations are in section six.

2. METHODOLOGY

It has been established that there is correlation between economic diversification and the stabilisation of export revenues, strengthening of investment and, thus, economic growth (Hammouda et al., 2006). This paper investigates progress on economic diversification in Botswana by appraising the evolution of trends, in a number of variables such as GDP, employment mix, composition of exports and sectoral contributions to government revenue using data tables and graphs. In addition, several related concentration ratios are employed to assess economic diversification. These include the Herfindahl index, Ogive index, Entropy index, Hirschman index and the Normalised-Hirschman index (See Appendix). Overall, these concentration ratios are theoretically comparable in their measurement, such that the same conclusions can be drawn and they can be used interchangeably. The ratios allow for an easy to understand statistical interpretation of the degree of concentration.

The **Herfindahl Index (HI)** is a measure of industrial concentration, equal to the sum of the squared market shares of the firms in the industry (Hammouda et al., 2006). The HI ranges from zero to a maximum of one. Values closer or equal to one indicate low levels of diversification (high concentration), while values closer or equal to zero show high levels of diversification (low concentration). The Herfindahl Index can also be used to measure export diversification. It can be expressed in thresholds as follows; economies with highly diversified exports are likely to have Herfindahl Indices below 0.05, followed by a slightly diversified range of 0.05-0.1, while between 0.1 and 0.4 indicates a concentrated export basket and lastly, indices above 0.4 reflects a highly specialised export basket (Chandra et al, 2007). The HI is calculated as:

$$HI = \sum_{i=1}^{n} S_i^2 \qquad (1)$$

where S_i is the market share of the i^{th} firm, or sector. Sectors vary from 1 to n.

These ratios are complemented by other approaches that investigate the structural changes, in particular, of exports for a given industry. Such measures help to determine horizontal or vertical diversification within the export profile. Horizontal export diversification is the expansion of economic activity within a certain product group/sector by adding new products on existing export baskets within the same sector. Vertical diversification is the expansion of economic activity across product groups or a shift in production from the primary sector to the secondary or tertiary sectors (increased value added activities). A common method for measuring diversification with respect to structural changes is the **commodity-specific cumulative export experience function (CXF)**. The CXF, therefore, provides an indication of the "traditionality" of exports. The function is expressed as:

$$CXF_{it} = \frac{\sum_{t=t_0}^{t} x_{it}}{\sum_{t=t_0}^{T} x_{it}} \qquad (2)$$

where x_{it} is the value of export of commodity i in year t, expressed in constant prices; t_0, τ and T represent the initial (start period), current and terminal periods, respectively. Properties of the CXF are similar to that of a cumulative distribution function in that it may take small values in the initial period, but increase in the terminal or end period. On the graph for individual export items, plots shifted to the left or those linear reflect a more traditional commodity (primary product); and at the same time it reflects growth in exports of that product in the initial period. Meanwhile, plots which are shifted to the right reflect a non-traditional commodity (manufactures), growth in exports in later years as well as diversification within the sector. The CXF plots can also be used to shed light on the diversification of export industries, in that, export items for which CXF plots are shifted more to the right are expected to be vertically diversified in addition to being non-traditional.

However, in a situation where two export items have identical cumulative export experience functions, it is possible to identify which one is more traditional than the other. This can be done by ranking the exports according to the traditionality attribute using the mean of the cumulative export experience function for each export commodity, called the **Traditionality Index.** A more traditional industry has a higher value of T_i and a non-traditional one has a lower value. It is computed as follows:

$$T_i = \frac{\sum_{t=t_0}^{T} CXF_i}{T - t_0 + 1} \qquad (3)$$

3. DETERMINATION OF DIVERSIFICATION

The use of more than one method helps to test the robustness of the results. Therefore, the determination of progress in economic diversification involves both a review of historical trends and application of statistical methods (concentration ratios and the commodity-specific cumulative export function).

Sectoral contributions to GDP

A historical review of sectoral contribution to GDP (Chart 1) shows that the mining, government, trade, hotels and restaurants, finance and business services and transport sectors, on average, increased their share of total output between 1974/75 and 2009/10. Overall, the mining sector has been the largest contributor to total output. In contrast, contributions by the agriculture, construction and manufacturing sectors have gone down during the same period. Meanwhile, the growth rate of the mining sector has been higher than that of the non-mining sectors during the 1990s and early 2000s (Chart 2). However, growth of the non-mining sectors remained positive during the 2008/09 global economic recession while that of the mining sector contracted, which highlights the importance of a balanced economic base. The non-mining sectors with high growth during 2008 were the transport, water and electricity, finance and business services sectors, as well as general government, whilst for 2009 it was the construction and agriculture sectors. In 2010, growth of both mining and non-mining output was almost at par, recording increases of 7 percent.

Herfindahl Index for GDP

As explained above, Herfindahl Index values closer to one indicate low levels of diversification (high industry concentration), while values closer to zero show high levels of diversification (low industry concentration). The calculated Herfindahl Index plotted in Chart 3 shows that there is some degree of instability in the index during the period under review (1974/75 to 2009/10). Most of the instability is partly attributed to the variability in mining growth. Meanwhile, the index was stable in the late 1970s largely because agriculture, mining and construction sectors played a larger role in total output during that time. The period from 1982/83 up to the late 1980s shows a highly concentrated GDP, which was due to the boom in the mining sector, mainly because of the Jwaneng mine coming on stream in 1982, and the recovery in the diamond market. The index declines slightly after the 1990s, but remains higher than the 1970s values. The decline in the index partly reflects the strengthening role of the banks, insurance and business services and trade, hotels and restaurants sectors, while that for the mining sector declined rapidly (the squared share of the mining sector declined from 0.18 in 2006/07 to 0.16 in 2007/08, 0.13 in 2008/09 and eventually to 0.08 in 2009/10). On the whole, diversification gains in the 1970s (mainly attributable to diversifying away from the agriculture sector to the mining sector) and early 1990s were not sustained because growth in other sectors was not able to keep up with that of the mining sector. On the basis of the thresholds stipulated by Chandra et al (2007), total output is relatively undiversified at the sectoral level (the Herfindahl index has been hovering between 0.13 and 0.30, which is above 0.1).

Government Revenue

In 2005/06, revenue from the mineral sector accounted for 54.9 percent of total government revenues, up from 47.4 percent ten years back in 1995/96. However, due to the financial crisis, the contribution of mineral earnings to total revenue declined from 40.2 percent in 2007/08 to 35.6 percent in 2008/09 and further to 29.8 percent in 2009/10. The second largest contributor to government revenue was the customs and excise at 29.6 percent in 2009/10. It is worth noting that revenue from non-mineral income tax, as well as Value Added Tax (VAT) (limited sales tax prior to 2002), increased significantly between 2001/02 and 2009/10 (Chart 4). Non-mineral tax revenue grew on average by 33.2 percent annually, higher than the 28.8 percent for other tax revenue (Sales tax/VAT, export duties, property taxes, vehicle taxes, license fees and airport taxes). Customs and excise revenue grew at an average rate of 18.5 percent and mineral revenue by 2 percent in the same period. These developments point to diversification of revenue sources, thus reducing vulnerability of government finance. The overall rise in non-mining revenue is an indication of gains in diversification, improvements in tax administration, and the increase in tax rates, levies and other charges. Other revenues include export duties, property taxes, vehicle taxes, license fees and airport taxes.

Employment

Between 2002 and 2010, employment growth averaged 3.7 percent. During the same period, local government employment grew on average at an annual rate of about 27 percent (3.7 percent excluding Ipelegeng[3] workers) and other sectors grew modestly

3 The Ipelegeng Program is a Government project aimed at reducing poverty by creating temporary employment.

with the exception of agriculture and construction sectors, which grew at an annual rate of 0.1 percent and negative 2.1 percent, respectively (Chart 5 overleaf). In terms of contribution to total employment, central government contributed the highest share at an average of 29.8 percent between 2001 and 2010, followed by commerce with 18.1 percent, manufacturing with 10.8 percent and local government with 10.8 percent (8.1 percent excluding Ipelegeng workers). The contribution of the mining sector to formal employment between 2001 and 2010 was small at 3.1 percent. This is due to the fact that the mining sector is highly capital intensive in nature and the mining companies employ workers in the fields of health, education, security and construction that are not counted as mine workers. In addition, the temporary closure of some mines during 2009 contributed to the decline in mine employees.

The employment data, however, has several pertinent deficiencies. Notably, the employment survey does not cover small businesses employing less than five workers. Small businesses are widely regarded as having potential to grow and help diversify the economy; therefore, their exclusion in employment figures is likely to conceal the important contribution they have on employment creation. In addition, employment data do not fully capture workers in traditional subsistence agriculture. Thus, the impact of agricultural support schemes on employment is not readily apparent. These schemes include subsidies for ploughing through the Integrated Support Programme for Arable Agriculture Development (ISPAAD) and promotion of livestock rearing through the Livestock Management and Infrastructure Development (LIMID).

Sectoral contributions to exports

As with the broader economy, there has been slow progress in diversifying the export base. For some time in the 1990s, exports of motor vehicles grew markedly, following the establishment of a Hyundai assembly plant in 1994, as well as assembly of Volvo trucks. This was, however, short-lived as the Hyundai plant closed in 2000 and the Volvo plant in 2005. Thus, the slide in the share of motor vehicle exports from a peak of 16.1 percent in 1995 to 2.1 percent in 2000, and subsequently to 1.5 percent in 2010. The structure of exports in Chart 6 shows that the mining sector contributed more than half of total exports for the period under review. Meanwhile, the textile sector has grown significantly from 2003, boosted by favourable procurement of inputs outside the country. Textile exports have also benefited from the devaluation of the Pula in 2004 and 2005. However, the textile industry was adversely affected by the 2008/09 global economic recession as reflected by the fall in exports in 2009, alongside similar falls in other categories of exports (except for vehicles and soda ash). The abolition of the favourable treatment of inputs from outside the Southern African Customs Union (SACU) region in 2009 has also impacted negatively on the textile sector and some companies have closed operations due to high production costs and stiff competition from China and India. As a result, several textile manufacturing businesses have only remained in operation through government support.[4]

Botswana has access to several goods and services markets in the Southern African Development Community (SADC) region, the European Union (EU) through the EU/African Caribbean and Pacific (ACP) agreement, the United States of America through the African Growth and Opportunity Act and the SACU, which allows for free movement of goods and services between SACU countries (Botswana, Lesotho, Namibia, South Africa and Swaziland). However, there are challenges in benefiting fully from these agreements because of tariff and non-tariff barriers; for example, rules of origin constraints and product standards and difficulties in meeting quotas (either inadequate domestic production and quality and standards of goods).

Concentration ratios: Exports

Chart 7 (on page 31) plots the results of the Entropy measure of concentration, which has generally increased between 1990 and 2010, implying reduced concentration of the export portfolio.

Plots for the Herfindahl, Ogive and Normalised-Hirschman Indices in Chart 8 show a largely similar trend and turning points. Overall, movements in the indices reflect gains in diversification between 1995 and 1999 as a result of the increase in exports of vehicles (boosted by the Hyundai plant), as well as from 2007 to 2009 due to the general increase in the export values for several items (for example, textiles and copper-nickel matte). The Herfindahl and Normalised-Hirschman Indices are above 0.40, for the entire sample period, indicating that the export base is concentrated. However, it is likely that more diversification gains would be apparent in the mineral sector if diamond exports were disaggregated to separately show processed and unprocessed diamonds. Meanwhile, the 'other goods' group has become increasingly diversified.

Commodity-specific cumulative export experience function for Botswana

Plots for the cumulative export experience functions for most of the export commodities are linear, while only three commodities are shifted to the right, implying that the exports mix has not changed significantly during the period under study (Chart 9). The plots for exports of textiles, other goods and copper-nickel matte are shifted to the right reflecting increased growth in exports and for other goods.[5] It also shows diversification within the sub-group.

It was established in 2009.

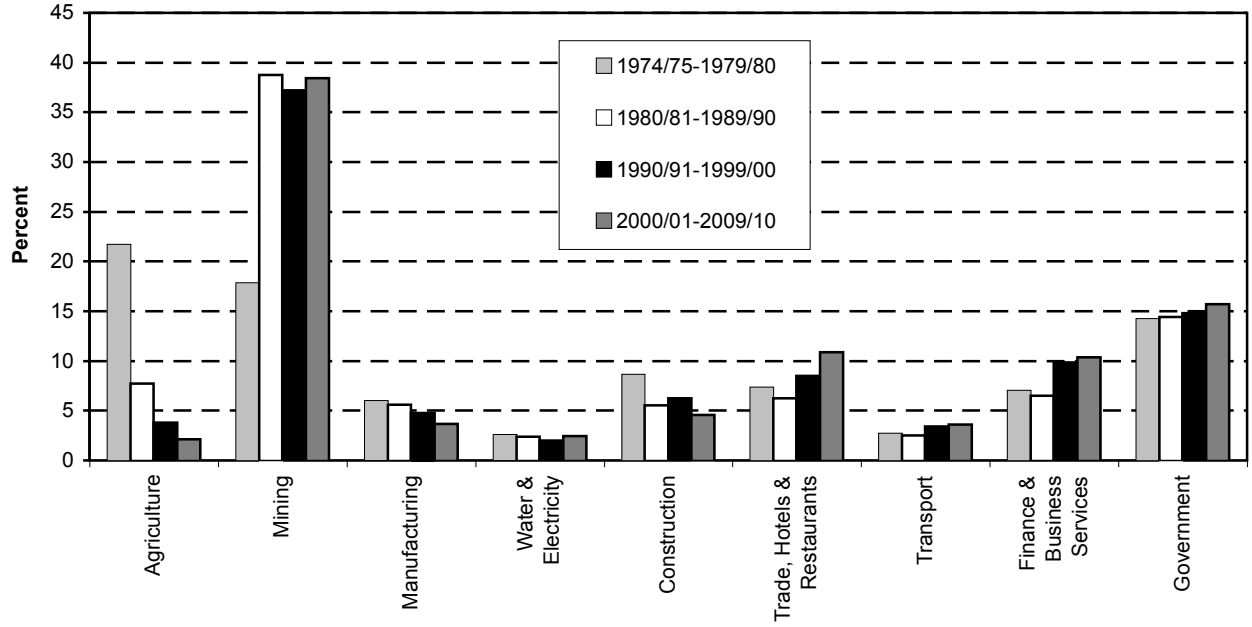
4 In 2010, the government announced a rescue plan for the crisis-hit textile sector which aimed at saving the industry and improving competitiveness of the sector in order to retain jobs.

5 The sub-group 'other goods' contains all other export goods aside from the major exports.

Meanwhile, the vehicles and parts plot moved towards the right in the early 1990s indicating some form of dynamism and strong growth, but the tendency in the recent years was to shift towards the left, reflecting a decline in exports of this commodity due to the closure of the Hyundai plant. The plot for diamonds, which is Botswana's primary export, has remained basically linear, implying that it is a traditional commodity. Moreover, the impact of mining diversification through diamond beneficiation is not reflected in the data. The share of diamonds in total exports averaged 74 percent between 1990 and 2009 with a peak of 85 percent in 2001 reflecting the buoyant global market and a trough of 63 percent in 2007 due to the impact of the beginning of the recent global economic recession, which led to the temporary closure of some mines in the country.

In addition, an important investment promotion initiative was establishment of the Botswana Development Corporation (BDC) in 1970 with the objective of supporting sustainable investment ventures in Botswana, as well as joint ownership or partnerships with private investors. Among others, these relationships facilitated developments in financial services, manufacturing, construction, tourism, agriculture and property/real estate. Furthermore, the National Development Bank was set up in 1974 to provide long-term and project finance and thus promote investment in areas such as agriculture, commerce and industry. Subsequently, the Financial Assistance Policy (FAP), which mainly provided funding in the form of grants, was introduced in 1982 with the aim of promoting entrepreneurship and thus accelerating economic diversification. The FAP contributed to the growth of the manufacturing sector at an

Chart 1: Averages of sectoral distribution to GDP



Source: Statistics Botswana

Government Economic Diversification Initiatives

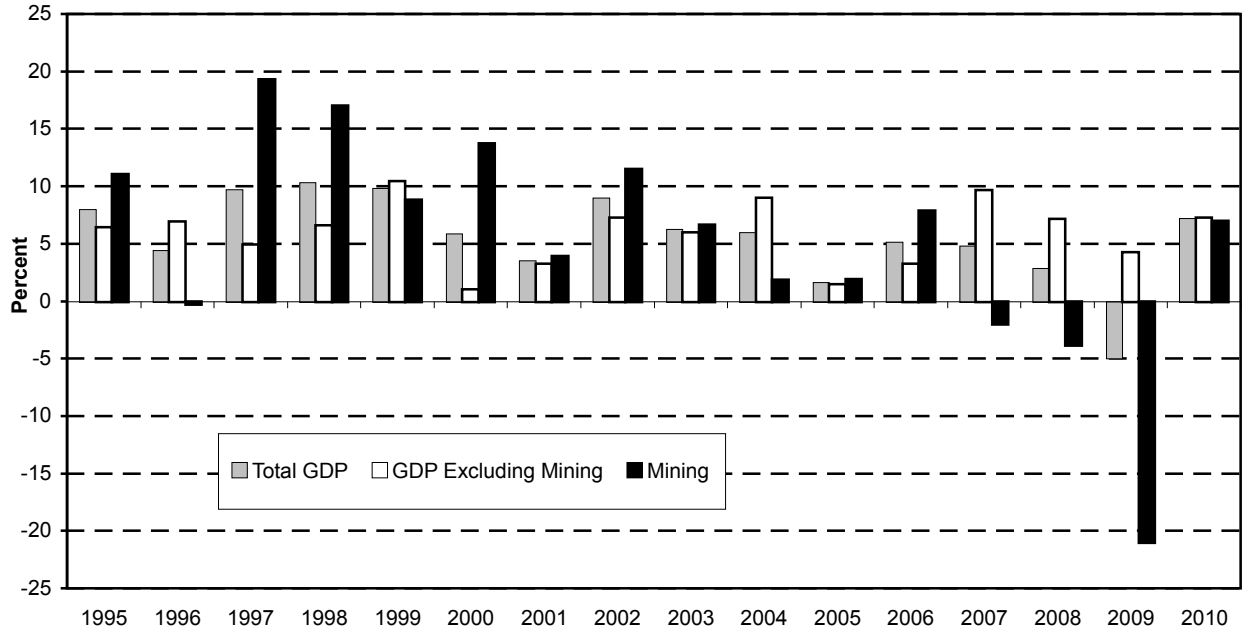
Apart from ensuring macroeconomic stability, the Government of Botswana has continually invested resources to support economic diversification by instituting a number of programmes to stimulate and promote investment in both the traditional and non-traditional sectors. The various trade agreements that Botswana is party to have also provided an opportunity for the country to gain market access for goods and services, as well as diversify the sources and range of imports. In terms of specific industries, there has been continuing support for agriculture, including various schemes and extension services for both livestock and arable farming.[6]

average annual growth rate of 5.3 percent between 1979/80 and 1989/90 (BoB, 2000), mainly because it attracted foreign manufacturers enticed by costless finance and provision of facilities. However, over time the FAP failed to achieve its objectives; hence, it was abolished in 2001.

The Citizen Entrepreneurial Development Agency (CEDA), established in 2001, is considered an improvement on the FAP. Apart from performing the basic function of providing low-interest loans, CEDA aims to build profitable, diversified and durable businesses through close supervision of investments. This is supplemented by the Local Enterprise Authority (LEA), established to cultivate and promote entrepreneurial skills, as well as business incubation and monitoring. In addition, the Botswana Investment

6 Examples include Arable Land Development Programme (ALDEP), ISPAAD and LIMID.

Chart 2: Growth of GDP from 1995 to 2010

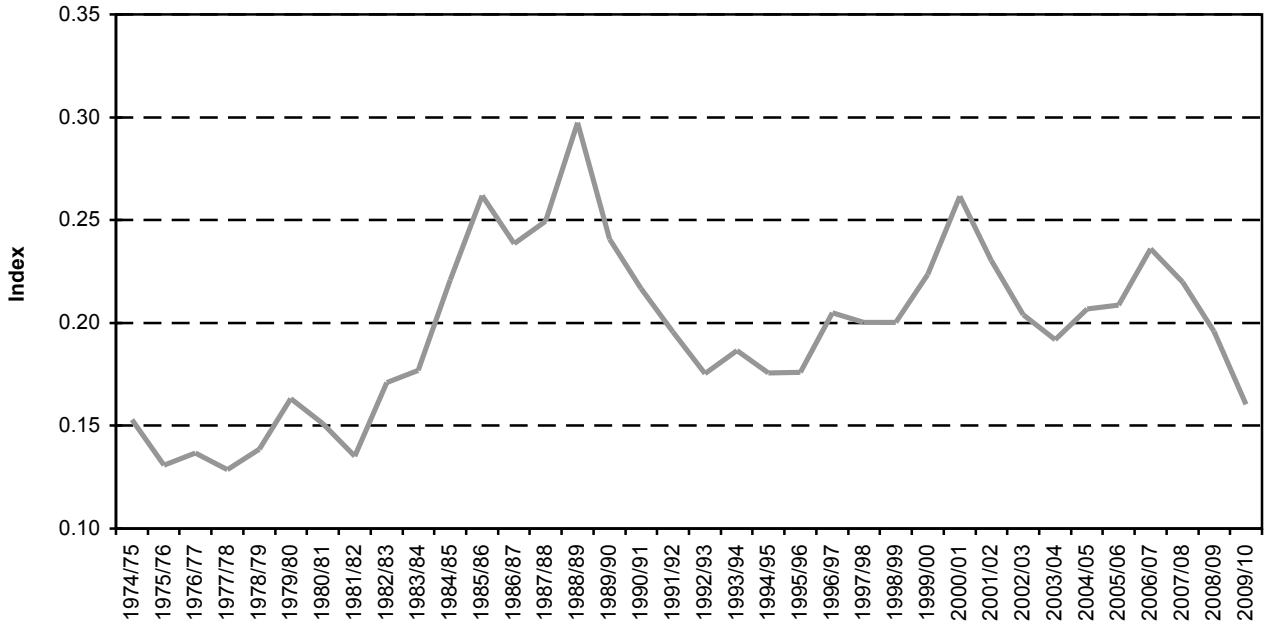


Source: Statistics Botswana

and Trade Centre (BITC) (merger between Botswana Export Development and Investment Authority and International Finance Services Centre) is earmarked to promote foreign direct investment and develop export markets.

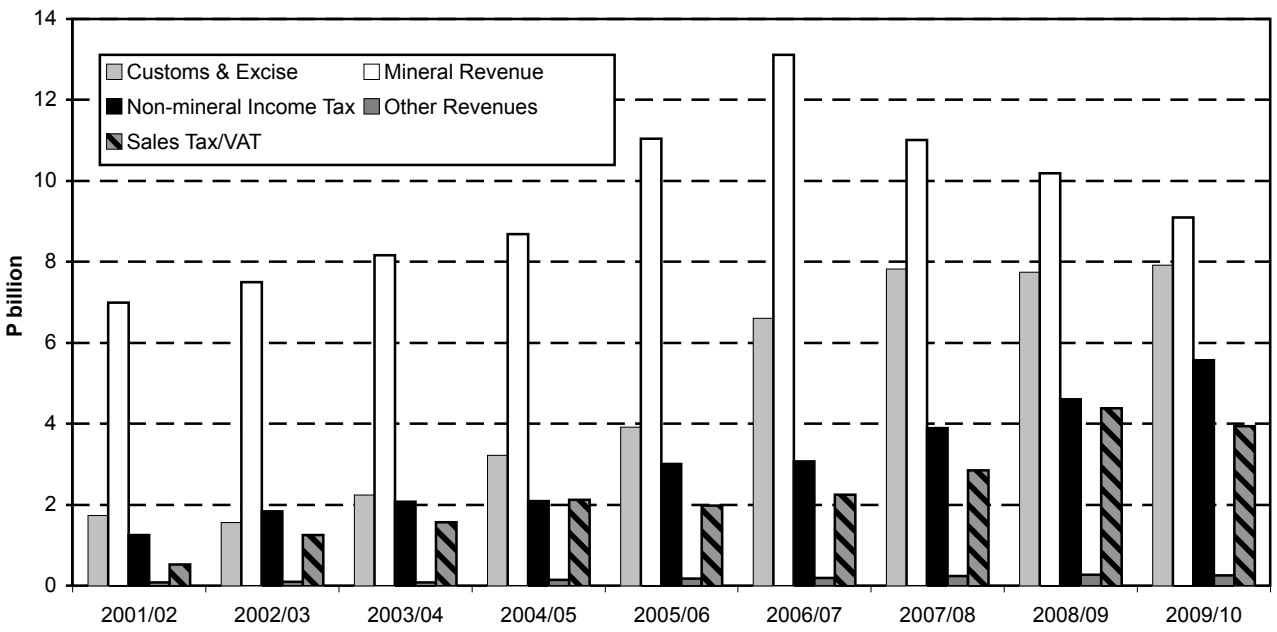
In addition, the Botswana Innovation Hub (BIH) is being set up with the aim of accentuating a knowledge-based economy through networks with high-end technology innovators, market experts and capital providers. Furthermore, the Economic Diversification Drive (EDD) initiative promulgated in 2010, promotes leveraging of the government's purchasing power to enhance local production and consumption of domestic produce (of goods and services) through preferential procurement and the application of price preference margins based on annual turnover. The long term strategy is to develop a vibrant and globally competitive private sector, independent of government support and protection. In turn, the government has also set up a National Strategy Office under the Office of the President, to coordinate implementation of economic diversification initiatives.

Chart 3: Herfindahl Index for GDP, 1974/75–2009/10



Source: Own calculation using data from Bank of Botswana and BFS Tables

Chart 4: Government Revenues (2001/02 to 2009/10 in Billions of Pula)



Source: Statistics Botswana

The strategy to diversify the economy also entails the attraction of foreign direct investment (FDI). Historically, a greater part of FDI went into the mining sector, while the second main recipient of FDI since 2000 was the finance sector (Table 2). In particular, the stock of FDI in the finance sector grew rapidly from P619 million in 2000 to P2 712 million in 2008. The finance and business services sector's contribution to output has, as a result, improved in the recent years.

5. Constraints to diversification and policy issues

A review of progress on diversification shows that it has been sluggish and insufficient. The export sector continues to be dominated by traditional exports; and there has been no rapid spread of investments into other sectors, save for the finance and telecommunications sectors. It has to be acknowledged, however, that the much more rapid growth of the mining sector (except during the global financial crisis) could not be matched by even respectable expansion of the non-mining sectors; for example, mining recorded an average annual growth of about 8.6 percent between 1995 and 2006 compared to non-mining sector growth of 5.6 percent during the same period. Overall, the notable expansion of non-mining sectors, owing mostly to development of the services sector, has not been sufficient to drive the economy to greater diversification. Nevertheless, the objective continues to be sustaining and harnessing the gains made so far towards greater economic diversification, but at the same time addressing some pertinent challenges as highlighted below.

Constraints to diversification

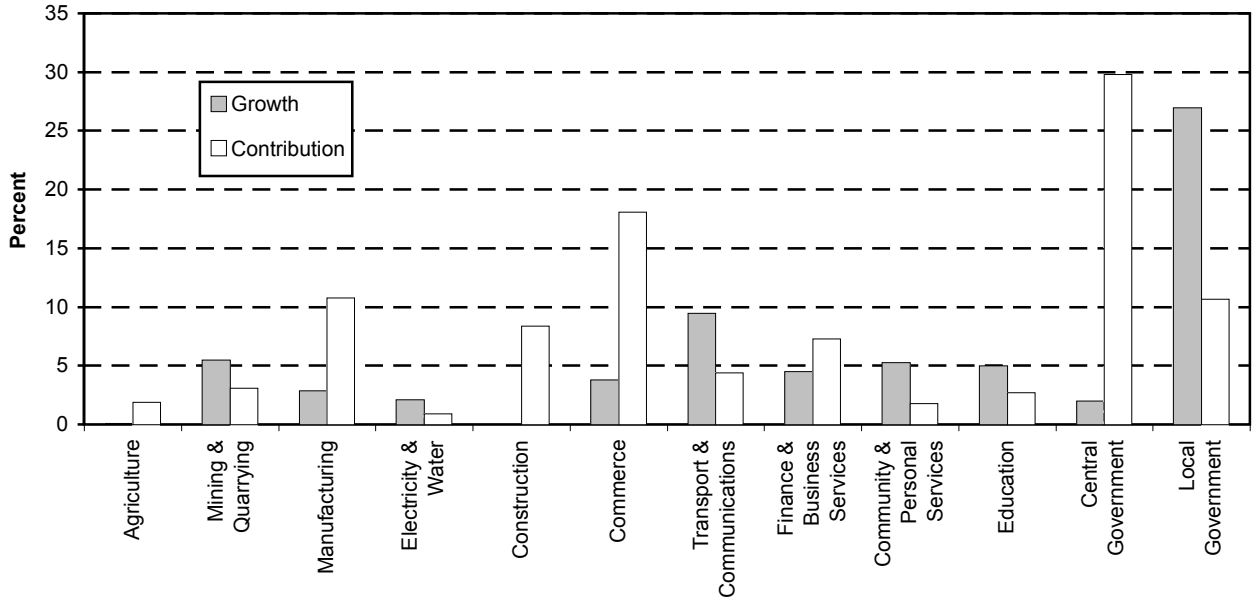
Small market and high transaction costs

Sachs and Warner (1995) argue that the geographic position of a country has implications for growth. Botswana is landlocked and far from large and major markets apart from South Africa. Therefore, industry in Botswana incurs high costs of trade, including transport costs, long duration to delivery and delays arising from transit regulations and requirements at border posts. The World Bank's 2009 survey of trade logistics ranked Botswana at number 134 out of 155 countries and, as such, Botswana was grouped among the bottom 10 'under-performers' during that year. The difficulty in arranging competitively priced shipments, as well as relatively long duration of shipments contributed to the poor performance.

Inadequate investment climate

Investment in tradeables is paramount to the success of Botswana's export-led growth strategy. However, entrepreneurship is weak in Botswana; hence, the country experiences insufficient domestic investment (Sentsho 2005:145, UNCTAD 2003:15, RoB 2005:9). In addition to supply-side constraints, some of the local companies still lag behind in terms of product quality, product diversification, and adaptation of modern technology, factors that have a negative impact on competitiveness. Moreover, the lack of locally produced inputs or raw materials and limited skills add to the high cost of production. Thus, the argument that industry is costly to run in Botswana. Apart from the traditional exporters, only a few companies (mostly foreign owned) produce for export, while a substantial number of local companies depend on government tenders for their sales (Regional Programme on Enterprise Development

Chart 5: Average growth rate (2002–2010) and contribution to employment (2001–2010)

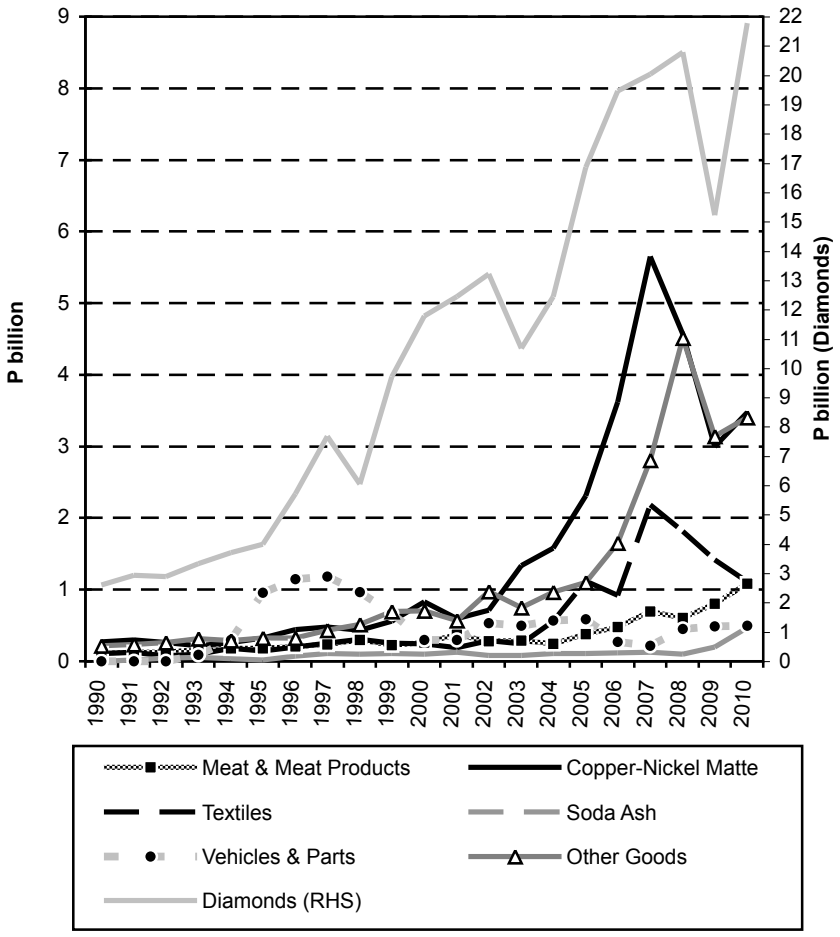


Source: Statistics Botswana

(RPED), 2007:15-17; Republic of Botswana (RoB), 2005:15-16).

Botswana's ranking on the ease of doing business has deteriorated in recent years. In 2011, Botswana ranked number 52, having declined from number 45 and 39 in 2010 and 2009, respectively (World Bank, 2011). The deterioration in the rankings reflected lower scores in starting a business, dealing with construction permits, getting permits and protecting investors, while the ranking improved for enforcing contracts.

Chart 6: Exports of goods from 1990 to 2010 (Billions of Pula)

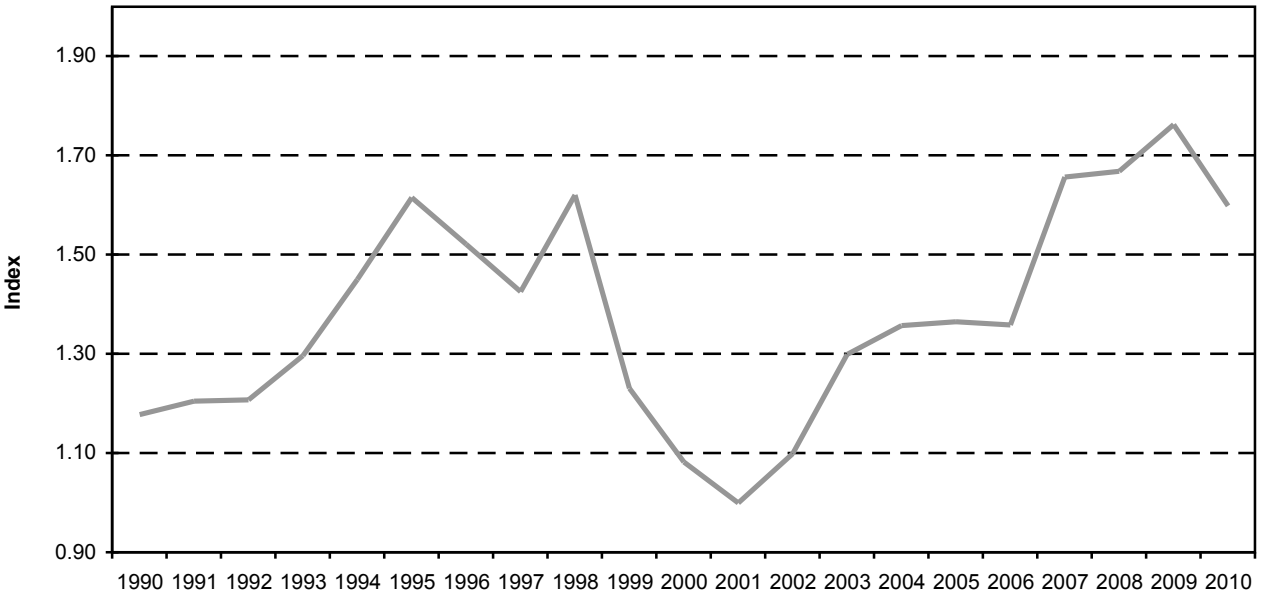


Source: Statistics Botswana

A few surveys on the investment climate in Botswana were conducted by UNCTAD in 2003 and the Africa Private Sector Group through RPED in 2007. While these studies indicate that Botswana was politically and economically stable, they found that the main weaknesses of the investment environment were lack of low cost skilled labour, bureaucracy and the high cost of utilities (UNCTAD, 2003:83-86). In the textile sector, issues arising from inadequate training for technicians and supervisors, low productivity and delays in getting work permits for foreign workers were the major constraints to investment (Salm et al., 2004:32-33).

The subsequent survey in 2007 (RPED 2007:3) reported that weaknesses in areas such as access to finance, access to land and inadequately educated workers in the manufacturing sector were a challenge to doing business. Furthermore, the survey revealed that Botswana firms were less competitive compared to those

Chart 7: The Entropy Index



Source: Own calculation using BFS Tables

in other middle-income countries due to low labour productivity and sluggish total factor productivity (TFP) growth. It was also observed that the informal sector, by copying product lines of established businesses, was becoming a significant threat to doing business, particularly in labour-intensive sectors. This introduced issues of unfair competition and tax compliance problems. However, the informal sector was reported to be still small. In addition, regulatory issues to do with lack of tender regulations and absence of competition law were reported to be a weakness to the business environment (RPED 2007:95).[7]

A survey by Grobbelaar and Tsotetsi (2005) on South African firms doing business in Botswana in 2005 found similar outcomes. The political and macroeconomic stability, as well as low corruption, were deemed to be the strongest points for the investment climate in Botswana. However, the major impediments highlighted included the small market, lack of finance, shortage of skilled labour, bureaucracy, unfair competition due to preference for local companies during tendering processes, high costs of utilities, and difficulty in accessing land and getting work permits (Grobbelaar and Tsotetsi 2005:77-82).

The deficient investment climate, however, appears to be more of an impediment to the non-mining sectors, compared to investment in mining which has thrived. According to the 2010/11 Fraser Institute survey of mining companies, Botswana ranked 14th overall, in the world, an indication that Botswana is a preferred mining destination due to its favourable policies towards mining. Botswana ranked first in Africa in areas of political stability, security and labour regulations, legal processes and tax, although it was held back by the problem of lack of skilled labour. Due to favourable policies towards mining investment, Botswana is enjoying a reputation of being the best rated African country for mining investment. Unfortunately, with similar favourable policies, the non-mining sectors are not able to attract investments the same way as with the mining sector. This is due, in part, to higher variety and dynamism in investment climates around the world where Botswana faces competition in areas that, unlike mining, are not determined by location. However, there may be aspects of mineral rights, revenue sharing and government support that place Botswana at an advantage.

Diversification Strategy and Policy Issues

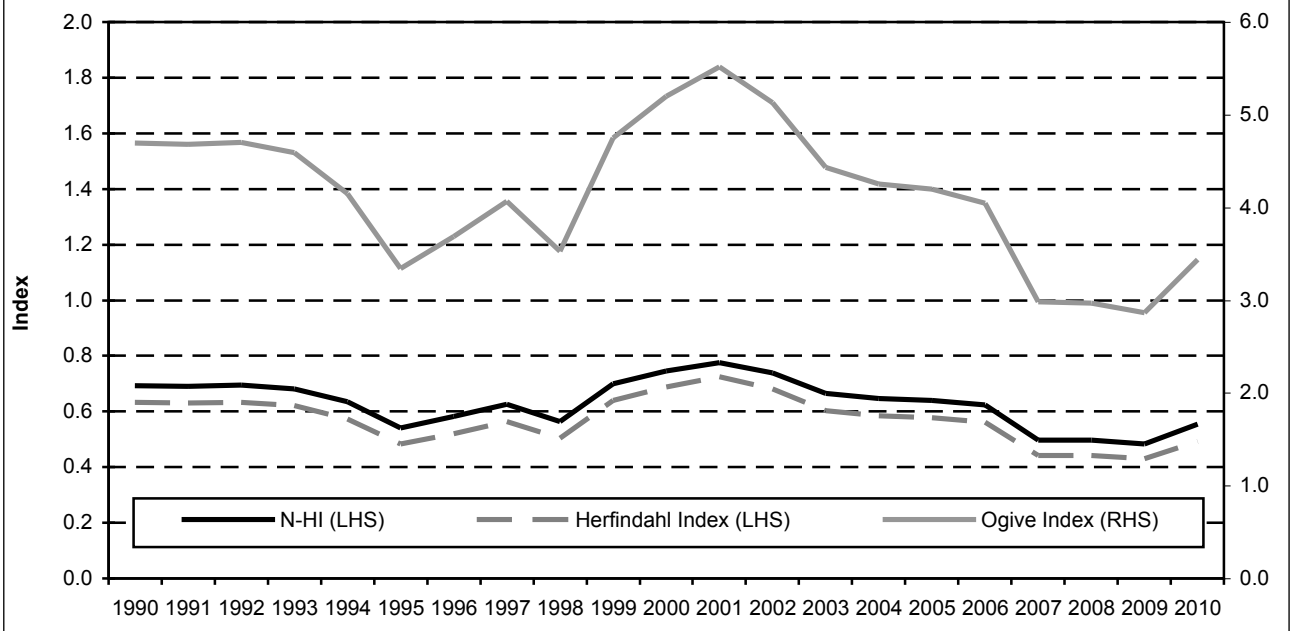
Economic diversification has been and continues to be central to Botswana's planning, development objectives and policy initiatives. However, given slow progress in economic diversification, there is need to continually review and update strategies. The relevant issues in this regard fall in the following areas.

(a) Market

Given the small domestic economy, in terms of both population size and income levels, policy and initiatives should focus on fostering international competitiveness of Botswana produced goods and services. Important dimensions, in this respect, include quality and uniqueness/specialty of goods and services. Trade facilitation through trade agreements is also important in engendering market access and availability of inputs. In particular, this includes taking advantage of the WTO dispensations and special arrangements with developed countries, while also striving to ensure that the SACU and SADC arrangements facilitate domestic industry access to the regional market.

7 Following the establishment of the Competition Authority under the Competition Act of 2009, issues of competition law and policy can now be addressed.

Chart 8: Concentration indices (Herfindahl, Normalised–Hirschman and Ogive)



Source: Own calculation using BFS Tables

(b) Beneficiation and economic linkages

Botswana has to harness unique opportunities, for example, in tourism and minerals. The benefits derived from these sectors can be extended by continuing support for development of upstream and downstream activities. It is notable that recent initiatives in the diamond sector have contributed to widening of the diamond industry and employment opportunities and potentially growth of support services for the industry.

(c) Investment climate

There is considerably more that has to be done to improve business conditions in the country, including realigning skills development to industry needs and reducing the number and length of processes required to launch businesses. It is, therefore, deemed positive that following publication of the 2011/12 Global Competitiveness Report, which showed deterioration in the country's business climate, an inter-agency, the National Doing Business Council, was set up to formulate measures that would improve the situation. Another area for improvement is with respect to the provision of infrastructure, utilities and other business services, in terms of both timely availability and cost. The ongoing development of energy, water reticulation and telecommunications should be helpful in this regard. Regular monitoring of the investment climate is important for promoting an environment that allows for innovation and transmission of newer skills.

(d) Government institutions

Institutions, such as CEDA and LEA, have some potential in supporting economic diversification, particularly through development of citizen entrepreneurship skills. However, there continues to be a need to regularly evaluate relevance and the proper place for such schemes in the context of changes in the economic and business environment; for example, whether it is better for government to provide guarantees for private financing of small, medium and micro enterprises (SMMEs), where there is a better chance of resources being used productively while making savings on government finance. Meanwhile, BITC would continue to have a role in promoting inward investment and market access, while participation of BDC in industrial development remains important.

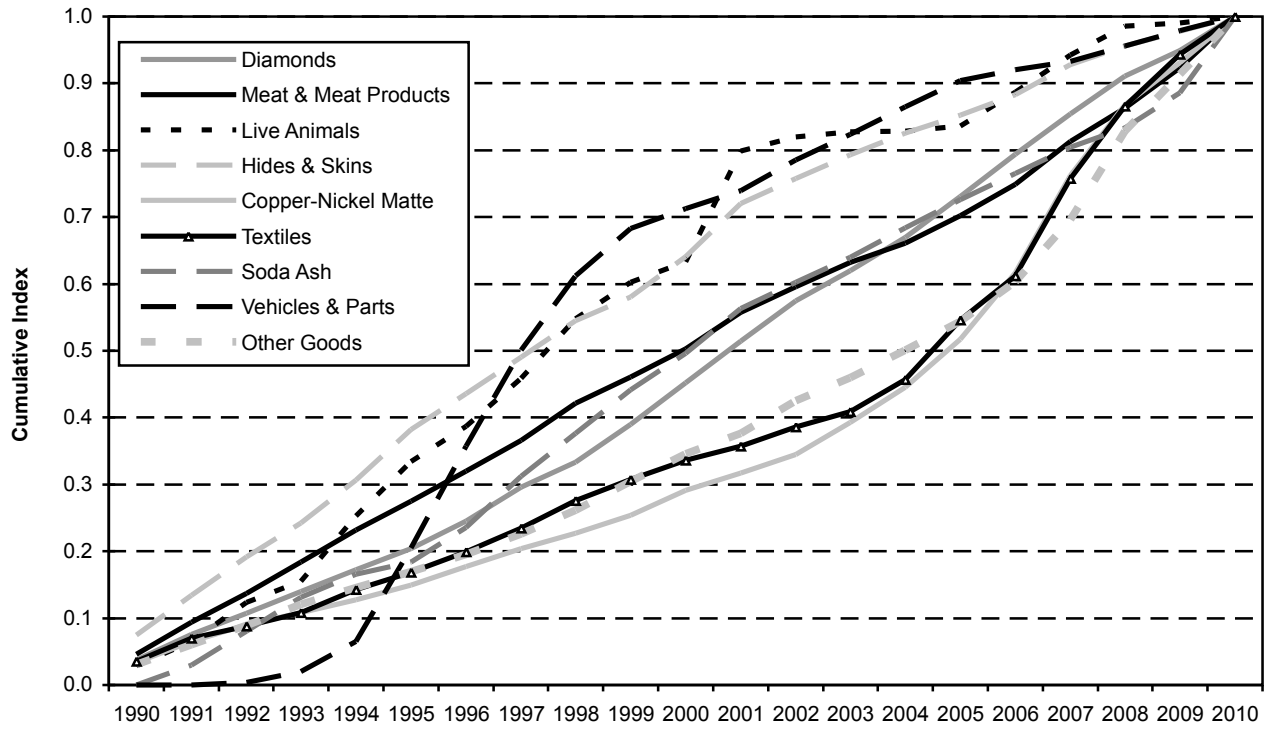
(e) Macroeconomic policy stability

In order to improve and sustain accelerated growth and economic diversification, there is need to continue to focus and emphasise macroeconomic and financial stability. For example, stable and predictable inflation, a competitive exchange rate and fiscal prudence (and predictability of the tax regime) continue to be crucial for supporting domestic economic activity, mobilisation and productive deployment of savings and attracting inward investment.

6. Conclusion

Botswana places economic diversification high among the national policy objectives. Thus, several policy initiatives are focused on widening and balancing the economic base of the country. However, measures of sectoral contributions to output, employment, exports, government revenue and economic growth continue to reflect dominance of the mining sector. Similarly, statistical measures of concentration suggest minimal success in the economic diversification effort. That said, there has been notable progress in the development of the services sector (finance and

Chart 9: Commodity–specific cumulative export function for Botswana



Source: Own calculation using BFS Tables

telecommunications), while the contributions of the other primary (agriculture in particular) and secondary sectors (notably manufacturing) have been disappointing. Significantly, this occurs despite targeted support programmes for these areas of economic activity.

In part, the low measured success of economic diversification away from mining is due to the spectacular growth of this sector, which tends to overshadow, even respectable expansion of other sectors. In this respect, it is significant that, while mining performance has been volatile recently, including a substantial contraction, the non-mining sectors, overall, have maintained steady growth. However, it is clear that there are significant impediments to the economic diversification effort; mostly supply side and microeconomic issues, rather than macroeconomic influences. As such, several studies, surveys and policy reviews highlight adverse influences such as weak policy implementation and coordination, relatively low levels of productivity, inappropriate skills mix and long bureaucratic processes for business establishment and acquiring supporting infrastructure and services. Other constraints include small market size, relatively high utility costs and elevated transport expenses due to long distance from sea ports.

However, economic diversification remains central to prospects for long-run growth, employment creation and increases in living standards. A diversified economy is more likely to be resilient in the event of inevitable demand and price shocks associated with primary commodities. Moreover,

Table 2: Stock of FDI by industry (Pula million), 2000–2008*

Industry	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mining	7792	7714	2957	2688	2494	2648	3134	3299	3313
Manufacturing	343	274	185	295	151	141	88	90	75
Finance	619	729	731	873	931	1290	3295	2050	2712
Retail and Wholesale	773	651	609	826	239	92	138	144	62
Electricity, Gas and Water	0	0	9	37	39	0	0	0	0
Real Estate and Business Services	161	115	93	118	93	94	41	116	462
Transport, Storage & Communications	105	162	155	183	134	97	87	39	33
Construction	16	15	13	10	28	1	8	8	24
Hospitality	17	135	129	154	57	23	20	32	25
Other	0	1	1	1	38	1	23	41	9
Total	9826	9696	4882	5187	4204	4387	6835	5819	6714

**Refers to the stock of FDI (equity and non–equity) at the end of the year and not the flow during the year.*

Source: Bank of Botswana Annual Reports

it is envisaged that the current mainstay of the economy, diamond mining, is moving towards more costly extraction processes and depletion. It is, therefore, important to continue to evaluate the efficacy of the economic diversification policy initiatives and programmes and the manner in which they are implemented. At the same time, it is essential to review bureaucratic processes with a view to accelerating establishment of businesses and provision of supporting resources and utilities. In addition, there should be continuing efforts towards trade facilitation to enhance market reach and access to resources for the domestic industry. Continued maintenance of a condusive macroeconomic environment would also support inward investment and diversification of the economy.

REFERENCES

African Development Bank (AfDB) (2007). "Africa's Natural Resources: The Paradox of Plenty" In African Development Report 2007: Natural Resource for Sustainable Development in Africa. AfDB: 96-141.

Bank of Botswana. (2000, 2002 and 2006). Annual Report. Gaborone: Botswana.

Botswana Financial Statistics (2000 to 2010, various volumes). Bank of Botswana. Gaborone: Botswana.

Central Statistics Office (CSO) (2008). Labour Force Survey 2005/06. Ministry of Finance and Development Planning: Government of Botswana.

Chandra, V., J. Boccardo and I. Isorio, (2007). "Export Diversification and Competitiveness in Developing countries", Working Draft, The World Bank.

Grobbelaar, N. and K. Tsotetsi, (2005). Africa's First Welfare State: The experience of South African firms doing business in Botswana. Business in Africa Report 5: The South African Institute of International Affairs (SAIIA).

Gylfason, T. (2005). "Institutions, Human Capital, and Diversification of Rentier Economies". Worshop on "Transforming Authoritarian Rentier Economies". Held 21-24 September 2005 in Friedrich Ebert Foundation: Bonn.

Hammouda, B.H., S.N. Karingi, A.E. Njuguna and M. Sadni-Jallab, (2006). "Diversification: Towards a new paradigm for Africa's development". Work in Progress No.35. Economic Commission for Africa: African Trade Policy Centre (ATCP).

Hillbom, E. (2008). "Diamonds or development? A structural assessment of Botswana's forty years of success". Journal of Modern African Studies 46, (2) 191-214.

Imbs, J. and R. Wacziarg, (2003). "Stages of Diversification". American Economic Review 93, (1) 63-86.

International Monetary Fund (IMF) (2007). "Botswana: Selected Issues and Statistical Appendix". IMF Country Report No. 07/228.

Jacquemin, A.P. and C.H. Berry, (1979). "Entropy measure of diversification and corporate growth". The Journal of Industrial Economics XXVII (4): 359-369.

Maipose, G. and T.C. Matsheka, (2004). "Explaining African Growth Performance: The Botswana Case Study". AERC Growth Project.

Mogae, Festus. (2003). "Botswana: Trade, Foreign Direct Investment and Economic Diversification." Remarks at the BOCCIM Northern Branch Dinner, Francistown Civic Center. October10, 2003. available (online) from http://www.sarpn.org.za/documents/d0000627/P588-P529-mogae.pdf (15 May 2008).

Regional Program on Enterprise Development (RPED): Africa Private Sector Group (2007). "An Assessment of the Investment Climate in Botswana". World Bank: Washington DC.

Republic of Botswana (RoB) (1997). Vision 2016: Towards Prosperity For All. Government Printer: Gaborone.

_____ (2003). National Development Plan 9. Government Printer: Gaborone.

_____ (2005). National Export Strategy 2006-2009 Draft. Joint Report by BEDIA, The Commonwealth Secretariat, International Trade Centre, UNCTAD/WTO. Gaborone: Botswana.

Sachs, J.D. and A.M. Warner, (1995). "Natural Resource Abundance and Economic Growth". NBER Working Paper.

Salm, A., W. Grant, J. Haycock and K. Kennedy, (2004). Botswana textile and apparel sub-sector study. ComMark Trust.

Samatar, A.I. (1999). An African Miracle: State and Class Leadership and Colonial Legacy in Botswana Development. Heinemann: Portsmouth, Hanover Street.

Sentsho, J. (2005). "Growth and Performance of the Mining Sector". In Economic Development of Botswana; Facets, Policies, Problems and Prospects. H. Siphambe et al. (eds) Bay Publishing: Gaborone:138-148.

Siwawa-Ndai, P.D. (1997) "Industrialisation in Botswana: Evolution, Performance and Prospects". In Aspects of the Botswana Economy: Selected Papers. J.S. Salkin et al. (eds). James Currey and Lentswe La Lesedi Publishers: Gaborone and Oxford.

UNCTAD (2003). Investment Policy Review Botswana. New York and Geneva.

UNCTAD (2007). World Investment Report. World Bank: Washington DC.

United Nations Economic Commission for Africa (UNECA) (2007). Economic Report on Africa 2007: Accelerating Africa's Development through Diversification. Addis Ababa: Ethiopia.

World Bank (2010a). Doing Business 2010. Washington DC.

World Bank (2010b) Connecting to People: Trade Logistics in the Global Economy. The Logistics Performance Index and its Indicators. Washington DC.

World Bank (2011). Doing Business 2011. Washington DC.

APPENDIX

The **Ogive Index (OGV)** is a common measure of industrial diversification or export diversification. This index measures the sum of squared deviations from an equal distribution of an economic variable, such as employment or exports in all sectors. It is calculated as follows:

$$OGV = N\sum_{i=1}^{N}(P_i - 1/N)^2 \qquad (4)$$

where $P_i = (x_i/X)$ is the share of i^{th} commodity (x_i) in the total value of some variable such as exports ($X=\sum x_i$). N is the total number of export commodities and 1/N is assumed to be the ideal share of export earnings for each commodity if they were all distributed equally in value terms. The minimum value of OGV is zero, and it correlates to a diversified export portfolio, while a large value of the OGV index represents low export diversification (Hammouda et al., 2006:28).

The **Entropy Index (ENT)** measures the extent of

spread of the distribution for any given variable and it is commonly used in a variety of sciences, including economics and business and finance (Jacquemin and Berry, 1979). It is calculated as:

$$ENT = \sum_{i=1}^{N} P_i \log_2 (1/P_i) \quad (5)$$

where N is the total number of export commodities and P_i is the share of the i^{th} commodity in total exports. The minimum value for the Entropy Index, which is zero, implies that there is extreme concentration. The maximum value is given by $\log_2 N$ and it denotes greater diversification.

The **Hirschman Index** is also another measure of export concentration. It is calculated as follows:

$$H = \sqrt{\sum_{i=1}^{N} \left[\frac{x_i}{X}\right]^2} \quad (6)$$

where x_i is the export value of i^{th} commodity and X is total exports. N is the number of commodity groups. The Hirschman index is similar to the Herfindahl Index, except for the square root. A higher Index reflects low diversification and a lower value means high diversification. The Hirschman Index can be transformed so that its value can be expressed between zero and one. The transformed Index is referred to as the Normalised-Hirschman Index (Hammouda et al., 2006:29). It is transformed through the following formula:

Normalised-Hirschman Index (N-HI)

The Normalised-Hirschman Index is interpreted in the same way as the Hirschman Index in that values close to zero indicate low concentration or high diversification, while those close to one reflect great concentration or low diversification.

$$N\text{-}HI = \frac{\sqrt{\sum_{i}^{N} P_i^2} - \sqrt{\frac{1}{N}}}{1 - \sqrt{\frac{1}{N}}} \quad (7)$$

where P^1 and N are interpreted as above.

The Monetary Transmission Mechanism in Botswana: A Structural Vector Auto-Regression Approach

Lekgatlhamang Setlhare[1]

Abstract

This paper examines the empirical monetary transmission mechanism operation in the Botswana economy. While all previous studies used the Cholesky decomposition to identify the vector autoregressive model used to study the transmission mechanism, this study employs a structural identification scheme so as to allow simultaneous interaction between monetary policy and the exchange rate variables. Empirical results indicate that monetary policy is weakly transmitted to inflation through both the interest rate and exchange rate variables, with some evidence of existence of simultaneity between monetary policy and the real exchange rate. However, there is a strong direct transmission of unanticipated exchange rate changes to inflation.

1. Introduction

In order to effectively design and implement monetary policy, central banks need a thorough understanding of the monetary transmission mechanism operating in the economy. The transmission mechanism of monetary policy refers to the process through which monetary policy actions are transmitted into changes in the policy objectives, such as economic growth and inflation. Notably, knowledge of the transmission mechanism is imperative for undertaking monetary policy measures that would achieve and/or maintain price stability. In the case where the policy framework entails projection of a medium-term path for inflation, the monetary transmission process would provide the foundation for the inflation forecasts, forecast horizon, as well as the timing and magnitude of the central bank's reaction to price developments. This paper aims to study, empirically, how monetary policy actions affect inflation and output in the Botswana economy.

Knowledge of the monetary transmission mechanism (MTM) should not be based on general stylised facts about monetary policy effects; a model approach is essential as it empirically characterises the transmission relationships relating to the specific economy in question and quantifies such relationships. Although there has been a fair amount of research on the transmission channels, especially for developed economies (e.g., Romer and Romer (1989), Bernanke and Blinder (1992), De Arcangelis and Di Giorgio (2000), Bredin and O'Reilly (2001), Holtemoller (2003), and Barakchian and Crowe (2010) and references therein), it is considered that the transmission channels may differ between developed countries and developing countries and it is still not well known how monetary policy is transmitted to the real side of the economy (see Holtemoller (2003)). Furthermore, since the financial sectors of developing economies (such as Botswana) are still undergoing significant development, it is likely that the transmission channels in these countries may differ from one period to another. This suggests that knowledge of the MTM must be updated periodically, as the financial sector continues to develop and/or changes following major reform(s) or structural transformation(s) of the economy.

The study is organised as follows. Section 2 briefly explains the structural vector autoregression methodology in the context of the monetary transmission mechanism. Section 3 summarises Botswana's monetary policy framework, after which Section 4 briefly discusses theoretical issues regarding the monetary transmission channels. After explaining the identification and empirical modelling methodology in Section 5, Section 6 presents the empirical results. Concluding remarks are offered in Section 7.

2. SVAR Method and the Monetary Transmission Mechanism

To analyse the transmission mechanism, the paper employs both the vector autoregressive (VAR) model and the structural VAR (SVAR) model, for purposes of comparison. A VAR is a model which specifies each variable in terms of its lagged values and the lagged values of other variables in the model. Other than the use of economic theory to select the variables to include in the VAR, theory is not involved in the modelling process – hence, the VAR is atheoretic. The residuals of the model are not structural. However, in the SVAR model, each variable is a function of the contemporaneous (current period) value of the other variables in the model, in addition to all the lagged values described for the VAR. Modelling the contemporaneous relationships involves theory. Thus, the SVAR imposes structure on the VAR. Hence, the name structural VAR – the residuals of the model are structural. In this context, the objective of the research is to identify an exogenous monetary policy shock (the structural residual associated with the monetary variable in the model) within the SVAR framework and then estimate the dynamic response of real output, inflation and exchange rate to such a shock. The exogenous policy shock represents a change in the monetary policy instrument unrelated to changes in the goal variable(s).

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Key among the features of the SVAR methodology is its appropriateness in modelling the simultaneity between economic variables and monetary policy. Simultaneity is about developments in the economy inducing changes in monetary policy, while economic variables change in response to monetary policy actions (Shabbir, 2008). The SVAR framework also allows a distinction between the endogenous component and the exogenous change (or shock) of monetary policy action. This approach focuses on the effects of exogenous monetary policy actions, and not the general effects of monetary policy changes. In addition, the SVAR approach enables analysis of the dynamic response (using impulse response functions) of endogenous model variables to a shock in one of the variables.

SVAR models have been widely used to model the monetary policy transmission process, within both closed and open economies, for both developed and developing economies. The following is a short list of the studies conducted by Bernanke and Blinder (1992), Bredin and O'Reilly (2001), De Arcangelis and Di Giorgio (2000), Aslanidi (2007), and Shabbir (2008) for, respectively, the USA, Ireland, Italy, Georgia, and Fiji and Papua New Guinea. Despite the proliferation in SVAR-based models elsewhere, such studies are non-existent in Botswana. A previous study of the MTM for Botswana, Kganetsano (2007), used a VAR model, which is atheoretical. Hence, applying a SVAR model to the economy of Botswana is instructive. Empirical results could differ due to the use of one approach for identifying monetary policy shocks, as opposed to another. This study employs a SVAR model in an open economy context and identifies monetary policy shocks using a structural identification approach and, compares the results to those from a VAR model. This strategy imposes both short-run and long-run restrictions and allows the possibility of simultaneous interaction between the exchange rate and monetary policy in the economy.

3. Monetary Policy Framework in Botswana

While other subtle changes in the Bank of Botswana's monetary policy framework can be pointed out, two major changes should be highlighted in a study of the MTM. First, from 1993 (the beginning of the period considered in this study) to 1998, the Bank's policy objective was not defined in terms of price stability – the explicitly stated goal was achievement of positive real interest rates (which would contribute to inflation control). Explicit focus on the goal of price stability commenced in 1998 with the first publication of the Bank's monetary policy statement. However, it was not until 2002 that the Bank began to publish the goal as an annual numerical inflation objective, expressed initially as a range of 4 – 6 percent, in the 2002 Monetary Policy Statement. Second, since 2008 the price stability objective has been defined in terms of inflation within the medium-term (3-year period) objective range of 3 – 6 percent.[2] Underlying the price stability objective is the idea that maintenance of a low inflation rate will, in the long term, contribute to sustainable economic growth and a competitive real effective exchange rate that, in turn, will support diversified growth and competitiveness of domestically produced goods and services destined for domestic and external markets.

To achieve the inflation objective, the Bank uses monetary policy instruments, including interest rates (specifically, the Bank Rate) and open market operations – sale/purchase of Bank of Botswana Certificates (BoBCs). The BoBCs and open market operations, which were introduced in 1993, are explained in Kone (1996). Changes in official interest rates influence interest rate sensitive components of domestic demand and, thus, inflation.

In the current policy framework, monetary policy formulation is based on medium term inflation forecasts; hence, it is forward-looking. Changes in the monetary policy stance arise when it is projected that there will be a sustained rise in inflation above the objective range (inducing a policy tightening) and when price stability or disinflation occurs in the context of a sustained decrease in economic growth (inducing a policy easing). Inflation forecasts reflect medium term developments in economic and financial factors that affect inflation.

Since 2005, Botswana's monetary policy has been implemented in the context of a crawling band exchange rate mechanism. In this regime, the nominal exchange rate of the Pula is adjusted in small continuous steps, in a forward-looking manner. The rate of crawl is based on the differential between the Bank's inflation objective and the forecast inflation for Botswana's trading partners.

4. Monetary Transmission Channels

Several transmission channels of monetary policy have been identified in the literature. These include the interest rate, credit/lending, balance sheet, exchange rate and inflation expectations channels (see Mishkin, 1995).

In respect of the interest rate channel, changes in the interest rate affect inflation through aggregate demand, via effects on the demand for capital goods and durable consumer goods. Notably, a change in the policy rate will, via the banking system, impact longer-term lending and deposit rates which, in turn, will affect spending and investment decisions (Bordon and Weber, 2010) of economic agents through income and substitution effects. The resultant change in ag-

2 After introduction in 2006, the medium-term inflation objective existed in the context of annual credit growth target ranges, and concurrently with the annual objective. The annual inflation objective range could vary from year to year due to both economic and financial developments. However, in 2008, the Bank dropped both the use of credit growth as an intermediate target and annual horizon for the inflation objective, and exclusively focused on the medium-term objective range.

gregate spending should affect economic activity and, hence, inflation.

Another transmission process is the credit channel, comprising bank lending and balance sheet channels. The bank-lending channel considers loans and bonds as imperfect substitutes and the intermediation role of banks due to their advantage in knowing the credit worthiness of households and small firms. Due to the asymmetric information problem, bank-dependent borrowers (e.g., small firms) cannot easily find alternative sources of funds. Hence, as monetary tightening reduces bank reserves, these borrowers will experience a fall in loan supply, which has a negative impact on investment of the private sector and aggregate demand (see Wrobel et al., 2002; Bordon and Weber, 2010). The balance sheet channel holds that an increase in the interest rate reduces asset prices and, consequently, decreases the capitalised value of borrowers' assets, thereby worsening their balance sheets and reducing what borrowers can offer to secure loans. Moreover, the lower asset prices imply a fall in consumers' wealth, which will induce less consumption (the wealth effect). The outcome is reduced borrowing and expenditure by the households and/or corporate sector.

In open economies, particularly under flexible exchange rate systems, a change in the policy rate may affect the economy through the exchange rate channel. A rise in the policy rate will result in appreciation of the domestic currency, which will affect inflation and output by, respectively, reducing the price of imports (and imported inflation) and the external, as well as the internal competitiveness of domestically produced tradeable goods.

Lastly, inflation expectations, through policy credibility, have important effects on the effectiveness of the transmission mechanism. A central bank that has a credible policy (i.e., economic agents believe in the central bank's commitment to price stability) can effectively affect inflation by influencing expectations. The expectations channel is particularly effective in monetary policy frameworks where there is substantial communication of the policy process, such as in an inflation-targeting regime.

As implicitly noted above, the operation of transmission channels varies across countries on account of differences in the degree of financial intermediation, the size, concentration and health of the banking sector, development of capital markets, as well as structural economic conditions (Cecchetti, 1999). Notably, it has been observed that in low-income countries the operation of the traditional transmission channels (interest rate, bank lending and asset price) is impaired (Mishra, Montiel and Spilimbergo, 2010). Thus, although the interest rate channel is the most important transmission channel in industrial economies, the exchange rate channel tends to dominate in developing/transition economies (see Dabla-Norris and Floerkemeier, 2006). The weak institutional frameworks, securities markets and competition in the banking sector impair the traditional channels (interest rate, bank lending and asset price) (Mishra, Montiel and Spolimbergo, 2010).

5. Identification and Empirical Modelling

Identification

The first stage of the SVAR approach entails specification and estimation of a vector autoregressive (VAR) model that adequately captures the features of the data. In the second stage, 'structure' is imposed on the VAR model by imposing restrictions. In simple terms, identification is about relating the residuals from the estimated VAR to the 'structural shocks of the SVAR'.

In the literature, identification of VAR models is carried out using one or the other of the following methods: the Cholesky decomposition (using atheoretic short-run restrictions – this entails ad hoc recursive ordering (explained below) of variables), the structural identification (short-run restrictions and/or long-run restrictions (based on economic theory) and sign restrictions.

Empirical Modelling

In this paper the transmission mechanism is modelled using a SVAR model. The model is specified such that the variables included in the model enable identification of monetary policy shocks and capture features of a small open economy. In this regard, the variables considered are the domestic interest rate, real domestic output, domestic inflation, the real (alternatively nominal) exchange rate[3] and the foreign interest rate – the latter two variables are included to capture external pressure. Underlying this open economy approach is the fact that the Botswana economy can be influenced by external factors, such as foreign monetary policy and exchange rate movements. Specifically, the exchange rate variable is an important transmission channel for foreign shocks, the effect of which could induce a response from the central bank within the quarter (see Bjornland, 2005). In this context, a substantial depreciation in the exchange rate will lead to higher inflation, and the Bank could then respond to the worsening inflation outlook by tightening policy (i.e., raising the Bank Rate), and, conversely, if there were an appreciation of the exchange rate the policy rate could be reduced. Consequently, inclusion of the external variables will enable more accurate identification of monetary policy shocks. More generally, the exchange rate is an integral part of Botswana's monetary policy

3 In this paper, the nominal exchange rate is defined as the nominal effective exchange rate (NEER) of the Pula – a rise in NEER means appreciation of the Pula. The real effective exchange rate (REER), as opposed to the NEER, is appropriate in the model when the history of the exchange rate system includes a quasi-fixed exchange rate regime. This helps to ensure some variability even where the nominal exchange rate serves as an intermediate variable for monetary policy (De Arcangelis et al., 2000). However, the NEER is also used as this is consistent with the policy framework in Botswana.

framework, so it may have implications for the monetary policy transmission mechanism.

The paper uses a 5-variable empirical VAR model to quantify the response of real GDP, inflation and the real exchange rate to monetary policy shocks. The VAR model, written in terms of its vector moving average (VMA) representation is:

$$X_t=B(L)u_t \qquad (1)$$

where X_t a (5×1) vector of variables being modelled (the South Africa Treasury bill rate (tb), real non-mining output (yn), CPI inflation (dcpi4), the Bank Rate (br) and the first difference of the real effective exchange rate (reer in level or dreer in first difference form). B(L) are (5×5) convergent polynomial matrices in the lag operator, L, and u_t is a vector of reduced form residuals (or statistical shocks), assumed to be identically and independently distributed, u_t~iid(0,Ω).

The structural VAR model can be recovered from (1) and expressed in VMA as:

$$X_t=C(L)\varepsilon_t \qquad (2)$$

where C(L) is the structural counterpart to B(L) and ε_t represents the white noise structural or economic shocks, ε_t~iid(0,Λ). The empirical structural shocks of the model are: foreign interest rate shock, output shock, inflation shock, monetary policy shock and exchange rate shock and denoted, respectively: $\varepsilon_t=[\varepsilon_t^{tb},\varepsilon_t^{yn},\varepsilon_t^{inf},\varepsilon_t^{mp},\varepsilon_t^{xr}]'$. Combining equations (2) and (1) and manipulating gives $X_t=B(L)S\varepsilon_t$, used in identification below. S is the short-run matrix capturing simultaneous relationship among variables.

Turning to identification, the aim is to estimate (1) and then use the estimates to recover the parameters and structural shocks in (2). Briefly, identification requires imposing restrictions on the S matrix (so that the number of parameters in S equals that in Ω). The SVAR literature has established that, for a model with n variables, the actual number of restrictions required is: $n^2-(n^2-n)/2-n=(n^2-n)/2$.

As for specification issues, all the variables in the model, except for interest rates and inflation, which are in percentage terms, are measured in logs and represented using lower case acronyms. In terms of the properties of the variables, there has been a debate about whether the VAR/SVAR model should be specified in terms of the levels (or transformed form) of the variables. In this paper all the variables enter the model in their level form, except the exchange rate, (which is in first-difference form – to be explained below in the identification of the empirical model). The reason is that it has been established that, even for non-stationary variables that are cointegrated, the SVAR in levels is asymptotically equivalent to the vector error-correction model (Guay and Pelgrin, 2006, for details).

Illustration of the Identification Schemes

In this paper, 'structural shocks' are identified by implementing two types of schemes. The first type is the standard Cholesky decomposition, which imposes a series of contemporaneous recursive zero restrictions on the effects of structural shocks on model variables. This identification scheme orders the variable assumed to be the most endogenous last in the model (as illustrated below). This identification approach has typically been used in closed-economy studies. The empirical success of this standard identification scheme has established a consensus about the effects of monetary policy in closed economies (Bjornland, 2008). This is particularly so for advanced economies, where a contractionary monetary policy (e.g., an unexpected increase in the policy interest rate) results in a short-lived decline in real output and a fall, over a period of time, in the price level.

Use of the Cholesky decomposition approach yields the matrix in the recursive VAR equation (3), where neer is ordered last. This recursive ordering implies that a shock in the real exchange rate will affect the variables in the system with a lag. Similarly, policymakers can react to unanticipated changes in macroeconomic variables in the current period (a quarter, in this paper), but the effect (on domestic macroeconomic variables) of their change in policy will be felt on macroeconomic variables after a quarter. The SVAR model in (3) is just identified since the lower triangular matrix entails 10 zero restrictions; hence structural parameters can be uniquely recovered from the VAR. Equation (3) shows that the first variable in the system (i.e., tb) has no simultaneous relationship with any other variable in the model – thus, its statistical shock is identical to its structural shock; the second variable in the system (i.e., yn) has a one-way current period relationship only with the first variable in the model (given that this variable cannot affect the first variable within the same quarter) so that it is contemporaneously affected by its own and the first structural shock; and so on. This kind of relationship among variables is called recursive ordering.

Based on the foregoing, equation (3) implies that the T-bill rate will not respond to any of the model variables in the current quarter. This is the typical small country assumption in open economy studies. The rest of the variables are ordered such that macroeconomic variables (output and inflation) do not contemporaneously respond to monetary policy and the exchange rate shocks. Moreover, the fourth and fifth columns in (3) show that while the exchange rate reacts to the monetary policy shock in the same quarter, the reverse is not true (i.e., monetary policy is orthogonal to the exchange rate shock).

In this equation, two-way contemporaneous in-

$$\begin{bmatrix} tb \\ yn \\ dcpi4 \\ br \\ neer \end{bmatrix} = B(L) \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ s_{21} & 1 & 0 & 0 & 0 \\ s_{31} & s_{32} & 1 & 0 & 0 \\ s_{41} & s_{42} & s_{43} & 1 & 0 \\ s_{51} & s_{52} & s_{53} & s_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon^{tb} \\ \varepsilon^{yn} \\ \varepsilon^{inf} \\ \varepsilon^{mp} \\ \varepsilon^{xr} \end{bmatrix} \qquad (3)$$

teractions between any two, or more variables, are ruled out by assumption. Although this identification

scheme has successfully identified monetary policy shocks in closed economy models, studies that applied it in open economy models have often generated the empirical puzzles. Kganetsano's (2007) study used this identification strategy in a VAR model specified to include domestic output, domestic prices, the Bank Rate, foreign variables (South African CPI and world GDP) and, alternatively, narrow money supply (M1), broad money supply (M2 and M3) and credit to the private sector.

The model estimated in this paper is an open economy model, since it includes a foreign interest rate variable and the exchange rate. The exchange rate is viewed as an information variable that can be contemporaneously affected by economic disturbances, including monetary policy shocks. This implies that there is a possibility of a simultaneous interaction between the exchange rate and monetary policy. If this holds, then the recursive ordering of variables (described above) erroneously rules out simultaneous interactions between the exchange rate and monetary policy. In this case, the estimated responses of model variables to the structural shocks will be severely biased due to misspecification – specifically, the effects of the shocks will be underestimated since the simultaneous reaction of one variable to shocks in the other variable will not be captured (see Bjornland and Leitemo, 2005). Moreover, the misspecification arising from the simultaneity problem could generate empirical puzzles, such as the "exchange rate puzzle" or delayed overshooting (Borys and Horvath, 2008; Bjornland, 2005).[4] In this regard, a second identification scheme (structural identification) is used, with a view to addressing the possible simultaneity problem associated with monetary policy and the exchange rate.

The structural identification approach is appropriate, since it accommodates the existence of simultaneous interaction between the exchange rate and monetary policy. In addition, this approach uses identifying restrictions based on economic theory to transform the reduced form VAR into a system of structural equations (Gupta, 2008). This paper identifies the monetary policy shock within a framework similar to that used in Gali (1992), Bjornland (2005) and Artis and Ehrmann (2006), in which both the short-run and long-run restrictions are employed.[5]

In illustrating the second (structural identification) method, short-run restrictions are discussed first. This approach builds on the standard traditional VAR method of identifying monetary policy shocks in closed economy models. In this study, application of the methodology is done after restricting the foreign interest rate (the T-bill rate) to be exogenous in the VAR. Notably, a recursive ordering is imposed between monetary policy shocks and the block of domestic macroeconomic variables.

In this context, the orthogonality condition is also imposed between the domestic macroeconomic variables and the sequence of exchange rate shocks. This suggests a one-quarter delay in the process of exchange rate pass-through to macroeconomic variables, and implies the existence of nominal rigidities – that is, at least within the quarter, variables do not respond to a change in a nominal variable.

The short-run (recursive) restrictions part of the structural identification approach can be explained as follows: the foreign interest rate is treated as exogenous to the system on the basis of the typical small open-economy assumption[6]. Meanwhile, the recursive ordering assumption relating to domestic variables serves to indicate that in setting the policy rate, although policymakers do consider the current values of the variables (Barran, Coudert and Mojo, 1996), macroeconomic variables are sluggish in responding to monetary policy changes (and exchange rate changes) in the economy. Imposing both the small country and recursive assumptions generates the S matrix in equation (4).

As for the long-run restrictions part, one such

$$\begin{bmatrix} tb \\ yn \\ dcpi4 \\ br \\ dreer \end{bmatrix} = B(L) \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ s_{21} & 1 & 0 & 0 & 0 \\ s_{31} & s_{32} & 1 & 0 & 0 \\ s_{41} & s_{42} & s_{43} & 1 & s_{45} \\ s_{51} & s_{52} & s_{53} & s_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon^{tb} \\ \varepsilon^{yn} \\ \varepsilon^{inf} \\ \varepsilon^{mp} \\ \varepsilon^{xr} \end{bmatrix} \quad (4)$$

restriction is required as only ten restrictions are needed for the model to be just-identified. Inspection of the model shows that there is need to impose a restriction to distinguish between monetary policy and exchange rate shocks. The recursive ordering assumption does not apply to the interaction between the real exchange rate and monetary policy due to the possible simultaneity problem. As Bjornland (2005) observes, setting to zero implies that the monetary policy instrument is restricted from having an instantaneous response to any exchange rate shock, regardless of its magnitude. This is inconsistent with economic theory because, as an information variable (or asset price), the exchange rate could change, as the expected return on assets responds to news on future changes of economic fundamentals, including the money supply (or the monetary policy stance).

This phenomenon is likely to be subdued, in the short run, in a crawling band exchange rate system, which allows for some changes in the exchange rate

4 The exchange rate puzzle and delayed overshooting are observed when, in response to a restrictive monetary policy stance (e.g., an increase in the policy interest rate), the nominal exchange rate depreciates instead of appreciating (puzzle) or appreciates gradually for an extended period of up to about three years (delayed overshooting).

5 More specifically, the identification scheme draws mainly from that of Bjornland, which was developed to address the commonly observed phenomena of the exchange rate puzzle and forward discount puzzle (i.e., delayed overshooting).

6 This is a plausible assumption in this study since Botswana's economy is arguably a small open economy relative to that of South Africa.

only within a ±0.5 percent band.[7] The absence of simultaneity will be reflected by the non-existent (or zero) response of the Bank Rate to the real exchange rate in the current quarter, and vice versa (for zero restriction on S_{54}). The parameter estimates will not be biased as in model which ignores the phenomenon when, in fact, it exists. In the context of simultaneous interaction, a large change in the exchange rate could result in forecast inflation deviating significantly from the inflation objective range in the medium term, which would prompt a contemporaneous policy response to anticipated second-round effects.

On account of the foregoing reasons, instead of using a short run recursive restriction to identify the exchange rate shock, a long run identifying restriction is used to allow for the potential two-way contemporaneous interaction to be determined by the data. The long-run restriction used assumes that a monetary policy shock has no permanent effect on the real exchange rate. This is a standard long-run neutrality of nominal shocks,[8] which is consistent with a large class of models in the monetary policy literature. As observed by Giordani (2001, p.2), "[few] propositions in macroeconomics are less controversial than long-run money neutrality…".

Given, the use of the long run identifying restriction, the real exchange rate variable enters the model in first-differenced form (dreer), not level form. In this case, as the long-run restriction is applied to the change in the real exchange rate, the effects of a monetary policy shock on the level of the real exchange rate will eventually sum to zero. This is essential, given that the level of the real exchange rate is non-stationary (according to the unit root test, although the test result is not reported).

6. Estimation and Empirical Results

The SVAR and recursive VAR models were estimated over three sample periods: the whole time period (1993:3 – 2011:1), the fixed exchange rate period (1993:3 – 2005:1) and the crawling band period (2005:2 – 2011:1).[9] The change in the exchange rate regime between the fixed and crawling band exchange rate systems is used to determine the choice of sample periods, given the substantial change in the exchange rate regime (with potential effect on the monetary policy operations) that was accompanied a large devaluation of the Pula. In searching for the optimal lag length, the VAR model was initially estimated with 4 lags for the (1993:3 – 2011:1) and (1993:3 – 2005:1) periods, while 2 initial lags were used for the (2005:2 – 2011:1) period, given the short sample period. The lag length selection process was undertaken using the Likelihood Ratio, Final Prediction Error, as well as the Akaike, Hannan-Quinn information and Schwarz criteria. Although the residuals of the optimal VAR model typically fail the normality test, they are free from autocorrelation and heteroscedasticity problems. In addition, all the models satisfy the stability condition, which is necessary for the validity of impulse response analysis.

Prior to presentation of results, several comments on the data used in the models (plotted in Appendix II) should be made – the comments relate to the derivation and/or characteristics of the data. The inflation rate series was derived as the percentage change in the CPI (headline) for the year's quarter over the CPI for the same quarter in the previous year, instead of the quarter-on-quarter percentage change, hence denoted by dcpi4 (instead of dcpi). The nominal and real effective exchange rates are weighted average of a basket of foreign currencies (in nominal and real terms, respectively). On account of high volatility and/or effects of seasonality, the non-mining output, headline consumer price index (CPI), and effective exchange rate (nominal and real) series were seasonally adjusted using the X-12 filter. As for the output series, caution is needed in interpreting the data, because the high volatility of the published data may be due to measurement errors. This is especially the case given that the data are often subject to significant revisions. Such measurement errors could have impact on the empirical results.

Analysis in SVAR frameworks is mainly conducted in terms of impulse response functions (IRFs) and/or variance decompositions. This paper uses IRFs to examine the dynamic response of macroeconomic variables in the Botswana economy to monetary policy and exchange rate shocks. Impulse responses of domestic variables to the exchange rate shock are also examined since, for a small open economy, such as Botswana, the exchange rate plays a very important role in the formulation of monetary policy; given its substantial influence on the overall price level.

The results are presented below, first from using the structural identification strategy and then from the Cholesky decomposition strategy. The change in the exchange rate regime during the span of the data allows only one SVAR model to be identified using the structural identification, whereas four models use the Cholesky scheme. Specifically, the Cholesky scheme is used for both the fixed and crawling exchange rate regimes since, in the fixed exchange rate system, the exchange rate variable becomes exogenous in the model. However, in the crawling exchange rate regime, the short sample size prevents use of the long-run restriction of structural identification.

Results of Structural Identification

The results, presented in Appendix I (in Figures 1a

7 Several studies specified the SVAR model to allow for the possibility of simultaneity (or, at least, endogeneity of the exchange rate) in the context of a crawling band exchange rate system, although with wider bands – e.g., ±1 percent and ±15 percent (Creel and Levaseur, 2005; Elbourne and de Haan, 2005; and Mirdala, 2009).

8 This view is based on the quantity theory of money which states that one-time permanent changes in nominal variables have no effect on real variables in the long run (Serletis and Koustas, 1998).

9 The total time span of the data was constrained by availability of quarterly GDP data and the cut-off time to complete the paper.

through 5b), are in terms of impulse functions. The IRFs show point estimates of responses (central forecasts) of variables to a one standard deviation rise in the Bank Rate, as well as responses of the variables to either the real or nominal effective exchange rate. Along with the IRFs are the corresponding 95 percent confidence lines – significance of an impulse response occurs when both confidence lines lie on the same side of the zero line. Results for the full sample period are presented in Figure 1a through Figure 3b.

The results presented in Figures 1a and 1b are from a model specified to include the first difference of the real effective exchange rate (dreer). The model was identified using the structural identification scheme. In Figure 1a, (1.1a) shows the response in the Bank Rate to a monetary policy shock.[10] The Bank Rate rises in response to the policy shock, as it should when the model has successfully identified the monetary policy shock, and gradually returns to the base line value.

The endogenous response of inflation to the monetary policy shock is shown in 1.1b. Inflation falls quickly within a period of 2 quarters, albeit not significantly, since the zero line lies inside the confidence band. Inflation continues to fall, with maximum effect around the third quarter, where inflation would have declined by a value within 0.2 – 0.25 percentage points, and then returns to the base line by the fifth quarter. The initial decline in inflation is consistent with macroeconomic theory (as the policy rate rises, investment and consumption of durable goods will fall, resulting in lower output growth). On the other hand, the empirical reaction of output to the policy shock (1.1c) is counter-intuitive, given that the restrictive monetary policy results in a weak positive response (instead of negative) of the level of output. Similarly, the increase in inflation after the fifth quarter contradicts theory.

A possible reason for the unexpected behaviour of inflation and output to the policy shock could be due to, as argued by Barakchian and Crowe (2010), a change in the policymaking environment during the period. Notably, there have occurred changes in the monetary policy framework in Botswana and exchange rate regime, as explained in Section 3.

With respect to the real exchange rate variable, the one-off unexpected one standard deviation rise in the policy rate results in the immediate appreciation (increase in dreer) by 0.5 percentage points (see 1.1d). This impact response is consistent with the contemporaneous reaction allowed by the identification scheme of the growth of the real effective exchange rate. After this impact effect, the exchange rate depreciates back to the steady-state value, roughly within the first quarter. Both the impact appreciation and the subsequent depreciation of the real exchange rate are insignificant. The fast response of dreer occurs mainly due to the fast reaction of the domestic inflation to the policy tightening.

The following discussion examines the transmission of foreign shocks to the Botswana economy in terms of the impulse responses of domestic macroeconomic variables to a shock in the exchange rate variable (denoted by srxr in the charts). The results are presented in 1.2a through 1.2d in Figure 1.2. Firstly, 1.2a shows that, consistent with theory, dreer increases in response to the one standard deviation shock in the exchange rate. Moreover, the growth of the real exchange rate rises, instantaneously, by a notable magnitude (about 1.8 percentage points) that is significantly greater than zero.

The exchange rate shock results in a significant decrease in domestic inflation (1.2b) albeit by a small magnitude. In particular, domestic inflation reacts to the appreciation in the exchange rate by falling quickly, reaching a maximum impact around the second quarter, with inflation having fallen by more than –0.4 percentage points. This outcome is in line with macroeconomic theory since an appreciation in the exchange rate will reduce aggregate demand, and hence inflation, by reducing net exports. The response of the level of output to the one standard deviation exchange rate appreciation is consistent with theory over the first three quarters, although it is small in magnitude – a maximum decline of about –0.2 percent (see 1.2c). After the third quarter, output rises above the base line for an extended period over the forecast horizon, which is inconsistent with theory.[11]

The impulse responses of the policy rate to the exchange rate shock (in 1.2d) accord with theory and sound monetary policy. The policy rate decreases, instantaneously, in response to exchange rate appreciation. This implies that as the exchange rate appreciates and thereby contributing to a decline in domestic inflation, the Bank is in a position to conduct policy easing. In the circumstances, the cut in the policy rate to support growth would be consistent with medium-term price stability.

Finally, the results indicate that a monetary policy shock has some contemporaneous effect on the exchange rate (1.1d), while the exchange rate shock also has some instantaneous influence on the policy variable (1.2d), suggesting existence of a simultaneous relationship between the two variables. However, the contemporaneous reactions of the real exchange rate to monetary policy and vice versa are both numerically small and insignificant. Hence, the evidence for a simultaneous relationship is weak.

Overall, the responses of inflation and output to a monetary policy shock are largely counter-intuitive. Firstly, the output response is in the wrong direc-

10 Figure 1.1a shows that a one standard deviation shock (denoted by smp in the charts) to the policy rate is equivalent to a 0.25 percentage points change in the Bank Rate. This is consistent with the Bank's adjustment of the Bank Rate by at least 25 basis points.

11 It should be noted that the responses of the macroeconomic variables to the interest rate and exchange rate shocks do not improve when the Cholesky scheme is used to identify the VAR specified to include tb, yn, dcpi4, reer, br. In fact, the results deteriorate to some extent.

tion. Secondly, the conventional response of inflation to a monetary policy shock occurs entirely in the first four quarters, a finding which is not consistent with the predominant view in monetary economics that the impact of policy through the transmission mechanism is characterised by "long and variable lags" (Friedman,1960).

Results of Cholesky Decomposition

All the models estimated over samples 1993:3 – 2005:1 and 2005:2 – 2011:1 were identified using the Cholesky decomposition. Cholesky models include neer being used instead of the reer, since the long-run restriction does not apply when the exchange rate is nominal. Meanwhile, the use of the reer and the associated structural identification (which is appropriate for the crawling band system) is hindered by the small sample size. The responses of variables to one standard deviation positive shocks (in the Cholesky scheme) to the Bank Rate and exchange rate are presented in Figures 2a through 5b.

The results presented in Figure 2a through 3b are from a model of the full sample period. In Figure 2a and 2b, the model was specified such that the neer is treated as an endogenous variable in the system, except to monetary policy – this concurs with Elbourne and de Haan (2005), who argued that, in the context of a crawling band exchange rate regime, the neer should be treated as an endogenous variable. However, in Figures 3a and 3b the model was specified so that the neer is exogenous in the system.

Results due to the Cholesky decomposition differ substantially from those obtained through structural VAR, with respect to all variables, except for the interest rate. Notably, the Cholesky scheme generates the typical price puzzle (2.1b), whereby inflation rises in response to a monetary policy tightening, unlike the structural identification for which inflation decreases within the initial 4 quarters. Secondly, the appreciation and subsequent depreciation (1.1d) of the reer following the monetary policy shock (which is predicted by Dornbusch's overshooting model) under structural identification is much faster than the appreciation (and subsequent depreciation) of the neer associated with the policy shock under the Cholesky approach (2.1d). In the latter case, the neer appreciates gradually up to quarter 17 or 18, after which a gradual depreciation begins – this is the delayed overshooting phenomenon explained above. Following appreciation in the neer and reer, respectively, output falls throughout the forecast horizon under the Cholesky scheme (2.2c), while it decreases only briefly under the structural identification (1.2c).

Meanwhile, inflation falls following an unexpected appreciation of the exchange rate under both types of identification. However, inflation declines less in response to the shock in neer (denoted by sxr in the charts) under the Cholesky scheme than in reaction to appreciation of the reer under the structural identification scheme. On the other hand, the decline in inflation is significant over the whole of the first three quarters under the Cholesky approach, not just significant over a period of 2 to 3 quarters. Overall, better results are obtained using structural identification, compared to those obtained using the Cholesky scheme mainly due to the price puzzle arising from the latter.

Figures 3a and 3b present results from a model similar to that whose results are in Figures 2a and 2b. Both models are identified using the Cholesky identification, the difference is that in Figures 3a and 3b the neer is treated as exogenous with respect to all domestic variables. A comparison of the results from these two models shows that the results are very similar, with respect to the dynamic responses of all the macroeconomic variables.

Turning to the fixed exchange rate regime period, results are reported only for one model due to space constraint. Results from other model specifications in this regime are similar. The model, whose results are reported in Figures 4a and 4b, was identified using the Cholesky approach. In this model the neer is assumed to be exogenous. This assumption is necessary, given that the exchange rate was more rigidly fixed in this period, with infrequent large discrete changes.

As can be seen in Figures 4.1a to 4.1d, a shock in monetary policy produces a price puzzle, as is the case in Figures 2a to 3b, where the Cholesky scheme is also used. A notable outcome is that the neer appreciates both quickly and substantially over the first 5 quarters, reaching a maximum of over 0.5 percent in the sixth quarter. Thereafter, there is also a somewhat quick depreciation, which dies out by quarter 15. This result may be reflective of the nature of the exchange rate regime whereby, as Botswana's real exchange rate appreciated beyond what was consistent with reer stability, the nominal exchange rate would be devalued and/or technically adjusted. For example, the exchange rate was devalued by a large percent in February 2004 and May 2005.

This contrasts with the more gradual and lower appreciation of the nominal exchange rate following a monetary policy shock in the crawling band regime in which the exchange rate is adjusted continuously by small amounts and in a forward-looking manner (discussion of these results will follow soon). In response to an exchange rate shock, output decreases instantaneously by over –0.3 percent and continues to fall by over –0.4 percent in the first 1 or 2 quarters. From the third quarter, output increases above the base line. Similarly, the monetary policy shock results in an instantaneous fall in inflation by –0.15 percentage points, after which inflation falls further to the maximum of about –0.2 percent. The fall in inflation then diminishes until it rises above the base line between quarters 3 and 4, and reaching a maximum increase in the fifth quarter before declining substantially again. Overall, there is no clear pattern for inflation following an exchange rate shock since the IRF fluctuates around the steady state value (base line). The lack of a clear pattern also exists and is exacerbated in respect of the response of the Bank Rate to the exchange rate shock.

In the case of the crawling band, most of the impulse responses of macroeconomic variables to either the policy or exchange rate shock fluctuate around the base line, which is not informative (see Figures 5a and 5b). This outcome is most likely due to the small sample size, of only 6 years, for the regime.

Turning to the comparison of results with those of Kganetsano (2007), both this paper and Kganetsano show that policy is weakly transmitted via the interest rate channel. The IRFs of the policy rate and domestic inflation to the policy shock in this paper are similar to those found by Kganetsano. That is, in response to a monetary policy shock, the policy rate rises instantaneously, and then gradually returns to the steady state (base line). The difference in results arise in that Kganetsano's study finds the impact effect value of 50 basis points, whereas this study estimates the value to be 25 basis points. The reason for Kganetsano's 50 basis points is that the sample period for his study is 1984:1 – 2004:4, whereas prior to 2005, the Bank never adjusted the policy rate by an amount less than 50 basis points. Another difference exists with respect to the responses of inflation to the monetary policy shock. Kganetsano finds that inflation responds by falling initially and then rising above the steady state in the fourth quarter. However, the results of this study show that inflation falls initially; but unlike in Kganetsano, inflation rises above the base line in the fifth quarter. Thus, through the SVAR approach, this study finds a longer transmission mechanism (beyond a year).

As to the reason for the subsequent counter-intuitive rise in inflation, Kganetsano associated the puzzle with the reaction of domestic credit to the shock – credit rises and remains above the steady state for about 16 quarters. Although the SVAR in this paper does not include credit in the model, this conjecture is considered relevant, at least partly, in explaining the underlying behaviour of inflation. A major difference in results relate to the IRF of output. Kganetsano finds a negative response of output, while this study finds a positive response of output to a contractionary policy.

7. Conclusion

This paper has applied the SVAR methodology to model and investigate Botswana's monetary policy framework. Both the structural and Cholesky identification approaches are used to obtain estimates of the impact of monetary policy and exchange rate shocks in an open economy context. The structural approach imposes both short-run and long-run restrictions, with a view to capturing any possible interaction between monetary policy and the exchange rate. This approach builds on the traditional (closed economy) VAR literature by assuming a recursive ordering between domestic macroeconomic variables and monetary policy. However, the departure from the standard approach of extending the recursive structure to open economy models emanates from the use of the long-run restriction to distinguish between monetary policy and exchange rate shocks. Thus, the resultant SVAR model allows simultaneous response between monetary policy and the exchange rate. Several models are identified using the Cholesky decomposition, reflecting the evolution of the exchange rate regime and for purposes of comparison.

In terms of results presented through impulse response functions, the structural identification based model produced better results, overall, than the Cholesky based model. In particular, although the direction and magnitude of the dynamic responses of macroeconomic variables to both the monetary policy and exchange rate shocks are largely the same, the difference concerns the response of inflation to a monetary policy shock. Notably, while the model based on structural identification captures the expected fall in inflation (over the first 4 quarters) due to policy tightening, the Cholesky based model shows an increase in inflation (price puzzle). However, both models show a weak positive response in output to the monetary policy shock, which is a counter-intuitive outcome. Similarly, both types of model generate similar results with respect to the responses of variables to the exchange rate shock. This is true when models are estimated over the whole sample period (1993:3 – 2011:1).

The aforementioned difference in results from the two identification approaches indicate that allowing for simultaneity between monetary policy and the exchange rate is necessary in the case of the Botswana economy, in order to more accurately identify the monetary policy shock and, in turn, obtain more accurate dynamic responses of macroeconomic variables to policy. Nevertheless, direct evidence of feedback effects between the exchange rate and monetary policy is quite weak. It is conjectured that, as more data become available, a SVAR model of the data (from 2005) will obtain even better results.

Overall, the empirical results from the identified VAR model indicate that the capability of monetary policy to influence both economic activity and inflation is still limited, perhaps reflecting the issues relating to the size, structure and developmental aspect of the banking and capital market system in Botswana. This is reflected by the weak interest rate channel – although the shock to monetary policy influences inflation in the right direction over the first 4 quarters, the impact is not significant. Moreover, there is an unexplained reversal of the impact on inflation over the forecast horizon, as well as the counter-intuitive impact on output. Meanwhile, the exchange rate channel has a dominating role in the monetary transmission process. The exchange rate shock not only influences economic activity in the right direction, it also influences inflation (significantly) in the right direction. More comforting is that the exchange rate effect complements monetary actions. That is, a tight monetary policy action causes inflation to decline initially (Figure 1a). In the circumstances, there is immediate real exchange rate appreciation which also adds to the decrease in domestic inflation (Figure 1b).

REFERENCES

Artis, M. and M. Ehrmann (2006). "The Exchange Rate – A Shock Absorber or Source of Shocks? A Study of Four Open Economies", Journal of International Money and Finance, 25(6), 874–893.

Aslanidi, O. (2007). "The Optimal Monetary Policy and the Channels of Monetary Transmission Mechanism in CIS-7 Countries: The Case of Georgia", Discussion Paper No. 2007/171.

Barakchian, S.M. and C. Crowe (2010). "Monetary Policy Matters: New Evidence Based on a New Shock Measure", Banco de Espana.

Barran, F., Coudert, V. and B. Mojon (1996). "The Transmission of Monetary Policy in European Countries", CEPII, February.

Blanchard, O. and D. Quah (1989). "The Dynamic Effects of Aggregate Demand and Supply Disturbances", American Economic Review, 79, 655–673.

Blinder, M., Chen, Q. and X. Zhang (2009). "On the Effects of Monetary Policy on Exchange Rates", Department of Money and Macroeconomics, Goethe University Frankfurt.

Bredin, D. and G. O'Reilly (2001). "An Analysis of the Transmission Mechanism of Monetary Policy in Ireland", Central Bank of Ireland.

Bjornland, H.C. (2005). "Monetary Policy and the Illusionary Exchange Rate Puzzle", University of Oslo and Norges Bank.

Bjornland, H.C. (2008). "Monetary Policy and Exchange Rate Interactions in a Small Open Economy", The Scandinavian Journal of Economics, 110(1), 197–221.

Bjornland, H.C. and K. Leitemo (2005). "Identifying the Interdependence between US Monetary Policy and the Stock Market", Bank of Finland Research, Discussion Papers, 2005/17.

Borghijs, A. and L. Kuijs (2004). "Exchange Rates in Central Europe: A Blessing or a Curse?", IMF Working Paper (Washington: International Monetary Fund).

Borys, M.M. and R. Horvath (2008). "The Effects of Monetary Policy in the Czech Republic: An Empirical Study", William Davidson Institute, Working Paper No. 922.

Cecchetti, S. (1999). "Legal Structure, Financial Structure, and the Monetary Policy Transmission Mechanism", Federal Reserve Bank of New York Economic Policy Review.

Dabla-Norris, E. and H. Floerkemeier (2006). "Transmission Mechanisms of Monetary Policy in Armenia: Evidence from VAR Analysis", IMF Working Paper (Washington: International Monetary Fund).

De Arcangelis, G. and G. Di Giorgio (2000). "Measuring Monetary Policy Shocks in a Small Open Economy", http://papers.ssrn.com/sol3/papers.cfm?abstract_id=275788

Dornbusch, R. (1976). "Expectations and Exchange Rate Dynamics", Journal of Political Economy, 84, 1161 – 76.

Creel, J. and S. Levasseur (2005). "Monetary Policy Transmission Mechanisms in the CEECs: How Important are the Differences with the Euro Area?", OFCE.

Friedman, R. (1960). A Program for Monetary Stability (New York: Fordham University Press).

Gali, J. (1992). "How Well Does the IS-LM Model Fit Postwar U.S. Data?", The Quarterly Journal of Economics, 709–738.

Giordani, P. (2001). "Stronger Evidence of Long-Run Neutrality: A Comment on Bernanke and Mihov", Stockholm School of Economics, Department of Economics.

Guay, A. and F. Pelgrin (2006). "SVAR Models and the Short-run Resilience Effect", Working Paper.

Gupta, A. (2008). "Comparing Bank Lending Channel in India and Pakistan", http://grad.econ.ubc.ca/abhayg.

Holtemoller, O. (2003). "Further VAR Evidence for the Effectiveness of a Credit Channel in Germany", Applied Economics Quarterly.

Kganetsano, T.A. (2007). "Transmission of Monetary Policy in Botswana", Loughborough University, Department of Economics.

Kone, Z. (1996). "Review of the BoBCs Auction System: The Case for the Dutch Auction", The Research Bulletin: Special Edition, Vol. 14, Bank of Botswana.

Mishkin, F.S. (1995). "Symposium on monetary transmission mechanism", Journal of Economic Perspectives, Vol 9 (4), 3–10.

Mishra, P., Montiel, P.J. and A. Spilimbergo (2010). "Monetary Transmission in Low Income Countries", IMF Working Paper (Washington: International Monetary Fund).

Serletis, A. and Z. Koustas (1998). "International Evidence on the Neutrality of Money", Journal of Money, Credit and Banking, vol. 30.

Shabbir, A. (2008). "Monetary Transmission Mechanism in Fiji and PNG", International Research Journal of Finance and Economics, 15, 284–290.

Wrobel, E. and M. Pawlowska (2002). "Monetary Transmission in Poland: Some Evidence on Interest Rate and Credit Channels", Materialy I Studia, Paper No. 24.

Appendix I

Results for the Total Time Period (1993:3 –2011:1)

Figure 1a: Responses of Macroeconomic Variables to a Monetary Policy Shock

Figure 1.1a: Responses of br to a unit shock to smp

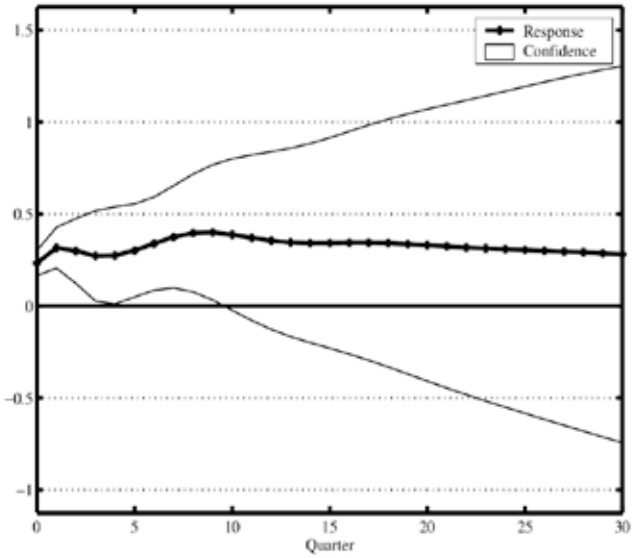


Figure 1.1b: Responses of dcpi4 to a unit shock to smp

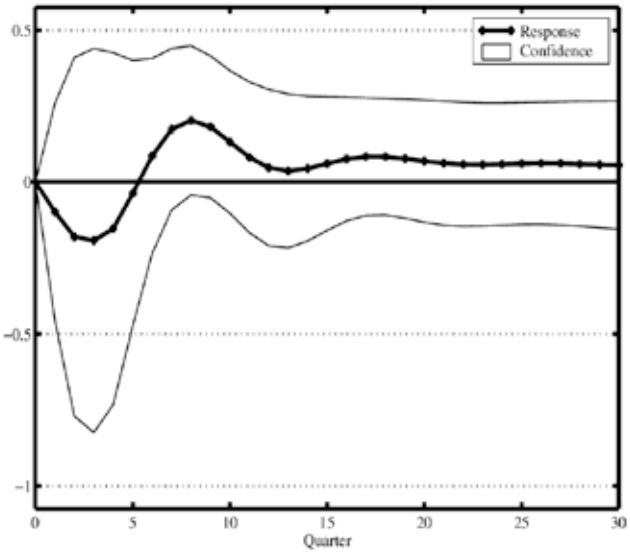


Figure 1.1c: Responses of yn to a unit shock to smp

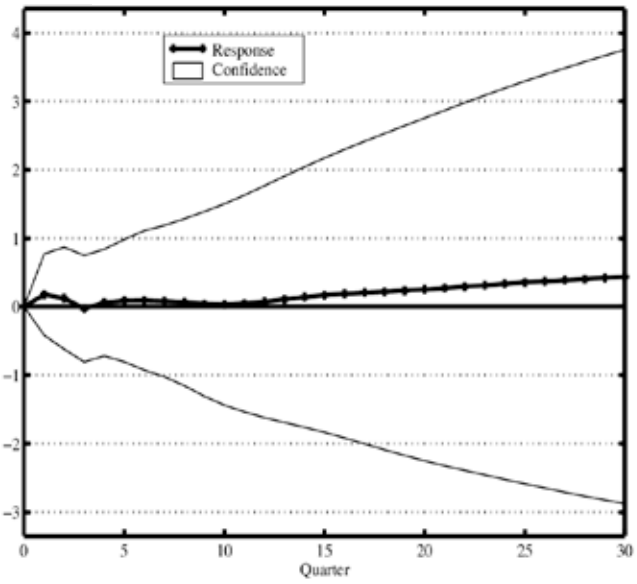
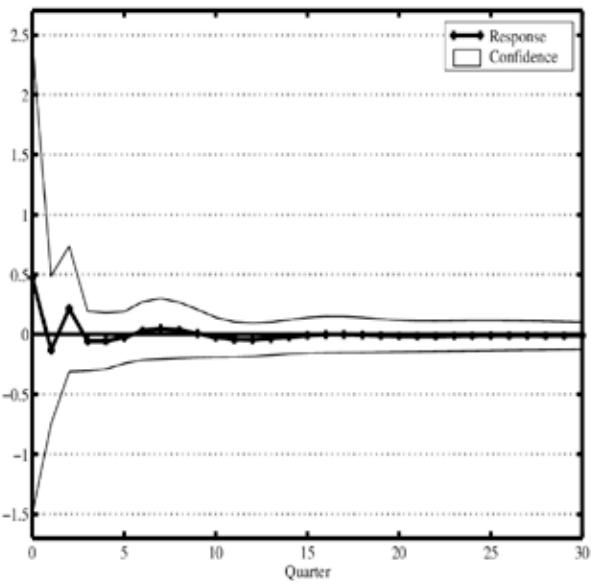


Figure 1.1d: Responses of dreer to a unit shock to smp



Notes: 1. Dynamic responses of macroeconomic variables to a shock in monetary policy.
2. IRFs are from a VAR model of 3 lags, identified using structural identification.
3. The VAR model orders variables as (tb, yn, dcpi4, dreer, br); the exchange rate (the first difference of the real effective exchange rate (dreer)) is *endogenous* in the system, except to monetary policy.

Figure 1b: Responses of Macroeconomic Variables to an Exchange Rate Shock

Figure 1.2a: Responses of dreer to a unit shock to srxr

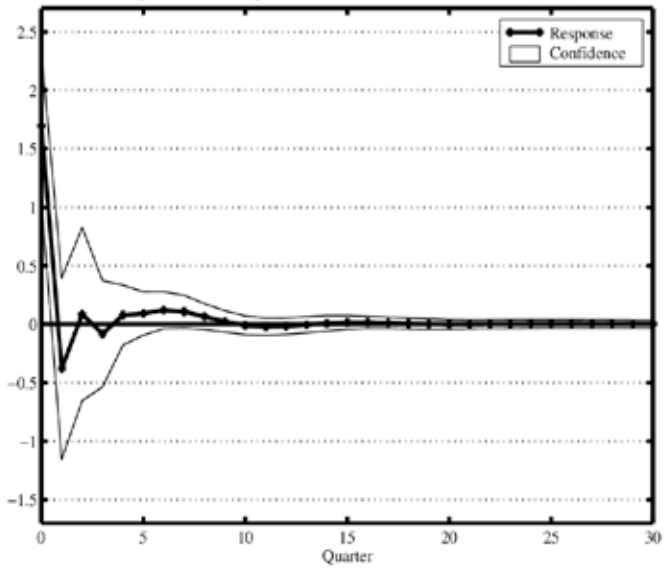


Figure 1.2b: Responses of dcpi4 to a unit shock to srxr

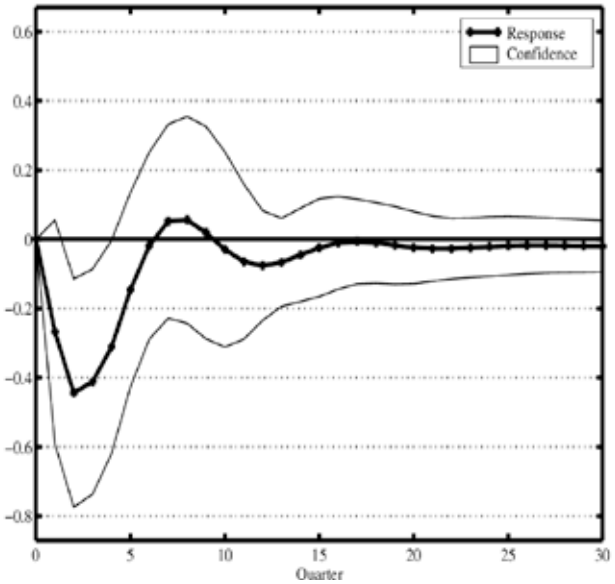


Figure 1.2c: Responses of yn to a unit shock to srxr

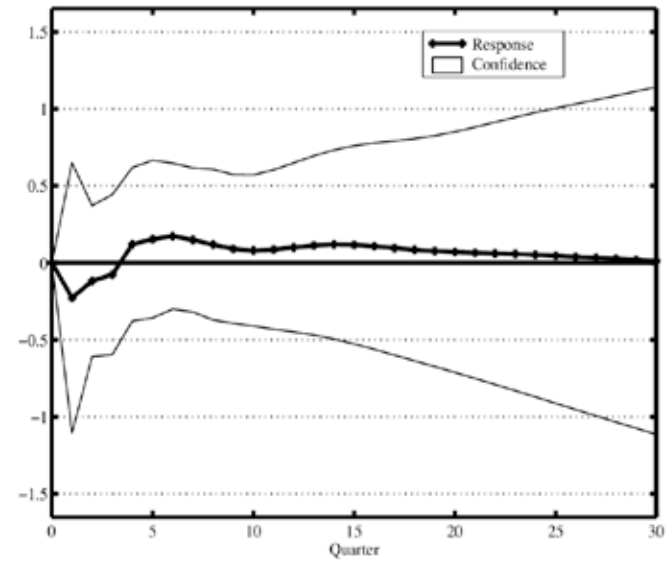
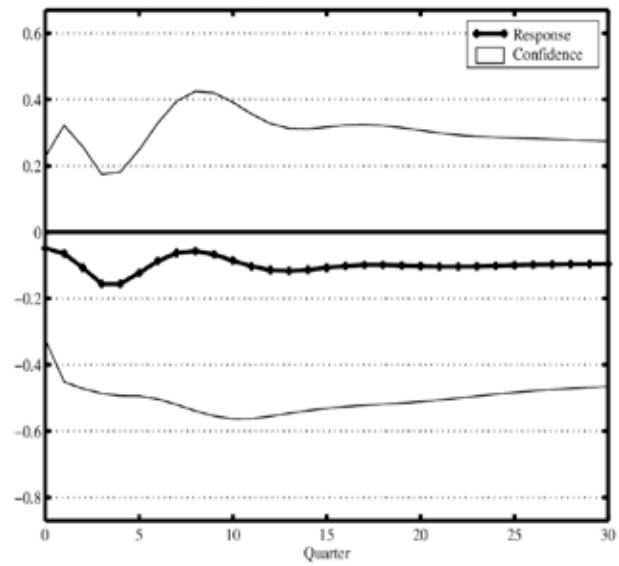


Figure 1.2d: Responses of br to a unit shock to srxr



Notes: 1. Dynamic responses of macroeconomic variables to a shock in the exchange rate.
2. IRFs are from a VAR model of 3 lags, identified using structural identification.
3. The VAR model orders variables as (tb, yn, dcpi4, dreer, br); the exchange rate (the first difference of the real effective exchange rate (dreer)) is endogenous in the system, except to monetary policy.

Figure 2a: Responses of Macroeconomic Variables to a Monetary Policy Shock

Figure 2.1a: Responses of br to a unit shock to smp

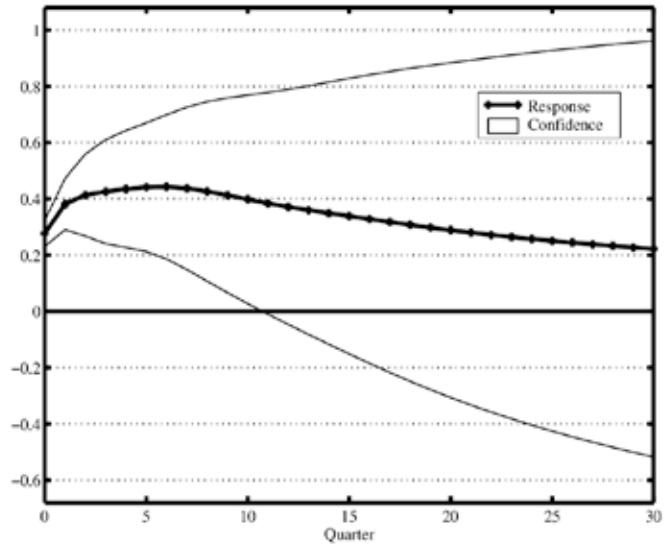


Figure 2.1b: Responses of dcpi4 to a unit shock to smp

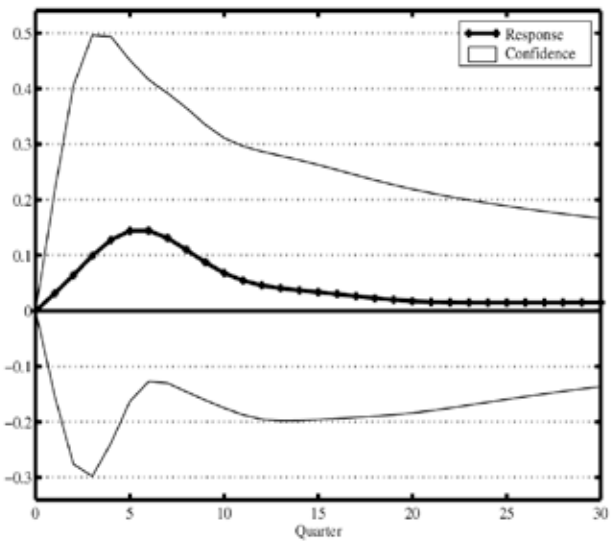


Figure 2.1c: Responses of yn to a unit shock to smp

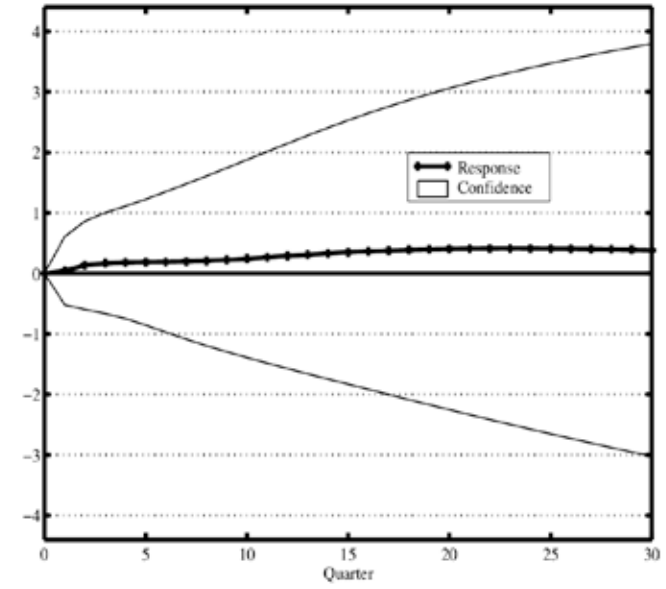
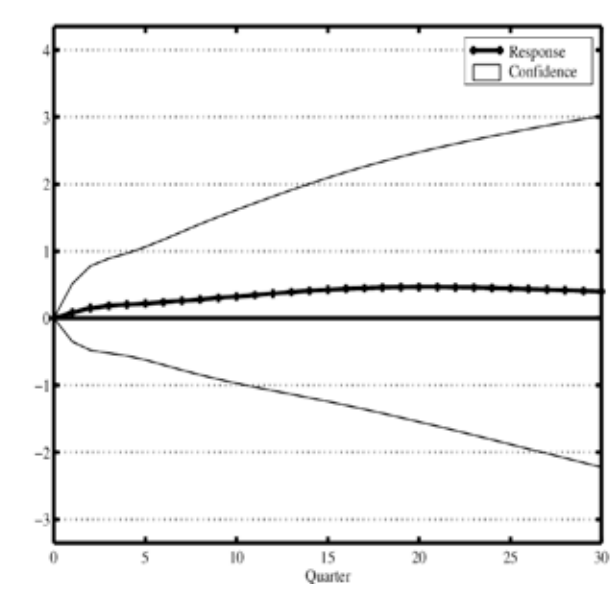


Figure 2.1d: Responses of neer to a unit shock to smp



Notes: 1. Dynamic responses of macroeconomic variables to a shock in monetary policy.
2. IRFs are from a VAR model of 2 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, yn, dcpi4, neer, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is *endogenous* in the system, except to monetary policy.

Figure 2b: Responses of Macroeconomic Variables to an Exchange Rate Shock

Figure 2.2a: Responses of neer to a unit shock to sxr

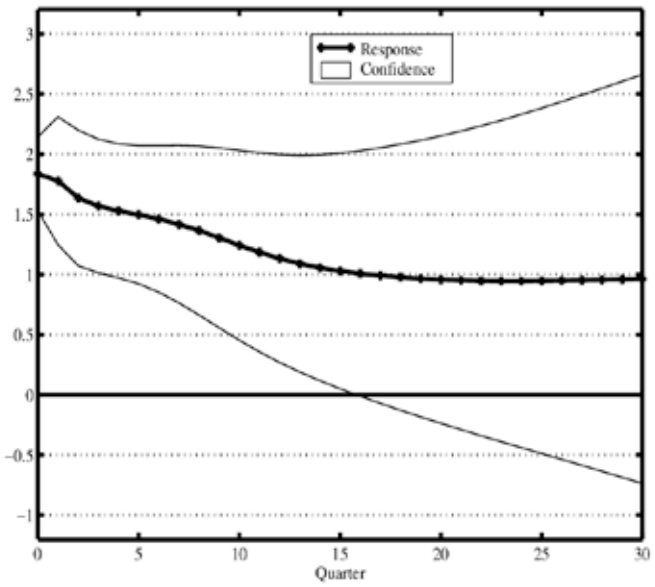


Figure 2.2b: Responses of dcpi4 to a unit shock to sxr

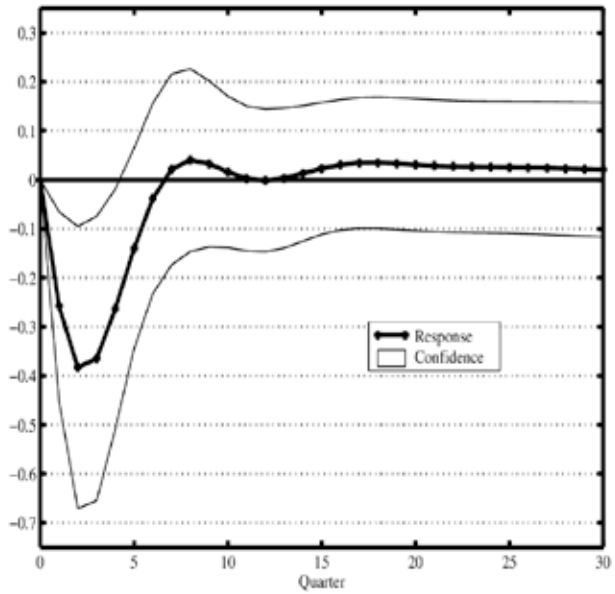


Figure 2.2c: Responses of yn to a unit shock to sxr

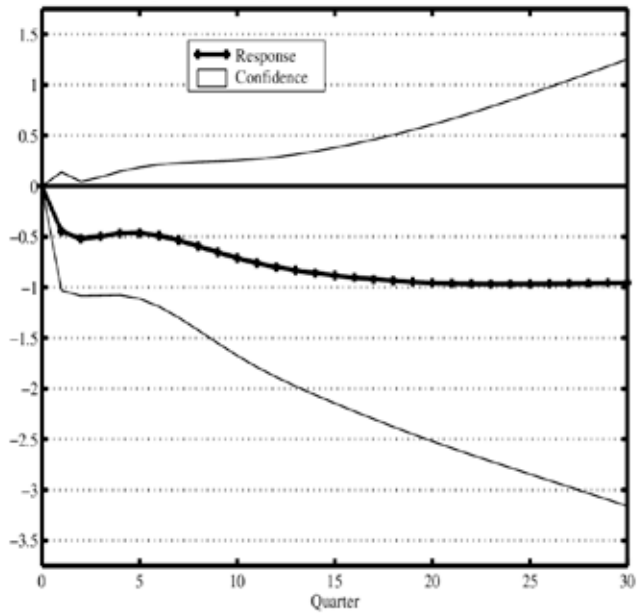
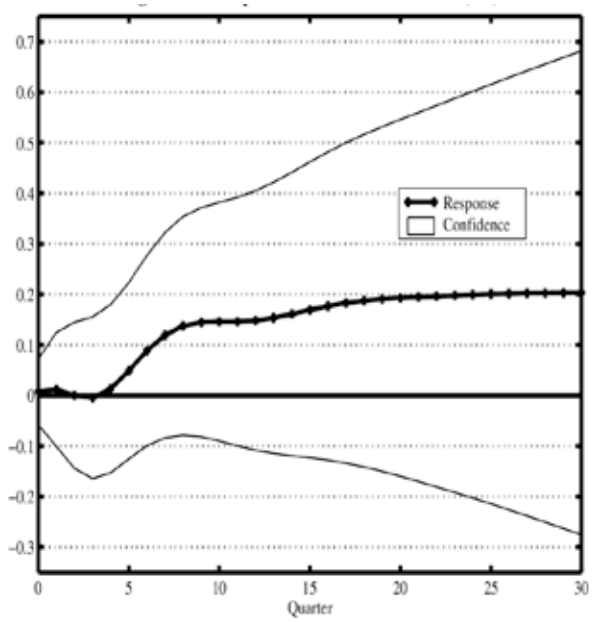


Figure 2.2d: Responses of br to a unit shock to sxr



Notes: 1. Dynamic responses of macroeconomic variables to a shock in the exchange rate.
2. IRFs are from a VAR model of 2 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, yn, dcpi4, neer, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is *endogenous* in the system, except to monetary policy.

Figure 3a: Responses of Macroeconomic Variables to a Monetary Policy Shock

Figure 3.1a: Responses of br to a unit shock to smp

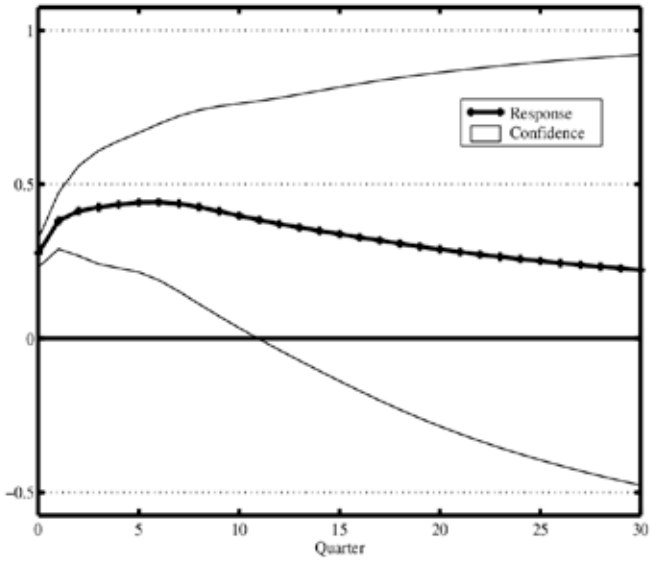


Figure 3.1b: Responses of dcpi4 to a unit shock to smp

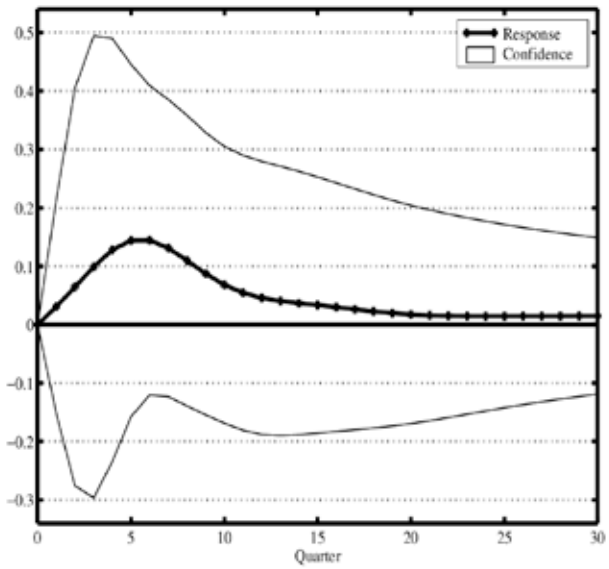


Figure 3.1c: Responses of yn to a unit shock to smp

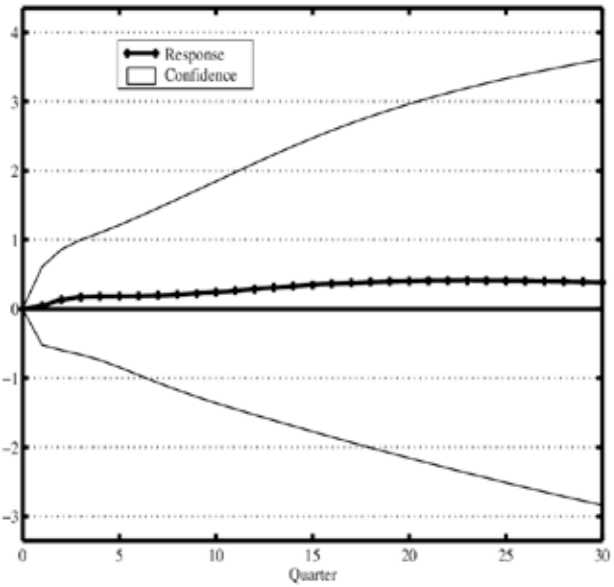
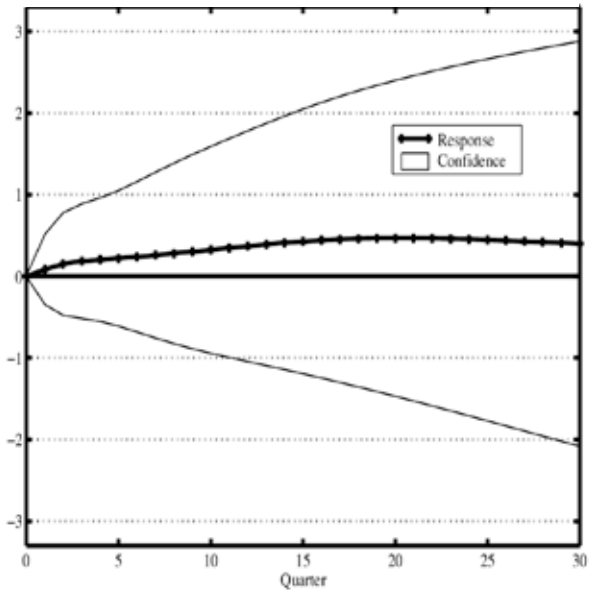


Figure 3.1d: Responses of neer to a unit shock to smp



Notes: 1. Dynamic responses of macroeconomic variables to a shock in monetary policy.
2. IRFs are from a VAR model of 2 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, neer, yn, dcpi4, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is *exogenous* to the domestic economy.

Figure 3b: Responses of Macroeconomic Variables to an Exchange Rate Shock

Figure 3.2a: Responses of neer to a unit shock to sxr

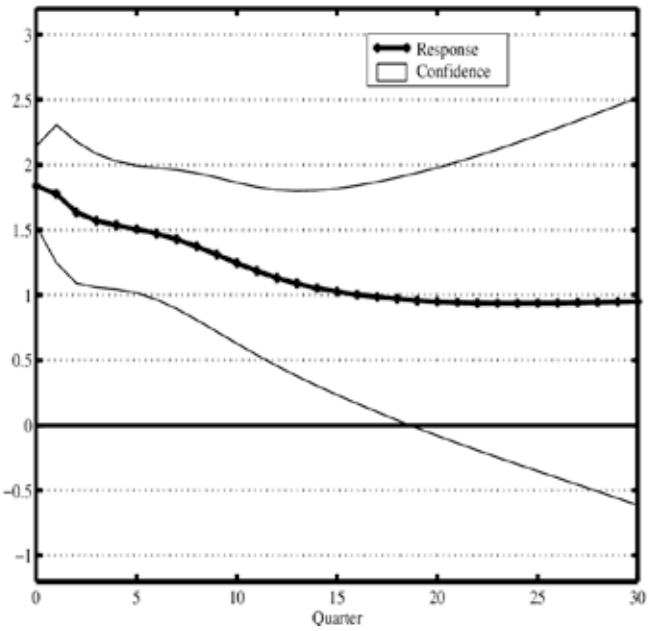


Figure 3.2b: Responses of dcpi4 to a unit shock to sxr

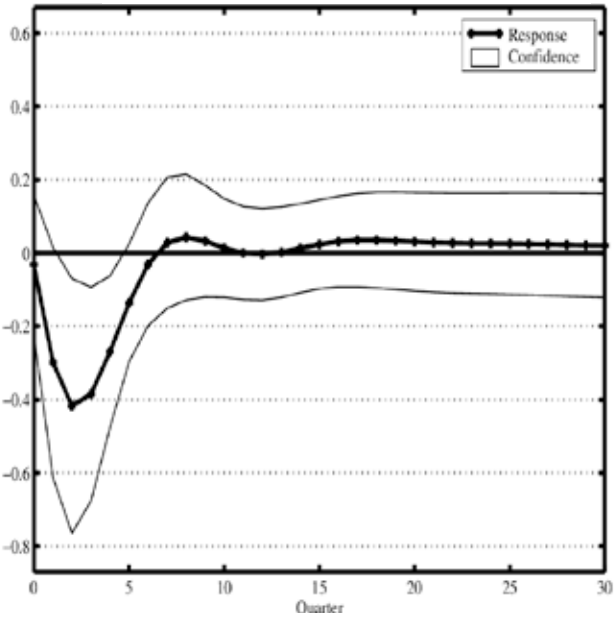


Figure 3.2c: Responses of yn to a unit shock to sxr

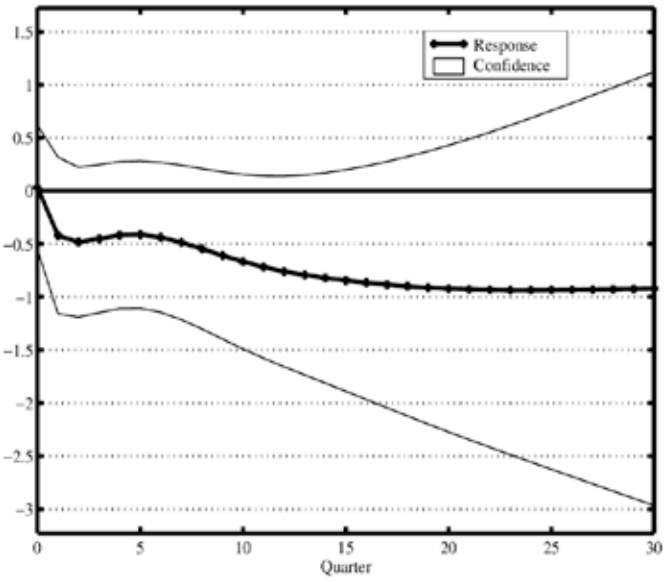
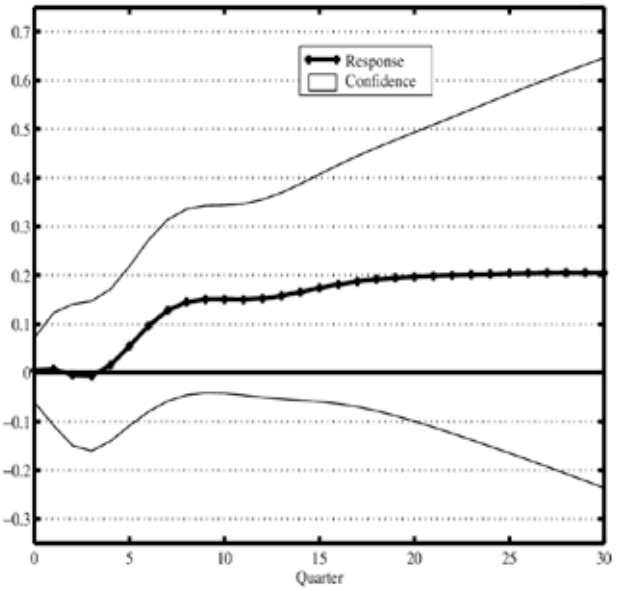


Figure 3.2d: Responses of br to a unit shock to sxr



Notes: 1. Dynamic responses of macroeconomic variables to a shock in the exchange rate.
2. IRFs are from a VAR model of 2 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, neer, yn, dcpi4, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is *exogenous* to the domestic economy.

Results for the Fixed Exchange Rate Regime (1993:3 – 2005:1)

Figure 4a: Responses of Macroeconomic Variables to a Monetary Policy Shock

Figure 4.1a: Responses of br to a unit shock to smp

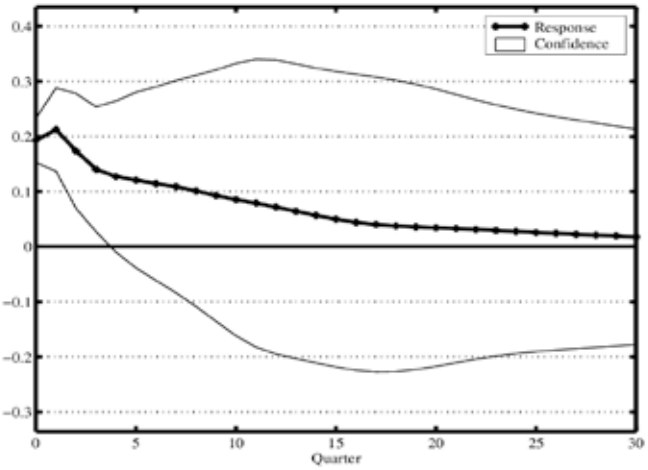


Figure 4.1b: Responses of dcpi4 to a unit shock to smp

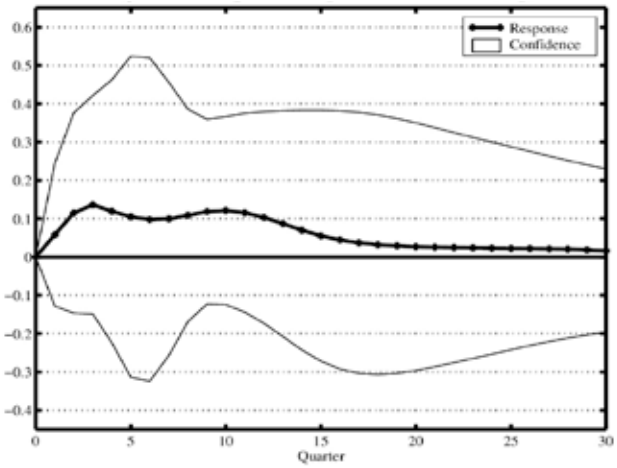


Figure 4.1c: Responses of yn to a unit shock to smp

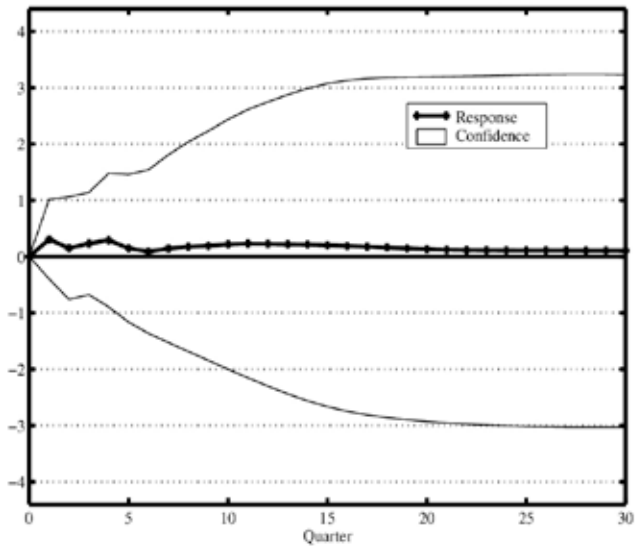
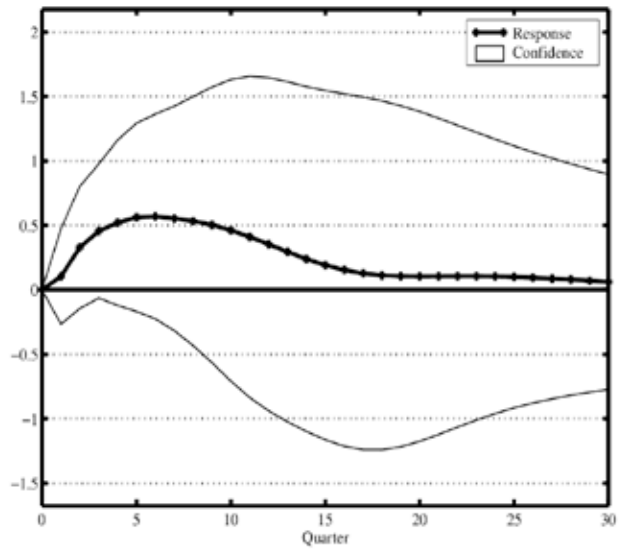


Figure 4.1d: Responses of neer to a unit shock to smp



Notes: 1. Dynamic responses of macroeconomic variables to a shock in monetary policy.
2. IRFs are from a VAR model of 3 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, neer, yn, dcpi4, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is *exogenous* to the domestic economy.

Figure 4b: Responses of Macroeconomic Variables to an Exchange Rate Shock

Figure 4.2a: Responses of neer to a unit shock to sxr

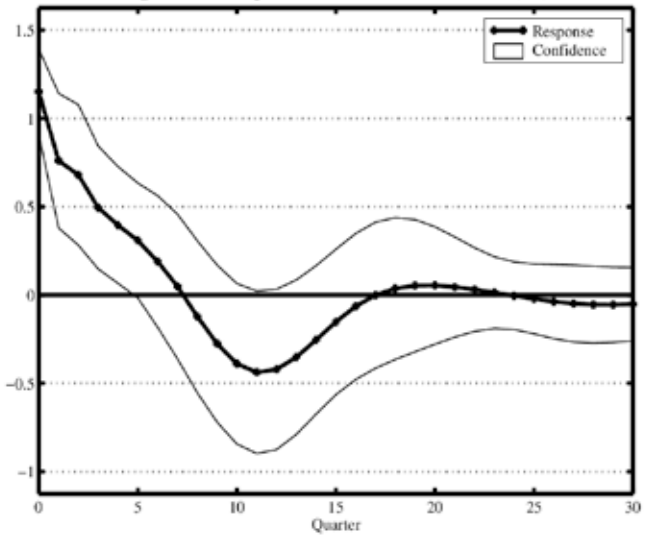


Figure 4.2b: Responses of dcpi4 to a unit shock to sxr

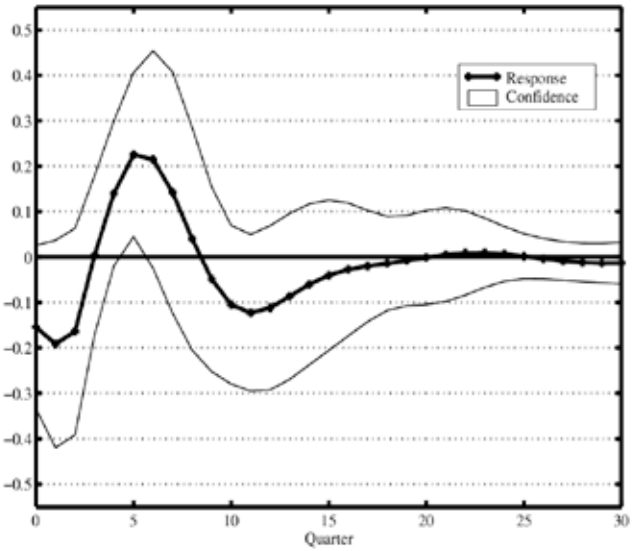


Figure 4.2c: Responses of yn to a unit shock to sxr

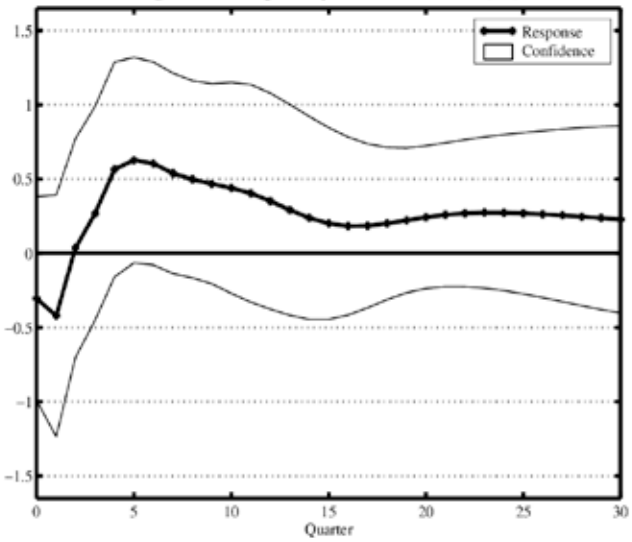
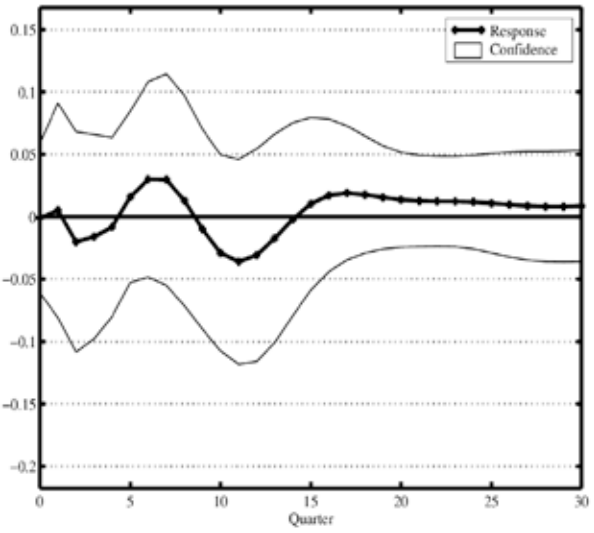


Figure 4.2d: Responses of br to a unit shock to sxr



Notes: 1. Dynamic responses of macroeconomic variables to a shock in the exchange rate.
2. IRFs are from a VAR model of 3 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, neer, yn, dcpi4, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is exogenous to the domestic economy.

Results for the Crawling Band Exchange Rate Regime (2005:2 – 2011:1)

Figure 5a: Responses of Macroeconomic Variables to a Monetary Policy Shock

Figure 5.1a: Responses of br to a unit shock to smp

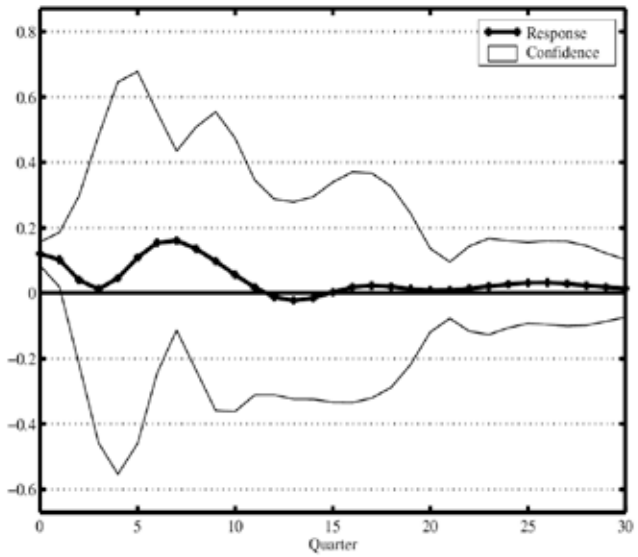


Figure 5.1b: Responses of dcpi4 to a unit shock to smp

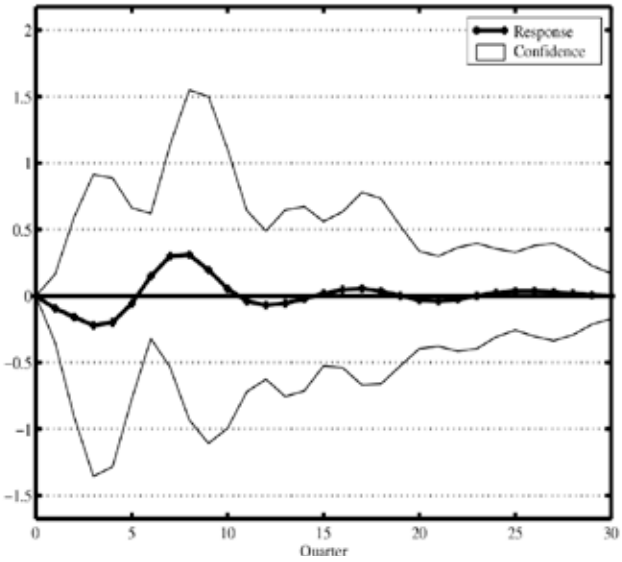


Figure 5.1c: Responses of yn to a unit shock to smp

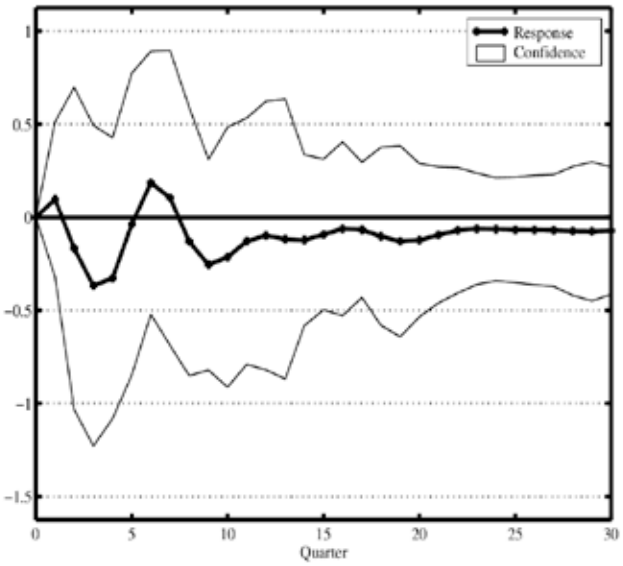
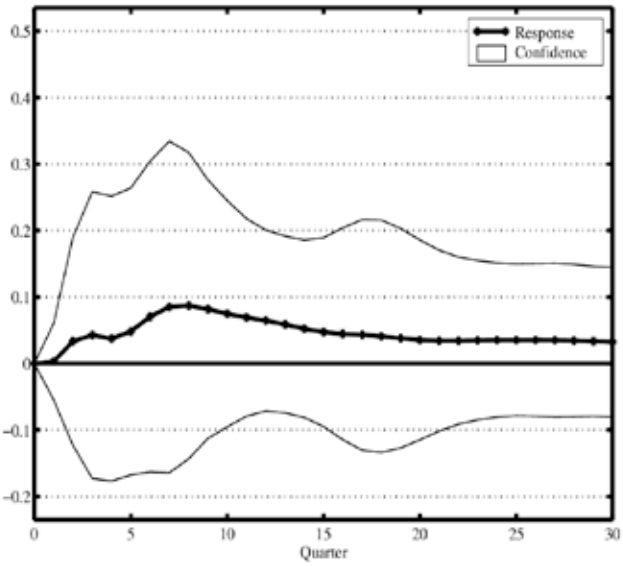


Figure 5.1d: Responses of neer to a unit shock to smp



Notes: 1. Dynamic responses of macroeconomic variables to a shock in monetary policy.
2. IRFs are from a VAR model of 2 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, yn, dcpi4, neer, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is *endogenous* in the system, except to monetary policy.

Figure 5b: Responses of Macroeconomic Variables to an Exchange Rate Shock

Figure 5.2a: Responses of neer to a unit shock to sxr

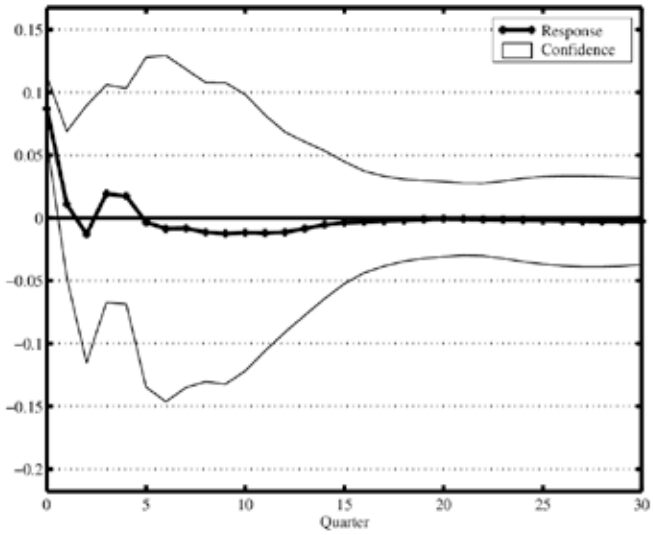


Figure 5.2b: Responses of dcpi4 to a unit shock to sxr

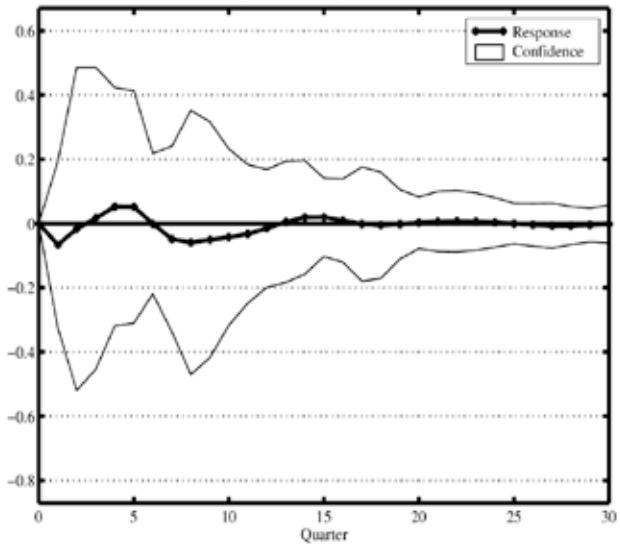


Figure 5.2c: Responses of yn to a unit shock to sxr

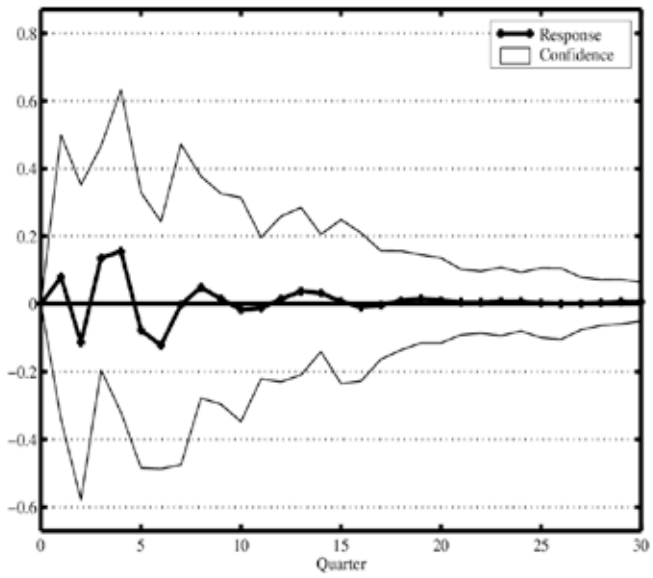
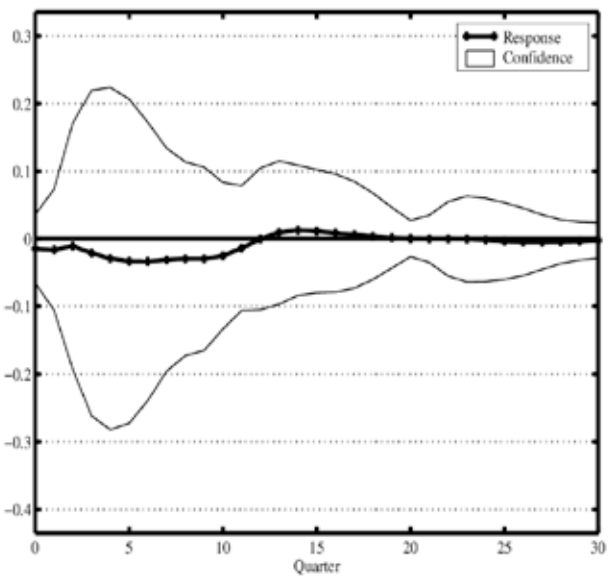


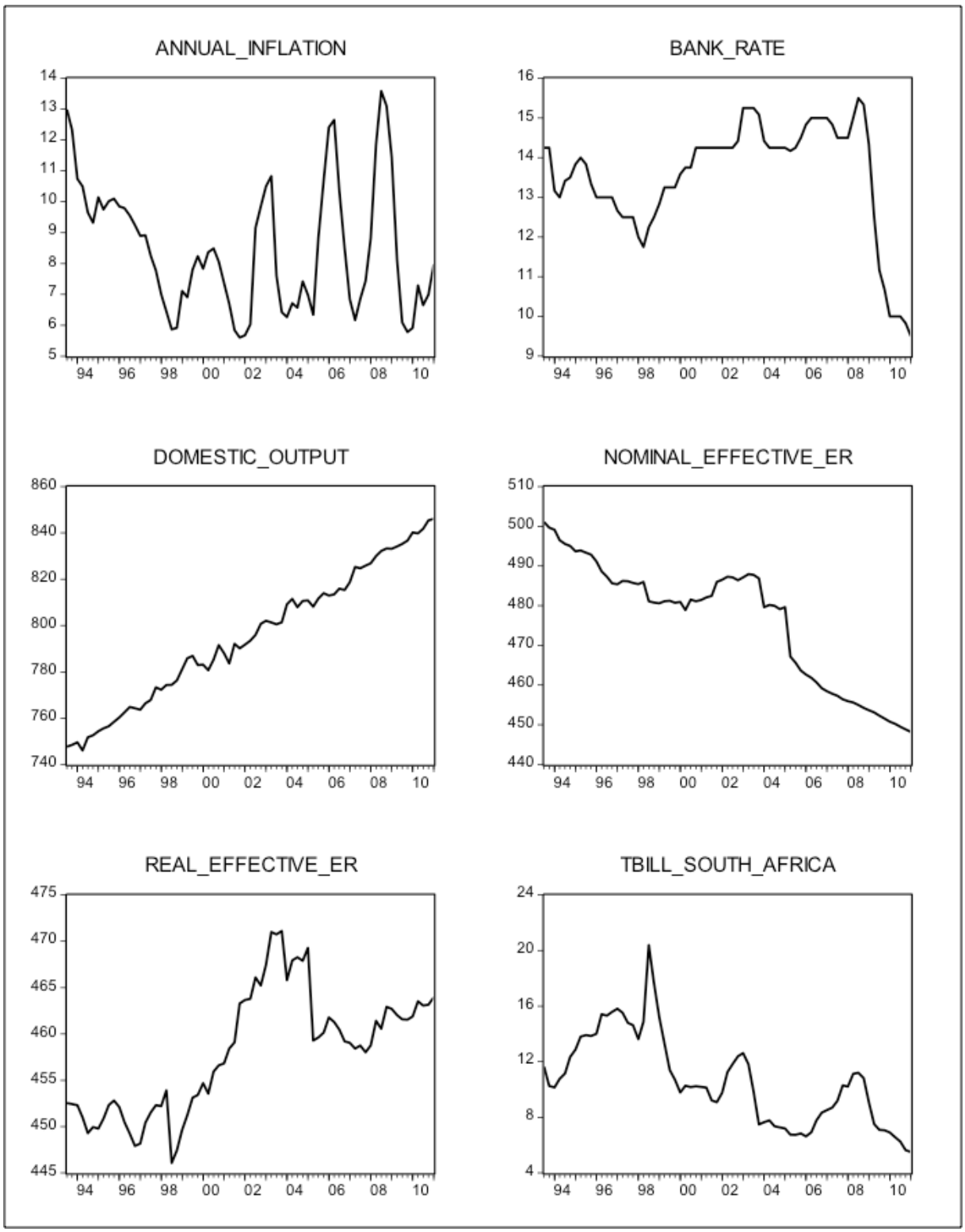
Figure 5.2d: Responses of br to a unit shock to sxr



Notes: 1. Dynamic responses of macroeconomic variables to a shock in the exchange rate.
2. IRFs are from a VAR model of 2 lags, identified using Cholesky decomposition.
3. The VAR model orders variables as (tb, yn, dcpi4, neer, br); the exchange rate (the level of the nominal effective exchange rate (neer)) is *endogenous* in the system, except to monetary policy.

Appendix 2

Model Variables



Notes: 1. On account of the maximum number of characters allowed by the Eviews programme in the name field, short form of variable names has been used for some of the charts.

2. Given the reason in note 1, NOMINAL_EFFECTIVE_ER stands for nominal effective exchange rate, REAL_EFFECTIVE_ER stands for real effective exchange rate, and TBILL_SOUTH_AFRICA stands for Treasury bill rate for South Africa.

Risk and Reward in Currency Diversification Strategies: Do Emerging Markets Hold the Key (for An Investor in Botswana)?

Pako Thupayagale[1]

Abstract

This paper investigates the risk and reward associated with investing with emerging market currencies (i.e., risky assets). The IMF's Special Drawing Rights (SDR) (i.e., a safe-haven asset) is also included in the analysis as a benchmark comparator. The data show that, in terms of the risk and returns relationship, investments in the currencies of Brazil, Russia, India, China and South Africa (BRICS) provide evidence of the risk-return hypothesis (i.e., high risks are associated with high returns). The SDR is shown to provide a hedge against the cyclicality of the foreign exchange returns of the BRICS. The main objective of this analysis is to evaluate if a joint portfolio of the risky asset and safe asset would generate a more attractive risk-reward ratio relative to an investment comprised entirely of a safe-haven asset. The results of this exercise indicate that over both a 5-year and 10-year investment horizon the joint investment outperforms a simple SDR basket, in both US dollar and pula terms. Finally, these results may stimulate further discussion on investor exposure to emerging markets and the implications this may have on the risk-reward profile.

1. Introduction

Investors can potentially improve the risk-adjusted performance of their portfolios by investing internationally and thereby take advantage of the associated return and diversification benefits. Indeed, the diversification and return benefits provided by emerging markets have attracted significant investor attention which, in turn, has led to substantial capital inflows to these economies. For investors appraised against a specific benchmark, this may mean a readjustment of this benchmark in order to capture a greater opportunity set. At a more theoretical level, asset pricing models, such as the Sharpe-Linter capital asset pricing model (CAPM) suggest that investors should hold global portfolios. Empirically, many authors have documented the gains from international diversification of investment portfolios (e.g., Ang and Bekaert, 2002, and references therein).

Against this background, this paper considers whether a risk-averse (or safety-conscious) investor (e.g., an asset managers with a defensive mandate or money market funds, or similar) in Botswana could improve his/her risk-return ratio by widening the universe of investable currencies. In particular, diversify out of traditional safe-haven currencies (such as the US dollar and Swiss franc) and into emerging market currencies. Over the past decade, given (comparatively) lower yields in most of the advanced economies, investors have targeted investments in high-yielding emerging markets such as those of Brazil, Russia, India, China and South Africa (henceforth, the BRICS). This strategy is often described as the 'search-for-returns'. In this regard, a common strategy is the carry trade, which has attracted investors because of its high risk-adjusted returns.[2] The focus on the BRICS is notable for a variety of reasons. First, the BRICS, currently account for 25 percent of global GDP. Second, over the past 10 years (i.e., this study's sample period), they have contributed over a third of world GDP growth. Third, looking forward to this decade, and beyond, it is anticipated that these trends will continue and become even more pronounced (Goldman Sachs, 2007). The BRICS are likely to remain key beneficiaries of any significant diversification in international portfolios. Success to this stage has been mostly a function of currency strength and commodity ties. Other factors – financial system stability and sovereign credit considerations – also argue for the inclusion of these assets in a diversified global portfolio.[3] For purposes of this analysis, the risk-averse investor is assumed to invest exclusively in advanced economies and the investment management function is undertaken in accordance with the prudential principles of security (i.e., safety), profitability (i.e., return), and liquidity using risk management concepts. For simplicity, this paper will use the Sharpe ratio to evaluate the relative attractiveness of an investment.[4]

This paper, therefore, examines if a risk-averse investor in Botswana could improve his/her risk adjusted performance by diversifying out of traditional safe-haven currency baskets and into the currencies of the BRICS' economies. The objective is to determine

1 Chief Dealer, Financial Markets Department, Bank of Botswana. The views expressed in the paper are those of the author and do not necessarily reflect those of the Bank of Botswana.

2 Carry traders take a short position in a currency with a low interest rate and a long position in a currency with a high interest rate.

3 For example, the Morgan Stanley Composite Index (MSCI) All Country World Investable Market index already includes the BRICS.

4 The Sharpe ratio is a risk-adjusted measure of return that is often used to evaluate the performance of a portfolio. The ratio helps to make the performance of one portfolio comparable to that of another portfolio by making an adjustment for risk.

if a risk-averse investor would have been better off exposed to a portfolio of advanced economy currencies or a combination of developed and emerging market currencies. After this investigation, appropriate policy recommendations are made. This paper is organised as follows. Section 2 provides a description of the data and outlines the research methodology. Section 3 evaluates the degree of 'security' or 'safety' in the foreign exchange markets of the BRICS'. In particular, the less volatile (or risky) an asset is, the more 'safe' it will be considered.[5] The prevailing liquidity conditions in the BRICS vis-à-vis the advanced economies are also assessed in order to evaluate the 'safety' or 'security' of investment, since the ability to enter or exit a position without an undue impact on the exchange is consistent with low volatility in the price (or return) of the exchange rate (and hence the extent of safety). Section 4 considers the total return and risk-adjusted returns of the BRICS currencies vis-à-vis a widely used basket of emerging market currencies. Section 5 presents a currency composite comprised of a BRICS currency and a standard proxy of advanced economy currencies. For convenience, this study will focus on the South African rand and Brazilian real, in terms of simulating the performance of a currency composite benchmark, given that the relevant data are readily available. Section 6 concludes.

2. Data

The data used in this study are obtained from Bloomberg and consist of monthly observations, spanning the period from January 2000 to December 2010, for 5 currencies: Brazilian real (BRL), Russian rouble (RUB), Indian rupee (INR), Chinese renminbi (CNY) and South African rand (ZAR). These are, therefore, the currencies of Brazil, Russia, India, China and South Africa (BRICS). In addition, the unit of account of the International Monetary Fund (IMF), the Special Drawing Right (SDR) is included for comparative purposes and to proxy a safe-haven currency or the currency of the advanced economies. The CNY is regulated by the authorities. Therefore, the results have no market significance and are only reported for informational purposes.

Summary statistics for daily returns for bilateral spot exchange rates for BRICS' currencies (and the SDR for comparative purposes) vis-à-vis the US dollar are reported in Table 1 for the full sample period.[6] Amongst these currencies, the highest average daily return was for the South African rand (at 0.1710 percent), followed by the SDR (0.1100 percent) and then the Brazilian real (0.0841 percent), with the Renminbi delivering negative returns. In terms of variability, the BRICS' currencies, with the exception of China – due to its fixed exchange rate system/tighter management of exchange rates – are volatile relative to the SDR. Brazilian currency returns are the most volatile with a standard deviation of 5.4147, followed by the South African rand at 5.2334. The returns of the SDR are the least variable. Most of the BRICS' currencies are positively skewed, which indicates a distribution with an asymmetric tail extending towards more positive values (i.e., there are extreme values towards the positive end of a distribution). In a positively skewed distribution, the mean is greater than the mode. Returns from the SDR are marked by a slight negative skew. The SDR is relatively symmetric in its distribution and this suggests that, for the most part, the returns are normally distributed. All the currency returns display excess kurtosis, which indicates the greater likelihood that future currency returns will be either extremely large or extremely small (thus, in a sense, kurtosis is a measure of 'volatility of volatility'). However, for the SDR (and to a lesser extent the ZAR), the kurtosis coefficient is very close to that associated with a normal distribution (i.e., which has a kurtosis coefficient of 3 and the measures of excess kurtosis are relative to 3). In fact, these basic summary statistics indicate that the returns distribution of the SDR has in many respects – skewness and kurtosis – the attributes of a normal distribution.

From the summary statistics presented above, a picture of the return (mean return) and safety (i.e., comparative risk or volatility levels) emerges. In particular, BRICS' currencies generally deliver higher returns and more volatility (i.e., less safety) relative to a traditional safe-asset currency.

3. Safety

The overarching objective for real money accounts (these are typically endowment and pension funds, or similar) is to ensure that funds are invested prudently, such that they are readily available when needed, while generating a reasonable return over the long run. Prudence is interpreted to mean safety or security in this analysis. To analyse safety, four standard metrics are used. First, sovereign credit ratings provide a basis in which to examine the perceived safety of an investment. Second, the annualised standard deviation of returns is used to proxy risk. The lower the risk, the safer the investment (return) is taken to be. Therefore, volatility measured in terms of annualised volatility of returns and the standard deviation of returns is also used to calculate volatility and infer safety or security of the investment. Third, safety is also evaluated through the correlation with the Chicago Board Options Exchange (CBOE) Volatility index (VIX), a widely used gauge of market volatility. Finally, liquidity conditions in the underlying market are used to deduce the safety of the investment, since illiquid markets are associated with wide bid-offer spreads which are indicative of risk.

5 Modern portfolio theory (MPT) defines risk in terms of volatility. MPT was introduced by Markowitz (1952). It defines risk as the standard deviation of return. Volatility is, therefore, a measure of risk on returns.

6 The summary statistics focus on price return, which only considers the capital gain on an investment. The interest on price return (or simple currency return) here is to highlight the basic time-series properties of these currency returns. Total return analysis is considered in Section 6.

Credit Ratings

Sovereign debt ratings are intended to be forward-looking indicators of the probability of default. They are summary assessments of a government's creditworthiness. The two major credit rating agencies – Moody's Investor Services (Moody's) and Standard and Poor's (S&P) – indicate that their evaluation of government risk derives from the analysis of a wide range of economic, social and political indicators (e.g., including per capita income, GDP growth, inflation, external debt, level of economic development and default history, etc.).[7]

cies of the BRICS (with the exception of China, given its capital controls) are more volatile (and, therefore, less safe). The ZAR delivers the highest volatility at 18.71, followed by the BRL at 17.87, while the RUB and INR have an annualised standard deviations of 8.69 and 7.27, respectively. The return from the SDR is the least volatile (given that results from the CNY are only informational given policy intervention) with a standard deviation of 5.40. These results are, therefore, consistent with the summary statistics presented in Table 1 and the credit ratings provided in Table 2 overleaf.

Table 1. Monthly Foreign Exchange Return: Summary Statistics

	Mean (percent)	Standard Deviation	Skewness	Kurtosis
Brazilian real (BRL)	0.1188	5.4147	1.4702	7.9670
Russian rouble (RUB)	0.1275	2.6094	4.2455	37.4337
Indian rupee (INR)	0.0341	1.7786	0.3045	5.9926
Chinese renminbi (CNY)	–0.1732	0.3894	–2.6596	10.5846
South African rand (ZAR)	0.1710	5.2334	0.6810	3.7479
Special Drawing Rights (SDR)	0.0803	1.4637	–0.0314	3.3809

1. CNY is regulated by the authorities; hence, it is not market determined. Thus, results are not comparable and are, therefore, for informational purposes only.

2. Skewness characterises the degree of asymmetry of a distribution around its mean. In a positively skewed distribution, the mean is greater than the mode and vice–versa in the case of a negatively skewed distribution. By knowing which way data are skewed, an analyst can better estimate whether a given (or future) foreign exchange return will be more or less than the mean.

3. Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. Data sets with low kurtosis tend to have a flat top near the mean rather than a sharp peak. Higher kurtosis means more of the variance is the result of infrequent extreme deviations, as opposed to frequent modestly sized deviations.

The first and second columns of Table 2 show that all the BRICS countries are investment grade. This indicates that their credit quality is favourable and warrants investment. However, it is also apparent that their credit ratings are located at the lowest tier of investment grade, i.e., they just make the investment grade. Their ratings are thus precarious with respect to investment grade status. Furthermore, a downgrade below BBB/Baa reclassifies the credit rating to speculative or 'junk' status, which would have adverse effects on the asset's value. The safety-conscious fund investor would appreciate the investment grade rating, but would naturally be circumspect about investing in the BRICS.

Volatility (or Risk) profile

The fourth column of Table 2 presents the annualised standard deviation of FX investments in the currencies of the BRICS. The volatility figures are consistent with those presented in Table 1 insofar as the curren-

Liquidity

Pension funds and other institutional investors often emphasise the importance of investing in highly liquid markets.[8] In contrast, illiquid markets imply that the cost of trading are high and the capacity of investors to unwind their positions is limited (or generates substantial volatility), which, in turn, may deter market entrants on both buy and sell sides. To evaluate market liquidity in the BRICS' economies, daily foreign exchange market turnover data are presented. The SDR is also included as a benchmark comparator.

The last column of Table 2 highlights the dominant role of the SDR constituent currencies in global foreign exchange turnover. These currencies are the most heavily traded because their economies are the largest and their capital markets are the deepest and most liquid. These currencies account for more than three-quarters of daily foreign exchange turnover. Turnover in the BRICS is shown to be very small relative to the major international currencies. However, from the perspective of an investor in Botswana, the liquidity conditions of the BRICS are not challenging, given the comparatively modest turnover

7 Sovereign credit ratings have a number of implications. First, they are an important determinant of a country's borrowing costs in international capital markets. Second, this rating may influence private financing costs since it provides a reference point for the borrowing levels of financial institutions and corporations. And third, investment guidelines may oblige institutional investors to construct their investment portfolios based on the credit risk signaled by the rating notations.

8 Liquidity refers to the ability of market participants to buy and sell securities. Liquidity is important because with greater liquidity it is easier for investors to buy or sell securities, investors are more likely to pay or receive a competitive price for securities purchased or sold.

Table 2: Sovereign Credit Ratings, Volatility (or Risk) and Market Liquidity

	Standard & Poor's	Moody's	Annualised Standard Deviation	Foreign Exchange Market Turnover
BRICS				
Brazilian real	BBB–	Baa3	17.87	0.7
Russian rouble	BBB	Baa1	8.69	0.9
Indian rupee	BBB–	Baa3	7.27	0.9
Chinese renminbi	AA–	Aa3	1.59	0.9
South African rand	BBB+	A3	18.71	0.7
International Monetary Fund				
SDR	AAA	Aaa	5.40	155.9

Notes:

1. Credit ratings are as of the end of 2010.
2. Within rating categories, S&P use (+) or (–) signs to show relative standing, with A+ being better than A or A–. Moody's uses a modifier of 1, 2, or 3 for the same purpose, with A1 being better than A2 or A3.
3. Below investment grade is speculative grade.
4. The annualised standard deviation is calculated for each individual currency against the US dollar.
5. Foreign exchange market turnover is expressed in terms of the percentage share of available daily turnover. In addition, because two currencies are involved in each transaction, the sum of the percentage shares of individual currencies totals 200%, instead of 100%.
6. The market turnover data are as at the end of 2010 and are from the Bank for International Settlements: Triennial Central Bank Survey – Report on Global Foreign Exchange Market Activity in 2010 (April).
7. The SDR is composed of the US dollar, euro, Japanese yen and British pound.
8. Daily foreign exchange market turnover is estimated at USD 4 trillion (BIS, 2010).

Table 3. Cross Correlations – Monthly FX Return Data from 2000 to 2010

	BRL	RUB	INR	CNY	ZAR	SDR	VIX
BRL	1.00	0.24	0.38	0.10	0.25	–0.16	0.32
RUB		1.00	0.39	0.16	0.35	–0.48	0.33
INR			1.00	0.14	0.42	–0.43	0.26
CNY				1.00	0.01	–0.17	0.13
ZAR					1.00	–0.41	0.16
SDR						1.00	–0.10
VIX							1.00

Notes:

1. The correlation coefficient is a statistical measure of association. The less correlated assets are the greater the diversification benefit.
2. VIX volatility index is a widely used proxy for global risk.

ratio of the domestic foreign exchange market. For example, the net daily turnover in the South African foreign exchange market was USD16.0 billion in the third quarter of 2010 (compared to USD15.3 billion in the previous quarter), of which 80 to 90 percent is in the US Dollar (Nedbank, 2010). This suggests that the share of the Botswana pula is insignificant from the perspective of the South African market. In general, therefore, liquidity conditions in the BRICS are, therefore, not restrictive from the perspective of a Botswana-based investor. Evidently, SDR liquidity is considerably higher, and all else equal, a global investor would be more comfortable with trading conditions in the SDR markets, given the much larger liquidity base.

Correlation with Risky Assets/Diversification of Risk

Table 3 presents the cross correlation between the BRICS' currencies and an index of global volatility (represented by the VIX volatility index), in order to ascertain if the BRICS provide a hedge against global volatility (or risky assets in general).[9] Portfolio diversification seeks to minimise risk (for any given level of return) by investing in currencies whose returns are not correlated. From Table 4, it is apparent that the currencies of the BRICS are correlated with risky assets (i.e., assets whose future return is uncertain, e.g., equities, commodities, etc.). The RUB returns are most correlated (33 percent) with global risk, followed by BRL returns (32 percent) while ZAR returns have a 16 percent correlation with global volatility. This means that as risky assets outperform, so too will the currencies of the BRICS and vice-versa. In contrast, the SDR provides a hedge against volatility in emerging market currency returns and risky assets,

9 Global market volatility is proxied by the VIX volatility index, the Chicago Board Options Exchange (CBOE) volatility index, which is a forward-looking measure of market expectations for the S&P500 equities. The VIX index is calculated as a weighted average of the implied volatility for S&P500 calls and puts.

Table 4: BRICS Currencies: Risk–Return Characteristics Relative to the USD

	Total Return (%)	Average Annual Excess Return	Sharpe Ratio
BRICS			
Brazilian real	402.3	12.17	0.68
Russian rouble	65.8	3.82	0.44
Indian rupee	118.6	4.22	0.58
Chinese renminbi	37.6	1.03	0.65
South African rand	160.4	6.14	0.33
International Monetary Fund (IMF)			
SDR	53.2	–3.16	–0.59

Source: Bloomberg and author's own calculations

Notes:

1. SDR is the unit of account of the International Monetary Fund. It is comprised of the US dollar, Euro, British pound and Japanese yen. Weights are based on the IMF 2006 review.

2. Total return is computed as: Total Return =[(1+spot return)×(1+interest return)]–1. Total return incorporates two sources of return: (interest) income and capital appreciation.

3. The excess return is the rate of return above and beyond the risk–free rate, which is usually the t–bill rate.

4. The Sharpe ratio is a commonly used measure of risk–adjusted performance that shows the average excess return (over the risk–free return) per unit of volatility in excess return. The Sharpe ratio is very useful because, although one portfolio can earn higher returns than its peers, it is only a good investment if those higher returns do not come with too much additional risk. The greater a portfolio's Sharpe ratio, the better its risk–adjusted performance has been.

more generally (as reflected in the correlation between the VIX volatility index and the SDR). These results point to the cyclicality of the high-yielding currencies of the BRICS' economies and the counter-cyclicality of safe-haven currencies like the SDR. This analysis also provides a simple, but powerful conclusion: high-yielding currencies (such as those of the BRICS) are cyclical, while the SDR is countercyclical.

5. Return

The return characteristics of BRICS' currencies have attracted investor attention. The first column of Table 4 shows that the total foreign exchange return against the US Dollar over the past decade has been robust. For example, investments in the BRL returned 402.3 percent; while, the ZAR and INR returned 160.4 percent and 118.6 percent, respectively. In contrast, the SDR returned only 53.3 percent. In line with the ordering of total return, the average annual excess returns of BRL are the highest (12.17), followed by ZAR (6.14), INR (4.22), RUB (3.82) and CNY (1.03). In contrast, the SDR yields a negative return. The total return and excess return figures essentially indicate that the BRICS' currencies were appreciating relative to the USD.

The final column of Table 4 presents the risk-adjusted returns or Sharpe ratio associated with investing in the currencies of the BRICS. Even after adjusting for risk (i.e., annualised standard deviation as presented in the fourth column of Table 2), the returns of the BRICS currencies outperform the SDR. However, in terms of the Sharpe ratio, this ordering is changed (given different underlying volatility profiles. For example, the BRL is still the best performer with a Sharpe ratio of 0.68, followed by CNY (0.65), INR (0.58), RUB (0.44) and the ZAR with the lowest Sharpe ratio (0.33) given its high volatility (18.71) relative to the excess return (6.14) generated in that foreign exchange market.

6. Return Dynamics for the Botswana Based Investor[10]

In view of the robust total return and robust risk-adjusted performance of the BRICS, a risk-averse (or safety-conscious investor) fund investor in Botswana may want some exposure to the BRICS in order to benefit from this outperformance. BRL and ZAR generate the highest total return among the currencies of the BRICS; 402.3 percent and 160.4 percent, respectively (Table 4). Similarly, the excess return they generate; 12.17 percent and 6.14 percent, respectively, are also the highest (Table 4). Yet their Sharpe ratios are the best and the worst, respectively, among the BRICS. Given these interesting features of the data, the analysis (for brevity) will focus on these currencies for further analysis. In particular, this Section evaluates the implications of adding ZAR or BRL to a safe-haven benchmark (proxied by the SDR) to examine whether or not it would improve the risk-reward ratio of this benchmark to a risk-averse Botswana investor given the potential 'optimality' of an equally weighted basket of a counter-cyclical or safe-haven asset (taken to be the SDR) and a cyclical emerging market currency (like the BRL or ZAR).

10 The analysis of return dynamics in this section is based on the concept of total return. The total return of an investment includes both the capital appreciation and the income received on the portfolio. In this analysis we use monthly interbank rates to calculate the interest income earned in the various markets (given that our data are monthly in frequency). The spreadsheet detailing these calculations is available from the author on request.

The Impact of Adding the Brazilian Real to a Safe-haven Benchmark

Table 5 below compares 5- and 10-year annualised returns for a simple portfolio (or benchmark) that is comprised completely of a safe-haven asset (i.e., the SDR) with one that is constituted in equal parts of a safe-haven asset and a risky asset (e.g., the BRL). The results of this analysis are heavily dependent on the reporting currency. As such, figures based on both US dollar and the Botswana Pula are presented.

TABLE 5: FOREIGN EXCHANGE RETURN ANALYSIS

USD terms	5 year excess annualised return	5 year annualised volatility	Sharpe ratio	10 year annualised excess return	10 year annualised volatility	Sharpe ratio
Simple SDR basket	2.22	4.91	0.45	2.39	4.58	0.52
SDR and BRL basket	5.06	6.67	0.76	7.48	7.02	1.07
SDR and ZAR basket	3.55	7.10	0.50	4.54	7.16	0.63

BWP terms	5 year annualised excess return	5 year annualised volatility	Sharpe ratio	10 year annualised excess return	10 year annualised volatility	Sharpe ratio
Simple SDR basket	5.51	10.30	0.54	4.30	12.00	0.36
SDR and BRL basket	*9.45*	*11.09*	*0.85*	10.22	11.61	0.89
SDR and ZAR basket	6.89	5.93	1.16	6.48	7.68	0.84

Note:

1. The Sharpe ratio is a measure of the excess return per unit of risk in an investment asset or trading strategy. The Sharpe ratio tells us whether a portfolio's returns are due to prudent investment decisions or a result of excess risk. This measurement is very useful because, although one portfolio can earn higher returns than its peers, it is only a good investment if those higher returns do not come with too much additional risk. The greater a portfolio's Sharpe ratio, the better its risk–adjusted performance has been. In the empirical finance literature, a difference of at least 30bps between Sharpe ratios indicates statistical significance.

In US dollar terms, adding the BRL to the safe-haven asset – over a 5-year horizon – more than doubles the received return. The composite SDR and BRL return is higher (at 5.06 percent) compared to the SDR (2.22 percent) alone. This indicates that when the benchmark is expanded to include a high-yielding currency, the received return increases. In fact, it more than doubles. However, this result is not surprising. When the volatility of the joint SDR and BRL benchmark is evaluated, volatility increases to 6.67 percent compared to 4.91 percent when the SDR is undiluted. The return benefit, therefore, dominates the increase in volatility. The Sharpe ratio reflects this conclusion and is 0.76 compared to 0.45 when the SDR is the sole constituent of the benchmark. Over a 10-year horizon, the results of the risk-reward ratio improves to 1.07, again reflecting that a joint SDR and BRL basket outperforms a pure SDR benchmark in US dollar terms, even after accounting for risk. Over both investment horizons, the performance of the joint SDR and BRL benchmark is statistically significantly larger relative to the pure SDR basket.

In Botswana Pula terms, over a 5-year horizon, the risk-averse investor would have earned an excess annualised return of 9.45 percent, and experienced an annualised volatility of 11.39 percent translating into a Sharpe ratio of 0.85. In BWP terms, therefore, the investor would also have been better-off than in the case where a pure SDR benchmark was used. This result is also statistically significant. Over a 10-year investment horizon, the Sharpe ratio rises to 0.88, indicating an even better risk-adjusted performance, which is, moreover, statistically significant. Over a 10-year horizon, both return and volatility increases, although the increase in the former, offsets the gain in the latter.

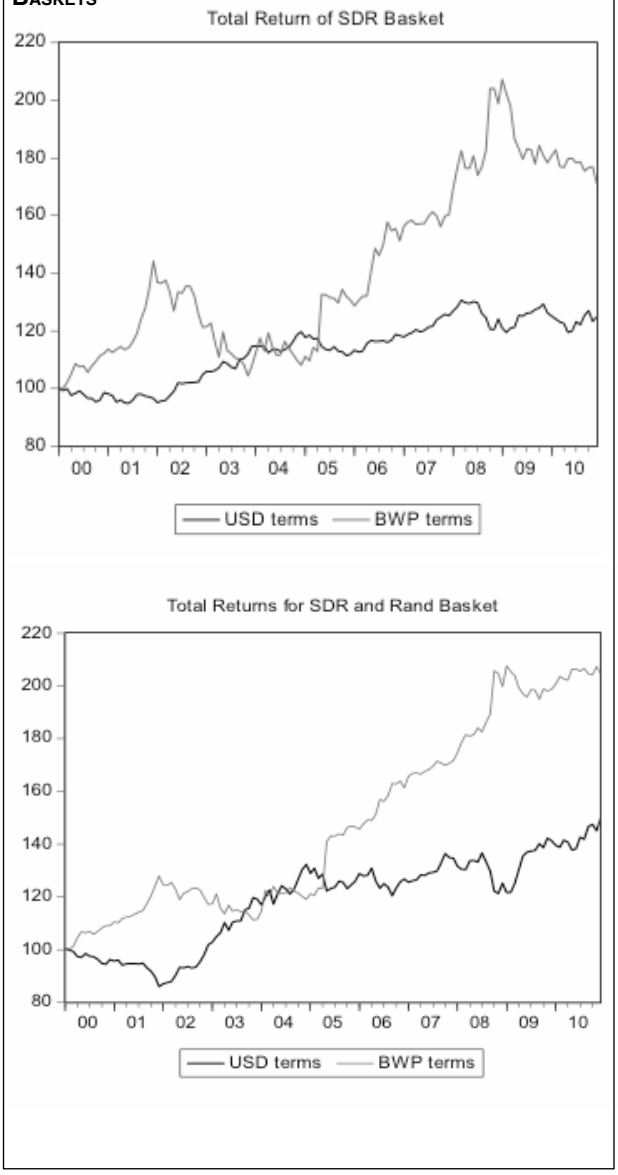
The Impact of Adding the South African Rand to a Safe-haven Benchmark

In US dollar terms, adding ZAR to the SDR basket would have enhanced returns on both the five and ten year horizons. Annualised returns are 133 basis points (bp) higher on a five year horizon and 214bp higher on a 10 year horizon. However, the additional return is almost exactly compensated for by additional portfolio volatility, so that the Sharpe ratio changes very little on both time horizons. Indeed, the differences in the Sharpe ratio are statistically insignificant.

In local currency terms (i.e., BWP), the result of adding ZAR to an SDR basket is more impressive, enhancing returns and reducing volatility. This result, however, is a function of Botswana's exchange rate policy, which has kept volatility in the Pula/rand exchange rate at very low levels compared to BWP spot against the SDR component currencies.[11] Effectively, an investor in Botswana would receive South Africa's yield without its associated volatility (since the exchange rate policy targets a stable and competitive ZAR/BWP exchange rate). Annualised returns rise 137bp on a five year horizon and lower volatility results in a doubling of the Sharpe ratio, with similar results over a 10 year horizon. The increase in the Sharpe ratio is statistically significant (relative to the

11 Stability in the bilateral rand/Pula exchange rate is a consequence of the peg to a basket of currencies comprising mainly of the rand. In addition, government's desire to foster the development of the non-traditional exports has focused on targeting a stable real effective exchange rate (Bank of Botswana, 2008).

Figure 1: Total Return Indices of Various Currency Baskets



Sharpe ratio of the simple SDR basket in pula terms) when the rand is added to a safe-haven basket. This suggests that a risk-averse investor, whose reporting currency is the BWP, could enhance risk-adjusted return through exposure to a composite rand and SDR portfolio or benchmark.

Since the South African rand is an important element of the country's exchange rate policy, Figure 1 graphically shows how the inclusion of this currency would enhance returns in a hybrid basket – i.e., a currency portfolio comprising both SDR and rand. In particular, in Pula terms, the benefits of including the rand in a hybrid basket are shown to be very salient, especially from 2005, when volatility in the ZAR/BWP exchange rate declined significantly relative to historic norms.

Conclusion

This paper satisfies two objectives. First, it examines the time series properties of foreign exchange returns for five emerging economies – Brazil, Russia, India, China and South Africa (BRICS) – in order to describe their risk and return profile. In terms of the risk and returns relationship, the data show evidence of the risk-return hypothesis (i.e., high risks imply high returns). Specifically, relative to a basket of advanced economy currencies (represented by the SDR) the foreign exchange returns of the BRICS are generally higher and more variable. However, on a risk-adjusted basis, the results – as measured by the Sharpe ratio – indicate that all the currencies of the BRICS economies outperform the SDR benchmark. In fact, risk-adjusted returns from the SDR basket are negative over the sample period – a reflection of the low yields associated with investing in these markets. Nonetheless, the SDR is shown to have other attributes, which make it attractive as an investment. In particular, the SDR is shown to counterbalance the cyclicality of the BRICS currencies. Moreover, from a portfolio construction perspective, the motivation for holding the SDR is for reducing the volatility of (portfolio) returns rather than increasing returns themselves.

Second, and in view of the seemingly complementary roles of the currencies of the BRICS and the SDR in a portfolio, an equally weighted portfolio of the SDR and BRICS currencies is constructed in order to evaluate its risk-reward ratio from the perspective of a risk-averse investor in Botswana. For convenience, the analysis focuses performance on a risk-adjusted performance of a composite Brazilian real and SDR portfolio and a combined South African rand and SDR portfolio – given the ready availability of the required data. Over a five and ten year investment horizon, the composite portfolio is shown to outperform the pure SDR basket in both US dollar terms and Botswana pula terms. These results suggest that asset managers and pension funds invested in Botswana who are invested in foreign exchange markets would have improved their risk-reward ratio by combining the SDR with either the Brazilian real and South African rand.

To end, these results show that emerging market currencies may have an important role to play in generating alpha (i.e., excess returns) in a foreign exchange portfolio. This conclusion should also help stimulate and inform investment planning on the part of domestic investors as they seek to maximise risk-adjusted returns.

References

Ang, A. and Bekaert, G., 2002, "International Asset Allocation with Regime Shifts," Review of Financial Statistics, Vol. 15, pp. 1137-1187.

Bank of Botswana, 2008, Annual Report 2007, Gaborone, Bank of Botswana.

Bank of International Settlements (BIS), 2010, "Triennial Central Bank Survey – Report on Global Foreign Exchange Market Activity in 2010," BIS (Basle, Switzerland).

Cairns, J., C. Ho, and R. McCauley, 2007, "Exchange Rate and Global Volatility: Implications for Asia-Pacific Cur-

rencies," BIS Quarterly Review (March).

Errunza, V., 2001, "Foreign Portfolio Equity Investments, Financial Liberalisation, and Economic Development," Review of International Economics, Vol. 9, pp. 703-26.

Goldman Sachs, 2007, BRICs and Beyond', Goldman Sachs Global Economics Group (New York, USA).

Markowitz, H., 1952, "Portfolio selection", Journal of Finance, 7, 77-91.

Nedbank, 2010, Nedbank Capital Treasury: Strategic Research, Nedbank, South Africa (December 10, 2010).

Schmittmann, J. M., 2010, "Currency Hedging for International Portfolios," IMF Working Paper WP/10/151 (Washington D.C.: International Monetary Fund).