REAL EXCHANGE RATE MISALIGNMENT AND SECTORAL OUTPUT IN ZIMBABWE
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Abstract
Using the feasible generalised least squares panel data techniques and data for the period 1980 – 2003 from a representative sample of Zimbabwean sectors that include agriculture, manufacturing and mining sectors, the study indicated that real exchange rate misalignment is harmful to sectoral output. The study indicated instead of undervaluation necessitating sectoral performance it however negatively affects sectoral output while real exchange rate overvaluation as expected, negatively and significantly affects sectoral output.
Key Words: Real Exchange Rate, Sectoral output, Misalignment, Overvaluation, Undervaluation

1. Introduction
Real exchange rate has not been an important variable in growth models and its significance only came following the seminal work of Barro (1994) of including macroeconomic variables in determining growth fundamentals. Real exchange rate signals the performance of the tradable and non-tradable sectors of the economy and provides significant information on the distribution of the scarce resources between the sectors so as to attain sectoral growth and economic growth at large. Movements in the real exchange rate should be in tandem with real fundamentals and if it has persistently wandered away from the long run equilibrium exchange rate, then it will be misaligned. The long run equilibrium exchange rate to which the real exchange rate should gravitate is defined as an exchange rate that is compatible with simultaneous attainment of both external and internal balance. External balance is explained as a sustainable current account position given a country’s capital position as a net lender or borrower (Razin 1997) while internal balance implies a situation where the labour and non tradable goods market clears in the current period and is expected to be in equilibrium in the future (Edwards, 1989; Montiel 1999).

Exchange rate misalignments act as indicators on how the exchange rate will have to gravitate in a freely floating exchange rate regime and how authorities need to revalue or devalue their exchange rate in countries employing the fixed exchange rate system. An exchange rate is overvalued if the prevailing exchange rate is below the long run equilibrium exchange rate while the converse holds for an exchange rate undervaluation. Exchange rate misalignment is argued to be an important determinant of economic growth. Overvaluation is presumed to hurt growth whereas the correlation between undervaluation and growth is weak.

In most cases, misalignment has been in the form of overvaluation which hurts the tradable activities, affecting growth performance adversely since productivity improvements tend to be concentrated in export or import competing industries (Dornbusch 1985). Persistent misalignment drove most developing countries and in particular Zimbabwe (through the adoption of Structural adjustment programmes) to put in place proper exchange rate management policies and practices (Munoz, 2006). Contrary to the move towards freely floating exchange rate regimes following the collapse of the Smithsonian agreement, most developing countries and in particular Sub-Saharan African countries are still having conventional fixed exchange rates (Montiel and Hinkle 1999). Sachs (1985) claims that the differences in development experiences in East Asia; Latin America and Africa may be attributed to trade regimes and exchange rate management practices whilst the World Bank (1984) asserts that the unstable and overvalued real exchange rates dwindled the volume of exports and...
these, supported by protectionist policies in Africa caused a drastic drop in agricultural output, which is the backbone of most African countries. The purpose of this study is to establish the degree of exchange rate misalignment and its associated impact on sectoral output. The novelty of the study is embedded on exposing the effects of misalignment on sectoral output.

Given that the real exchange rate and its associated misalignment are fundamental determinants of sectoral and economic output, it therefore becomes imperative to establish whether the deterioration in Zimbabwe’s sectoral performance could also have been a result of improper exchange rate management policies that could lead to misalignments.

The paper is organized as follows; section 2 provides an overview of exchange rate management and sectoral developments in the economy, section 3 discusses relevant literature. In section 4, econometric specification, variable construction and data are discussed. Section 5 reports empirical results. A summary of fundamental results is presented in section 6.

2. Exchange Rate Management in Zimbabwe

The period 1980 – 2003 saw Zimbabwe experimenting with a number of exchange rate systems to stimulate growth and stability in the economy. Prior to independence, the country adopted the fixed exchange rate regime where the Rhodesian dollar (R$) was pegged to the United States dollar (US$) at the rate of 1US$=0.6788R$ (Roussos 1988). After independence in 1980, the country continued with the fixed exchange rate regime though the referral currency changed to the South African rand (ZAR). The Z$ was then pegged to the ZAR at the rate of 1Z$=1ZAR. Further developments in the exchange rate system saw the Zimbabwean dollar being pegged to a flexible basket of currencies that includes the South African Rand, British Pound, United States Dollar among others from August 2003 – December 1993 (RBZ Quarterly Review, 1982). Between January 1994 – June 1994, a two tier exchange rate system was introduced. This includes the rate determined by the Reserve Bank and that determined by the market forces i.e. the market quoted rate. These exchange rate systems were latter unified in July 1994. The interbank market was used to determine the exchange rate for the various currencies. In 1997, the country developed a Balance of payments (BOP) deficit which coupled with high domestic inflation put immense pressure on the exchange rate. Since the exchange rate was fixed, this caused the reserve bank to intervene to defend and stabilise the value of the currency. However, this had serious negative consequences as the foreign exchange reserves were depleted to levels below three months import cover (RBZ Annual Report, 1998). Market confidence declined and speculative probable currency depreciation intensified promulgating into hoarding of foreign currency and further attack of the Zimbabwean dollar. This finally lead to a sharp depreciation of the Dollar by 31.4% from the rate of 13Z$/1US$ to 18Z$/1US$. In 1999 the exchange rate was pegged again at 1US$=38Z$ to revive the currency. This stance was taken against the background of dwindling foreign exchange reserves, escalating inflation and the declining credibility of the central bank as the monetary authorities of the country to abide with its rules.

This rate was officially changed in August 2000 when the official exchange rate was pegged at Z$50, then Z$51 and finally Z$55 per US$. In 2001 following the fiscal policy statement by the Minister of Finance, it was stated that the exchange rate was to be adjusted in line with inflation differentials (crawling peg) with Zimbabwe’s major trading partners. However, this peg was not adhered to as the exchange rate remained fixed at the...
Since the exchange rate is an important relative price in an economy, the RBZ introduced currency auctions to determine the official exchange rate in January 2004 semi-weekly. The Reserve Bank of Zimbabwe controlled these currency auctions. In the same year, the exchange rate was pegged at 1US$=824Z$, 4196Z$ (January 12), to 1US$=5730Z$ in December the same year. Movements in the nominal and real effective exchange rates are shown in Figure 1

![Figure 1: Real and Nominal Effective Exchange Rates](image)

The nominal effective exchange rate (NEER) was generally declining. It had an average of 130.9033. The NEER started 1980 with a rate of 337.8217 and closing the period in 2003 at 0.8067. On the other hand, the real effective exchange rate was moving upward, with an average of 117.4191. It had a maximum of 477.7375 in 2002 and a minimum of 45.8533 in 1992.

2.1.1 Macroeconomic Developments

Growth in the past two and half decades has been poor though a number of stabilization programmes were employed to enable economic growth in the country. In the period 1980 – 2003 growth averaged 2.32%. In 1981 the country introduced a policy document, Growth with Equity with the intention to promote growth and fairness in the economy. The impact of the initiative was mitigated by a serious drought that crippled the economy. In
1991, the Government of Zimbabwe (GoZ) introduced Economic Structural Adjustment Programmes (ESAP) with the intention of promoting growth through trade liberalization, reduction in government expenditure, eradication of distortions in the labour and tradable goods markets.

In the decade 1980-1989 real gross domestic product (GDP) averaged 2.7% per annum with inflation averaging 15% per annum. In 1980/1981, GDP grew on average by about 11% in real terms as a result of opening up of the economy to the external world which was corresponded by favourable commodity prices on the world market, a bumper agricultural harvest, and a buoyant consumer demand (Roussos 1988). The period 1982/83 was hampered by a number of constraints such as shortage of foreign currency for the importation of inputs, shortage of skilled manpower, transport bottlenecks and slow growth in exports due to world recessions (Roussos 1988). The growth rate was further restricted by the existence of drought conditions in the financial year 1981/1982. Moderate inflation, good rain season and stable international prices enhanced growth in the year 1985. The principal cause of the low growth rate in this period was the low levels of investment in the productive sectors (agriculture, manufacturing, mining etc) as it fell around 15% from levels of as high as 25%.

Figure 2: Real GDP Growth

In the ESAP period, growth averaged 1.5% per year. The programme embraced macroeconomic stabilisation, deregulation, and trade and exchange market liberalisation. Trade and exchange market liberalisation were meant to create a market based exchange rate system and to shift to the tariff system of protection. Domestic deregulation and investment promotion were to liberalise investment and deregulate prices and the agriculture market. Inclusive in the package was the monetary policy and financial sector reform, the reduction of the central government deficit from 10% of GDP to 5% of GDP by the fiscal year 1994/1995. Among the measures that were introduced during the reform comprise the unification of the official and market exchange rate thus the exchange control was the first to be deregulated.
However, growth in the reform period was hindered by a serious drought that hit the country in the fiscal year 1991/1992. High inflationary conditions coupled with an unsound exchange rate policy worsened the growth in output of export-oriented sectors causing a decline in overall economic growth. Inflationary pressure worsened in 2003 (inflation has been on an upward trend – see Fig 3 below) and this coupled with the lack of anchors, further reduced economic activity and the competitiveness of exports.

**Figure 3: Inflation trend in Zimbabwe**

![Graph showing inflation trend in Zimbabwe](image)

Following the failure of ESAP, Zimbabwe Programme for Economic and Social Transformation (ZIMPREST) was introduced in 1997 and its principal objective was to achieve a high rate of economic growth and speedy development to raise income and the standard of living. It focused much on factors that promote growth namely urgent restoration of macroeconomic stability (low inflation, interest rates, stable exchange rate with priority given to the stability of the exchange rate relative to the prevention of a misaligned currency), investing in human resource development and facilitating the public and private savings and investment needed to attain growth. This reform package was short lived as it did not attract support of international financial institutions.

In an attempt to restore economic vibrancy and harness economic downturn, the government introduced the Millennium Economic Recovery Programme (MERP) in 2000. This did not have any serious impact as it collided with the withdrawal of support for Zimbabwe by most of the international financial institutions.

The National Economic Revival Programme (NERP) was introduced in 2003. It included measures to resuscitate the economy and these include an export support exchange rate equal to Z$824 per 1US$ from the Z$55 which had been pegged since 2000. However the programme was doomed to failure, as it did not provide a clear policy framework to fight the macroeconomic imbalances particularly on fiscal reform and structural bottlenecks in the productive sector. Only the measure to boost gold and tobacco
production was implemented (African Economic Outlook 2004). More so, it failed to generate the much needed foreign currency to revive the economy.

The lack of foreign currency, the sustained overvaluation of the Zimbabwe dollar and structural distortions in major export sectors continued to whittle down exports, from 30.3% of GDP in 2000 to 9.6% in 2001(RBZ 2001)

2.2 Sectoral Performance

2.2.1 Manufacturing Sector

The manufacturing sector is the main contributor to GDP, accounting about 20% (on average) to total GDP. Manufacturing sector output declined by 12.5% in 2003 from a decline of 15% in 2002. Capacity utilisation within the sector fell to 55% from 60% in 2002 due to a shrinking domestic demand and less competitive exports. Industrial production, which relies on imports, was badly hit by the acute shortage of foreign currency.

2.2.2 Agriculture Sector

The agriculture sector is the second largest employer with about 25% of the total formal employment. It contributes about 14% of the total GDP. The sector was hard hit by the two serious droughts of 1983/1984 and 1991/1992 fiscal years. The sector was affected by the problem of foreign exchange (mainly for those who used crop chemicals which are to be imported).

2.2.3 Mining Sector

The volume of production remained unchanged in the period 1980/1989 due to stagnation in the rising cost of production necessitated by declining international commodity prices. The devaluation of the ZS (by 20%) in 1982 had negative effect on the output in that it reduced the purchasing power of the import allocation given to the mining sector by the Reserve Bank of Zimbabwe. Despite devaluation’s help in the competitiveness of the country’s mineral exports and assistance in the depletion of the accumulated stockpile as a result of the depressed demand during recession, the profitability of the sector was affected by the rapidly rising costs and the inability of the import allocation to keep pace. A decline in the mining sector was due to high levels of taxation, inadequate foreign currency for imported inputs, interest rate increase that have caused the financial costs to rise, low returns on investments and the unattractive investment code. The mining sector is heavily export oriented and contributes approximately 4% to GDP. Since the mining sector is export oriented the sector is likely to be affected by exchange rate volatility and misalignments.

The mining sector in Zimbabwe comprise of more than 40 minerals. 60% of export earners are minerals (Roussos 1988). The mining sector accounted for 14.3% of the country’s GDP in 2003. Non-metallic output fell by 40% in 2002. The mining sector was severely affected by the overvalued exchange rate and foreign currency shortages. Output of gold – the second largest hard currency earner in the mining sector production’s production fell by 14.3% in 2002 (to 15.47 tonnes from 18.05 in 2001) and fell by another 20% in 2003. Coal production also slumped by a third in the period 2001-2003(African Economic Outlook 2004).

3. Real Exchange Rate Misalignment and Sectoral Performance: A review of the literature

3.1 Real Exchange Rate Misalignment and Theoretical Framework

The measurement of exchange rate misalignment is non-consensual as it is unobservable. According to the purchasing power parity (PPP) the deviations of the real exchange rate from the parity in a determined year are defined as misalignments. Regardless of its simplicity the PPP methodology has shortfalls in that it accounts only for monetary sources of exchange rates and neglects contemporary
exchange rate fluctuations attributed to real factors. In addition to this, the measure only chooses a single equilibrium exchange rate for all periods.

Secondly, the parallel market premium can be used as a measure of exchange rate misalignment. Real exchange rate misalignment is measured as the deviation between parallel market and official exchange rates. A high-sustained premium is strongly argued to be a significant indicator of currency overvaluation, thus serving as a useful proxy. The measure is a proxy that captures with an amount of precision the degree of foreign exchange controls. It also reflects the risks of transactions associated with the parallel market (Bouton et al 1994), however Ghura and Grennes (1993) found out that the parallel market premium measure overstated the degree of misalignment in sub Saharan African countries in the seventies and eighties indicating that the black market premium is an imprecise indicator since it is sensitive to temporary shocks that may have little or no effect on the underlying fundamental real equilibrium exchange rate. Because of foreign exchange controls in Zimbabwe this measure highly captures foreign exchange controls and the risks associated with it rather than the extent of misalignment in the exchange rate.

Thirdly, there are trade equations which include single equation model. This measure has theoretical foundation in the so called dependant model developed by Salter (1959), Swan (1963)), where real exchange rate is defined as the relative price of tradables to non-tradables. The deviation of the actual real exchange rate from the equilibrium real exchange rate, determined from a theoretical perspective using real variables and neglecting monetary variables is defined as misalignment (Edwards 1987). This method involves the determination of fundamentals that affects the equilibrium real exchange rate.

The Model

The theoretical model followed in this paper is adapted from baffes et al (1997). The model assumes a small open economy that produces and consumes two goods namely the tradables and non tradables. The tradables are composed of importables and exportables. The real exchange rate is therefore theoretically defined as \( e_i = \frac{P_T}{P_N} \) where \( e_i \) is the real exchange rate, \( P_T \) and \( P_N \) are the prices of traded goods and non-traded goods respectively. \( P_T \) is assumed to be exogenous given that Zimbabwe is a small country to influence world prices.

Equilibrium exchange rate is a rate that sustains a simultaneous attainment of both internal and external balance. \( e_i \) is an internal exchange rate and it acts an important indicator of the incentive to reallocate domestic resources in a developing country like Zimbabwe where the growth of the traded goods sector relative to the non-traded goods sector is fundamental for development. Internal balance implies a situation where the labour and non-tradable goods market clears in the current period and is expected to be in equilibrium in the future (Edwards 1989, Montiel 1999). Internal balance holds when

\[
y_N(e_i) = c_N + g_N = (1 - \phi)e_c + g_N.
\]

..............................................1

that is when the supply of non-tradables under full employment conditions \( (y_N) \) is fully absorbed by private \( (c_N) \) and government \( (g_N) \) spending of non traded goods. \( \phi \) is the share of total private spending that is devoted to traded goods. External balance refers to a situation of sustainable current account position given a country’s capital position as a net lender or borrower (Razin 1997).

The current account balance is expressed as the sum of trade balance \( (\phi) \) plus net unilateral transfers \( (\nu) \) and net
investment income ($\kappa$). The trade balance is the difference between the supply of tradables ($y_T(e_T)$) and the sum of government ($g_T$) and private sector spending on tradables ($\phi c$). Net investment income is obtained by multiplying the real yield on foreign assets by total net foreign assets. The external balance therefore holds when

$$y_T(e_T) - g_T - \phi c + \nu + rf$$

The current account balance is $\zeta' = \phi + \nu + \kappa$. Combining equations 1 and 2 and assuming external balance in the long run, the real exchange rate that ensures equilibrium in the non tradable and external sectors simultaneously can be expressed as follows

$$e^*_t = f(g_N, g_T, \nu + rf)$$

Since Zimbabwe faces a serious binding credit ceiling then the trade balance becomes exogenous and equation 3 takes the following form

$$e^*_t = f(g_N, g_T, \varphi)$$

The final form of the equilibrium real exchange rate is determined after accounting for the effects of the country’s external terms of trade and trade policies. Since Zimbabwe is a small country, the foreign prices of exportables ($P^*_x$) and importables ($P^*_m$) are exogenously determined. The corresponding domestic prices are

$$P_x = E(1-t_x)P^*_x$$
$$P_m = E(1+t_m)P^*_m$$

Where $t_x$ and $t_m$ are exports and imports tax rates respectively. $E$ is the nominal exchange rate. The domestic price of exports and imports is given by:

$$\frac{P_x}{P_m} = \left(\frac{1-t_x}{1+t_m}\right) \frac{P^*_x}{P^*_m} = \theta \cdot \frac{\varphi}{\eta}$$

where

$$\theta = \frac{P^*_x}{P^*_m}, \eta = \frac{1+t_m}{1-t_x}$$

Changes in the external TOT and trade policy ($\eta$) variables will affect the RER for exports and imports. The equilibrium RER can therefore be ($e^*_t$) can be written as a function of the external TOT and trade policy variables in addition to the variables included in equation 4

$$e^*_t = f(g_N, g_T, \varphi, \eta, \theta)$$

Among the significant determinants of real exchange rate is technological progress. The model developed by Baffes et al (1997) can be expanded by introducing the technological progress variable ($\theta$) in the production function of the tradables and non tradable goods. The final function of the equilibrium exchange rate takes the following form

$$e^*_t = f(g_N, g_T, \varphi, \theta)$$

Since data on exports and import tax rates ($t_x, t_m$) in developing countries is unreliable, the trade policy variable ($\eta$) is proxied by the ratio of the sum of the real values of exports and imports to the value gross domestic product which Grobar (1993) defined as openness emanating from trade liberalization. Trade liberalization leads to real exchange rate depreciation.

Trade balance ($\varphi$) is proxied by capital flows and this defined as the ratio of the difference between the real values of exports and imports to real value of GDP. Capital inflows increase domestic spending leading to a real appreciation of the domestic currency.

Due to data unavailability government consumption on tradable and non tradable goods, government consumption is used in place of the two. A rise in government spending will appreciate the real exchange rate.

3.2 Real exchange Misalignment and Sectoral Performance

Exchange rate misalignment captures the impact of monetary and exchange rate policies that lead to an
inefficient allocation of resources between exporting and importing sectors (Dollar 2002). It affects sectoral growth through a number of channels. An overvalued currency causes a loss in export competitiveness of export producing (and import-competing) sectors within an economy. The moment the currency becomes overvalued, sell of goods in foreign markets becomes difficult (Dornbusch 1988, Collins and Razin 1997). If the exporting firms within the economy have a market power, that is, they can determine and set the price for their products, the effects of the overvalued currency will be mitigated. The situation will be detrimental to the exporting firm if it is small enough to influence world prices.

In competitive markets with homogeneous and standardised products, a sustained overvalued currency leads to a reduction of profit margins and financial health of the firms. With respect to the industrial sector, overvaluation is detrimental in the sense that the forward and backward linkages that other sectors like agriculture have will transfer the impact to other sectors through a spill over mechanism. Because of an overvalued currency firms will find it cheaper to forgo domestic inputs, from import competing firms in favour of inputs from foreign firms (Dornbusch 1988). This will fuel a bad trade balance and hurts the market in which import competing firms exist.

The services sector, which includes finance, insurance, real estate and communication, is also affected with overvaluation with services that depend on the tourism industry likely to affect most. If a local currency is overvalued the tourism may be hardly hit as visitors will opt for substitutes. The overvalued currency will tend to make the country an undesirable destination causing many service sectors to lose out. Generally the goods markets are hampered severely by real exchange rate overvaluation with both the exporting and the import competing firms losing out in terms of profits.

Overvaluation can affect both domestic and foreign investment in the sectors of the economy (Collins and Razin 1997). Since investment decisions are based on price signals then if the exchange rate is not aligned to economic fundamentals, there will be an inefficient allocation of resources (Nabli and Varoudakis 2002, Demac and Shabsigh 1999). Economic agents (chartists and fundamentalists) will respond to misalignment in the exchange rate by forming expectations from price uncertainties and this tends to affect investment (Kemme and Teng 2000). The capital accumulation process is strongly affected by this misalignment. This fall in investment necessitates a drop in future production and this has effects of fall in future employment too. These are termed the productive capacity costs associated with overvaluation (Williamson 1985).

The problem of unemployment emanating from an overvalued currency has secondary effects in the rest of the economy (Dornbusch 1988). Loss of jobs are transferred to less money within the economy and this necessitates a fall in demand corresponded by a further fall in the production and further unemployment through the multiplier effect. This will even create problems for the central government. If the misalignment is so pronounced and protracted, then firms or even industries may cease operations (Williamson 1985, Cavallo et al 1990). Foreign firms will relocate to some other countries. Productive capacity of both capital and labour will have been dealt a devastating blow and it may take a lengthy time for a country in such a situation to attract resources back into the economy (Dornbusch 1988). Such an impact will cripple the economy of its long run growth prospects.

Few studies were conducted to establish the relationship between real exchange rate misalignment and sectoral
growth. Pick and Vollrath (1994), Sekkat and Varoudakis (1998) conducted cross country studies on the effect of real exchange rate misalignment and agricultural exports and manufacturing trade respectively. Real exchange rate was found to be detrimental to both agricultural and manufacturing trade.

Cho et al (2003) used four sectors of the economy including manufacturing, machinery, chemicals and the agricultural sector. Using the fixed effects model he found out that exchange rate misalignment was much more harmful to the agricultural sector in comparison to the other sectors. Non linear effects of real exchange rate misalignment were not explored in all the presented studies. However, all the studies find that sectoral performance was inversely related to real exchange rate misalignment.

4 Equilibrium Real Exchange Rate and Exchange rate Misalignment

To determine RER misalignment, estimation of the equilibrium RER equation is critical. Equilibrium real exchange rate is estimated from equation 5 in the representative equation of the form:
\[
\text{log}e^* = \beta F^P
\]

Where \(\text{log} e^*\) is the log of the equilibrium real exchange rate, \(\beta\) is a vector of estimated coefficients from equation (6) and \(F^P\) is the logarithm of the sustained values of the real exchange rate fundamental determinants. The definition of misalignment followed as in Baffes (1997) is the one suggested by Edwards (1988) which is given as follows:

\[(e_t - e^*_t)\]

Where \(e_t\) = observed value of the exchange rate and \(e^*_t\) is the equilibrium exchange rate. If \((e_t - e^*_t) < 0\) then the currency is overvaluation; conversely, \((e_t - e^*_t) > 0\) the currency is undervalued.

Time series techniques are used. Data are from the World Development Indicators, Central Statistics office in Zimbabwe, RBZ, Penn World Tables 6.2 and IFS and covers the period 1980 - 2003.

5.0 Exchange Rate Misalignment and Sectoral Performance

Real exchange rate affects sectoral output through its effects on sectoral prices. This happens through the sector’s degree of tradability. It is the tradable component in the sectoral output that is of much significance.

The exchange rate links macroeconomic policies and exogenous events to sector and firm level outcomes; they link financial developments to output and employment. The study will be conducted following the empirical work of Bryan et al (2006) by regressing output in industry (i) in year (t) on real exchange rate misalignment and controls. Controls, like in the previous empirical work include the log of industry employment, log of industrial investment. This study further includes industry inflation and misalignment to ascertain the role they play in influencing sectoral output. The regression equation is as follows:

\[
\text{log} y_{it} = \beta_0 + \beta_1 \text{log} k_{it} + \beta_2 \text{Mis}_{it} + \beta_3 \text{log} n_{it} + \beta_4 \text{log} \pi_{it} + \mu_{it}
\]

\(y_{it}\), is output for industry (i) in period (t), \(k_{it}\), is industry investment; \(\text{Mis}_{it}\), represent exchange rate misalignment; \(n_{it}\), is employment; \(\pi_{it}\), denotes price indices in different sectors (implied deflators), \(\mu_{it}\), is the error term, (the error term is specified as \(\mu_{it} = V_t + e^*_{it}\)), \(V_t\), denotes sector and \(t\), signifies the time period.

5.1 Misalignment and sectoral Output

The results from the sectoral output regression models are presented in the Table 1:
Table 1: Impact of Misalignment on Sectoral Output

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>log k</td>
<td>0.106**</td>
<td>0.141**</td>
<td>0.043***</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>*</td>
<td>(0.018)</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.057)</td>
<td></td>
</tr>
<tr>
<td>log n</td>
<td>0.952**</td>
<td>0.506*</td>
<td>1.746***</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>(0.275)</td>
<td>(0.113)</td>
</tr>
<tr>
<td></td>
<td>(0.135)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>log π</td>
<td>0.073**</td>
<td>0.078**</td>
<td>0.017***</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>*</td>
<td>(0.004)</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.013)</td>
<td></td>
</tr>
<tr>
<td>Mis</td>
<td>-0.136*</td>
<td>0.758**</td>
<td>-0.269***</td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>*</td>
<td>(0.047)</td>
</tr>
<tr>
<td></td>
<td>(0.210)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sap</td>
<td>0.184**</td>
<td>0.217**</td>
<td>0.053***</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>*</td>
<td>(0.014)</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.074)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.267</td>
<td>4.111</td>
<td>1.548</td>
</tr>
</tbody>
</table>

Sectoral Effects yes yes yes
Time Effects no no no
Wald (Chi2) 2527 862.74

Notes: Levels of significance are denoted by ***: 99%, **: 95%, *: 90%. Figures in parentheses are standard errors.

In Table 1, column 1 considers a baseline regression model where the real exchange misalignment was included in its total form without disaggregating undervaluation from overvaluation. The results indicate that capital, labour, inflation, structural adjustment programmes and real exchange rate misalignment are significant determinants of sectoral output. Sectoral output is enhanced by capital, labour, structural adjustment programmes. Output is hampered by high levels of inflation and the presence of misalignment. Regarding misalignment, there exist a negative and significant relationship between sectoral output and RER misalignment. This implies that an increase in the level of misalignment would cause output to fall. This means that policy makers should be wary about the existence of misalignment in the real exchange rate as this hampers the performance of the sectors. The regression models 1 and 2 were conducted using the feasible generalised least squares (FGLS) technique due to the prevalence of heteroskedasticity in the variables (as detected by the Breusch – Pagan test) and correlation among the sectors. Baltagi (2001) asserts that in the presence of heteroskedasticity, the use of ordinary least squares techniques which assumes homoskedasticity will lead to consistent but not efficient estimates. This led to the adoption of the Feasible Generalised Least Squares Techniques. Furthermore, diagnostic checks (see appendix 2) on the correlation among the sectors indicated that the sectors are highly correlated and this necessitated the uses of the FGLS technique that at the same time captures the contemporaneous cross correlation existing among the panel.

5.2 Non Linear Effects of RER Misalignments

To observe the non linear effects on RER misalignments we sought to establish whether overvaluations hinder sectoral output while at the same time we seek to answer the question, do RER undervaluations promotes sectoral performance. In order to test these hypotheses we decomposed data into two different sub – samples, one with undervaluation and the other with overvaluation. The baseline regression model was modified by including overvaluation and undervaluation instead of RER misalignment. Regression 2 is modelled when real exchange rate misalignment is in the form of an overvaluation. In this model capital, labour, inflation, structural adjustment programmes and overvaluation are all significant variables in the explanation of changes in sectoral output. All the variables perform as expected. Capital and
labour positively contributes to sectoral output while inflation and overvaluation have profound negative effects on sectoral output.

Regression 3 is run with real exchange rate misalignment in the form of an undervaluation. Results indicate that capital, labour, inflation, structural adjustment programmes and undervaluation are fundamental variables in explaining sectoral output. Undervaluation has a serious negative impact on sectoral growth. The effect that undervaluation posits is that it dampens sectoral performance. Interesting is that the effect of misalignment in either form is found to be deleterious for sectoral output. The less the capital per worker than the long run per worker capital in a sector, the higher will be the level of sectoral output. Generally, an increase in capital brings out an increased output on the assumption that diminishing returns do not set in and a higher savings rate is likely to increase the steady state level of output per worker thereby stimulating an increased growth in the output of the sector. Capital in all the regression models is positive as expected, indicating that capital positively contributed to sectoral output.

Employment, which is used to capture labour, is statistically significant as expected. An increase in employment on the assumption of the low labour to capital ratio is argued to increase output. Generally from the classical theory of production an increase in employment promotes growth and the results from this model substantiate the assertion. A high level of employment increases demand due to an increase in money in the economy. This increase in demand will cause an increase in output thus leading to a growth in the sector.

An implied deflator captures the lack of price stability in the sector. The higher the price instability, the lower the profitability and growth of the sector. Generally, price stability attracts a high level of investment. If the prices are not stable investment is reduced. Therefore price instability has an indirect impact also that goes via investment. If inflation is unpredictable then investment deteriorates. Inflation as measured by the implicit deflators is highly significant in all cases of misalignment. The rate of inflation is quite high and this conforms to the findings of Barro (1996) that if inflation is above 40% growth is likely to be retarded. Inflation in Zimbabwe has hovered above the 40% mark in the period studied.

Turning to the variable of interest, real exchange rate misalignment has negative signs in all the three regression models and this is in tandem with a lot of empirical work that has been conducted thus far. This denotes that, in general misalignment impacts negatively on sectoral output regardless of the form of misalignment prevailing. The results confirm and substantiate the theoretical viewpoint that real exchange rate misalignment is harmful to the growth of sectors and the economy at large. These results support what other empirical works concluded, for instance, Ghura and Grennes (1993), Cottani et al (1990), Calderon and Aguire (2005), Dubas (2005) who found out a negative relationship between growth and real exchange rate misalignment, and Vollrath (1990) and Vouradikis and Sekkat (1998) who found out that misalignment compromised growth prospects of the agricultural sector and manufacturing sector respectively. The coefficient of misalignment in regression 2 is quite high and significant, and has a serious economic meaning on the performance of the sectors. If real exchange rate overvaluation increases by a 10% margin, sectoral output will decrease by 7.58%.

6.0 Summary
The paper explored the determinants of long run equilibrium real exchange rate and it is found out that for the case of Zimbabwe fiscal policy, trade policy, monetary policy, technological progress
and capital flows are fundamental in the determination of long run equilibrium exchange rate. The real exchange rate has been observed to be misaligned over the largest part of the study. Following the discovery that the real exchange rate was found to be misaligned its effects on sectoral output was explored and the study indicated that fiscal policy (captured through inflation and misalignment as the country operated a fixed exchange rate regime), labour and capital are fundamental variables in the explanation of sectoral output. To observe if there existed non-linear effects of misalignment, misalignment was categorised into undervaluation and overvaluation. However in the study there are no non-linear effects of undervaluation and overvaluation as both forms of misalignment are found to hurt growth. This is in line with previous studies. It is therefore recommended that real exchange rate should always be kept in line with what the fundamentals determinants of real exchange rate posits. Any misalignment in the exchange rate has negative effects on sectoral output.

References:

African Economic Outlook (2004)-Zimbabwe

Agarwala (1983) –Price distortions and growth in developing countries, World Bank Staff working papers, no575, Washington, DC, World Bank


Central Bank of Chile


Collins S and Razin .O (1997) - Real exchange rate misalignments and growth, NBER working paper series WP 6174
Jones and Kigel (1994) - Africa’s quest for prosperity, Has adjustment helped? Finance and Development
Pick and Vollrath (1994) - Real exchange rate misalignment and agricultural exports performance in developing countries, Economic Development and Cultural Change
Sachs J and Warner A (1997) - Sources of slow growth in African economies, Journal of African economies, 6 (3); 335-76
Sachs J.D (1985) - External debt and Macroeconomic performance in Latin America and East Asia, Brookings
Papers on Economic Activity 1, 523-64.
Toulaboe, D., (2000) - Real Exchange Rate Misalignment and Economic Growth in Developing Countries, Southwestern Economic Review

Wheeler D (1984) - Sources of stagnation in sub Saharan Africa. World Development (12); 1-23

Appendix 1- Real Exchange Rate Misalignment Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.036819</td>
<td>0.038797</td>
<td>0.949020</td>
<td>0.3577</td>
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<tr>
<td>DKFLOW</td>
<td>0.028164</td>
<td>0.007737</td>
<td>3.639998</td>
<td>0.0024</td>
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<td>DTECHPRO</td>
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<td>0.002020</td>
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<tr>
<td>DLNEXCRED</td>
<td>1.096802</td>
<td>0.290236</td>
<td>3.779000</td>
<td>0.0018</td>
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<tr>
<td>DLNTOT</td>
<td>0.332550</td>
<td>0.728163</td>
<td>0.456697</td>
<td>0.6544</td>
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<tr>
<td>DLNGOVCON</td>
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<td>0.242117</td>
<td>1.571314</td>
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<tr>
<td>DLNOPEN</td>
<td>-0.617711</td>
<td>0.113282</td>
<td>-5.452841</td>
<td>0.0001</td>
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<tr>
<td>RESID01 (-1)</td>
<td>-0.741864</td>
<td>0.283911</td>
<td>-2.613020</td>
<td>0.0196</td>
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<tr>
<td>R-squared</td>
<td>0.787182</td>
<td>Mean dependent var</td>
<td>0.094222</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.687867</td>
<td>S.D. dependent var</td>
<td>0.299498</td>
<td></td>
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<tr>
<td>S.E. of regression</td>
<td>0.167326</td>
<td>Akaike info criterion</td>
<td>- 0.469537</td>
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<tr>
<td>Sum squared resid</td>
<td>0.419970</td>
<td>Schwarz criterion</td>
<td>- 0.074583</td>
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<tr>
<td>Log likelihood</td>
<td>13.39968</td>
<td>F-statistic</td>
<td>7.926117</td>
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<tr>
<td>Durbin-Watson stat</td>
<td>1.692324</td>
<td>Prob(F-statistic)</td>
<td>0.000423</td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX 2: DIAGNOSTIC CHECKS

Regression Equation 1

Ramsey RESET test using powers of the fitted values of log $y_n$
Ho: model has no omitted variables
F(3, 56) = 0.83
Prob > F = 0.4819
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of $\log y_{it}$
chi2(1) = 4.71
Prob > chi2 = 0.0300

Regression Equation 2
Ramsey RESET test using powers of the fitted values of $\log y_{it}$
Ho: model has no omitted variables
F(3, 56) = 0.58
Prob > F = 0.6347

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of $\log y_{it}$
chi2(1) = 6.83
Prob > chi2 = 0.0090.

Regression Equation 3
Ramsey RESET test using powers of the fitted values of $\log y_{it}$
Ho: model has no omitted variables
F(3, 56) = 0.28
Prob > F = 0.8371

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of $\log y_{it}$
chi2(1) = 6.06
Prob > chi2 = 0.0011