# The Role of Financial Development in Natural Resource Abundant Economies: Does the Nature of the Resource Matter?

***Malebogo Bakwena[3] and Phillip Bodman[4]***

**Abstract**

*The paper evaluates the role played by financial development in oil vis-à-vis non-oil (mining) economies using a panel data set for the period 1984-2003. A novel two-step, variance corrected system Generalized Method of Moments (GMM) estimator proposed by Windmeijer (2005) is applied to a dynamic panel of 44 developing economies. The data reveals that financial development plays a crucial role in influencing the efficiency of investment, thus economic performance of these economies. However, the potency of financial institutions is highly dependent on whether the economy is an oil or non-oil (mining) producer.*

***Keywords:*** world economic growth, dynamic panel

***JEL classification*:** Q32, O11, O13, O16, C32, C33

## 1.0 Introduction

There is consensus in the resource curse literature that in order for resource endowments to be sustainable as well as have a positive effect on economic growth, they need to be saved or invested rather than consumed (Auty, 2007; Humphreys, Sachs, & Stiglitz, 2007; Torvik, 2007). The view makes sense because the former action may lead to capital accumulation. However, the usefulness of the accumulated capital on generating positive economic growth is a function of its quality rather than quantity. To ensure the former, there needs to be an instrument that ensures more capital productivity. Indeed, the finance-growth literature has established that a well functioning financial system will, among other things, not only encourage the accumulation of capital but also improve its productivity.

There is evidence (e.g. Isham et al., 2005; Manzano & Rigobon, 2007) to suggest that the effects of resource abundance on economic growth differ according to whether the resource is a point resource, e.g. oil and minerals that are mined from a narrower geographic base, or a diffuse resource e.g livestock or agricultural yield from small family farms. The former category of natural resource endowments tends to weaken institutions, thus economic performance, more than the latter (Isham et al., 2005; Manzano & Rigobon, 2007). It is against this background that the current literature (e.g. Boschini et al., 2007; Lederman & Maloney, 2008) has made a more concerted effort to distinguish between the kind(s) of the resource(s) a country is endowed with.

Although a vast amount of both theoretical and empirical literature has established a positive link between financial development and economic growth, accounting for the peculiar characteristics of natural resource economies in determining these links has not been studied thoroughly yet.[2] The question of whether natural resource abundance has an indirect effect on investment and economic growth through the financial channel needs to be further explored, particularly for developing economies. Thus the paper attempts to shed additional light on this hypothesised indirect link by examining the role of financial development in stimulating investment, and in turn economic growth, of oil vis-à-vis non-oil economies.

[3] Corresponding author thokweng@mopipi.ub.bw Tel. +267 3552151. Fax +267 3972936.

[4] M. Bakwena, Department of Economics, University of Botswana and P. Bodman, School of Economics, University of Queensland, Brisbane, QLD.

[2] There is contemporary literature (e.g. Mehlum et al., 2006; Boschini et al., 2007) that argues that the negative effect of natural resource abundance and economic growth (the so-called resource curse) disappears for economies with good political and social institutions. Consequently, instead of concentrating on the conditionality of the resource curse on political and social institutions, the current paper considers the advantages of financial ones. Besides, the earlier literature concentrates on cross-country data while currently, panel data is explored.

Previous studies have established a link between the degree of financial development and natural resource abundance (Nili & Rastad, 2007; Gylfason & Zoega, 2001). Regrettably, the cross sectional data that Gylfason and Zoega (2001) use does not take into consideration endogeneity, heterogeneity and omitted variables bias that is prevalent in growth models. To attempt to overcome this problem and further evaluate the reasons for differing economic performance between oil and non oil economies, Nili and Rastad (2007) applied a *first differenced* GMM estimator to annual data.[3] However, by using annual data Nili and Rastad (2007) are regrettably not appreciating that the output series is highly persistent. To avoid contamination of the results by cyclical dynamics, the majority of growth studies (e.g. Beck & Levine, 2004; Bond, Hoeffler, & Temple, 2001; Levine, Loayza, & Beck, 2000) use time periods based on (for example) five-year averages. Secondly, the *first differenced* GMM approach used has been documented to suffer from potentially biased estimates in small samples. In addition, by focusing on first differences the approach does away with cross-country relations.

Given such questions over the validity of the results from these studies, the current paper uses a variant of the *system* GMM estimator which has been suggested to offer gains in efficiency and consistency. Also, whilst Nili and Rastad (2007) use a sample group of all developing economies, irrespective of whether they are natural resource abundant economies or not, the current paper only uses natural resource abundant economies.[4] More broadly, the paper makes a contribution to the growth literature in general by using a panel technique that eases the statistical deficiencies associated with previous growth studies. Also a new data set intended to capture the peculiarity of resource economies is used to re-examine the role of financial development on economic growth. Specifically, the paper examines the role of the relationship between financial development and investment on growth in oil vis-à-vis non-oil resource abundant economies (i) averaging data over four years, instead of using annual data, so as to curb business cycle effects (ii) controlling for other growth determinants other than financial development (iii) using a newly modified two step *system* GMM estimator proposed by Windmeijer (2005) that is intended to address the downward bias in standard errors prevalent in Arrelano and Bover (1995)'s original two-step *system* GMM estimator (iv) controlling for omitted variables, simultaneity biases and the small sample biases associated with the habitual use of lagged dependent variables common in growth regressions.

## 2.0 Data

### 2.1 Indicators[5]

All indicators are from the World Development Indicators (WDI) database, unless it is stated otherwise**.**

**Financial indicators**

Although several indicators could be used to 'gauge' financial development, one may be more important than the other, depending on the role of financial system that is captured (Denizer, Iyigun, & Owen, 2002). For natural resource abundant economies, we need financial institutions to be able to promote the flow of credit to private investors. Accordingly, the flow of credit to the private sector (PRIVY) is a key variable (thus its use for analysis). The dominant roles of government in acquiring investment as well as the limited role of the private sector have been

[3] GMM is unique because even in the presence of measurement error and endogenous right hand variables it gives consistent estimates. Thus the choice of GMM is intended to deal not only with possible endogeneity, small sample time series and large cross sectional dimension (typical of most macroeconomic data) and simultaneity bias, but also with omitted variables problem common in growth modeling.

[4] The current paper's focus on natural resource abundant economies only is intended to capture the peculiar characteristic possessed by economies with abundant natural resources.

[5] Following from Beck and Levine (2004) and Levine et al. (2000), all the indicators underwent natural logarithmic transformation because it is possible that the relationship between economic growth and a range of economic indicators is nonlinear.

attributed to low quality of financial institutions and hence low investment and growth in such economies (Nili & Rastad, 2007). Moreover, in accordance with the natural resource and growth literature, the control of mineral revenues by governments has brought problems of how efficiently to allocate the revenues for development (Auty, 1993). The other financial indicator, M2/GDP (used as a proxy for financial depth) is used for comparison due to its popularity in the literature. Each of the indicators is outlined below.

The traditionally used measure of financial activity is the measure of financial depth (M2/GDP). There is a theoretical literature that argues a positive relationship exists between financial depth and economic growth. McKinnon (1973)'s model predicts that the positive relationship between these two variables is a result of the relationship between money and capital. The assumption made in this case is that a prerequisite for investment is the accumulation of saving in the form of bank deposits. Likewise, Shaw (1973)'s model predicts that financial intermediation encourages investment thus economic growth through debt intermediation. For both models, a positive interest rate acts as a catalyst through which increased volume of saving boosts financial depth, in turn, the increased volume as well as productivity of capital encourages growth. The current endogenous growth models also posit a positive relationship between financial depth and economic growth (King & Levine, 1993a).

Domestic credit to the private sector provides a better measure of financial activity because it accurately characterizes the actual amount of funds routed to the private sector. Hence, it is more related to investment and growth. Financial interaction with the private sector implies that more (than the public sector) credit is made available for more productive ventures. Therefore, the more credit is made available to the private sector, the higher the level of financial activity.[6]

The limitations associated with financial intermediary indicators goes to show how inadequate they are as measures of how well financial intermediaries carry out their functions of pooling risk, mobilizing saving, etc. There are other different indicators that have been suggested in the literature, such as the share of financial sector to GDP (Graff, 2003; Neusser & Kugler, 1998). This indicator is intended to cover a wide variety of financial activities and as such, it does not underestimate financial depth. Instead of concentrating on the channels of finance, it concentrates on the 'intensity of financial services,' by looking at the amount of resources dedicated to manage the financial institutions, which in turn would lower transaction costs (Graff, 2003, p. 51). The limited availability of data on the alternative indicators of financial depth leads the paper to stick to the 'traditional' measures.

### Indicator for economic growth

The paper follows the convention in the literature by using real per capita GDP as an indicator of growth ($Y$).

### Control Variables

The set of explanatory variables, $X_{it,}$ include the logarithm of inflation (GDP deflator), government size, trade and an index for the rule of law. The coefficient of the index of rule of law is intended to provide an estimate of the impacts of political as well as the legal framework on economic growth. The sign of the coefficient is expected to be positive since better-quality political and legal framework is expected to enhance economic growth (Barro, 1997; Barro & Sala-i-Martin, 1995). Government size is measured by the share of government consumption in GDP. Countries with relatively higher government expenditure are more likely to experience lower economic growth. This outcome makes sense because higher government spending

[6] Graff (2003) begs to differ in the accuracy of this measure by arguing that the domestic credit to the private sector offered by commercial banks creates 'conceptual difficulties' because it lumps together useful credit and non-performing loans.

requires more tax revenue, which leads to less efficient resource allocation. This indicator is particularly important in natural resource abundant economies because of the prominence of the fiscal linkage. The linkage has enabled the mining sector in developing countries to contribute a large share in terms of taxes and foreign exchange, which tends to be mismanaged. For instance, Auty (2001) described Saudi Arabia's government as having taken a 'paternalistic stance' in distributing oil rents and this made it difficult for them to adjust in cases of reduced oil revenue. Many of the welfare commitments, e.g. free of charge government services, were difficult to adjust. However, productive spending (such as spending on infrastructure and human capital) encourage growth.

The economies at hand tend to be quite open; they mainly import capital and export their resources. To capture this aspect, an indicator referred to as TRADE is used. Openness will possibly facilitate economic growth by broadening domestic firms' markets and by allowing them to acquire inputs at world prices (Shan, 2005). Thus the sign for the coefficient of this variable is expected to be positive. There is a tendency for resource-abundant countries to be high price economies (for instance, Sachs & Warner, 2001), so in order to capture this aspect, inflation is included (and also because of its impact on monetary aggregates (Shan, Morris, & Sun, 2001)). The coefficient of this variable is generally (e.g. Bekaert, Harvey, & Lundblad, 2001; Barro, 1997) expected to be negative. However, this relationship has been documented as being inconsistent (e.g. Levine & Zervos, 1993) and empirically, the harmfulness of inflation on economic growth '…is not overwhelming' (Barro, 1997, p. 90).

A summary of the description of the variables is given in Table 1.

**Table 1: Description of variables and their sources**

| Variable Name | Description | Definition | Source |
|---|---|---|---|
| **CREDIT** | Domestic credit provided by the banking sector (% GDP) | Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions are savings and mortgage loan institutions and building and loan associations. | World Development Indicators(WDI) database |
| **PRIVY** | Domestic credit to the private sector (% GDP) | Domestic credit to private sector refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises. | WDI database |
| **RULE OF LAW** | index of the rule of law | An index that ranges between 1 and 6. It is used here as a proxy for the | International Country Risk Guide (ICRG) dataset |

| | | | |
|---|---|---|---|
| | | quality of institutions. The higher the index, the better the quality of the institutions. | |
| **OIL** | Dummy variable | Oil = 0 mining economy (non-oil)<br>1 oil | Own coding |
| **INVEST** | Gross Fixed capital formation (% GDP) | Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. | WDI database |
| **GOVT** | Government size | Government expenditure as a share of GDP | WDI database |
| **DEPTH** | Money and quasi money as % of GDP | Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition of money supply is frequently called M2; it corresponds to lines 34 and 35 in the International Monetary Fund's (IMF) International Financial Statistics (IFS). | WDI database |
| **OPENNES S TO TRADE** | Trade (% GDP) | Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. | WDI database |
| **INFLATIO N** | Inflation, GDP deflator (annual %) | Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. | WDI database |
| **OUTPUT** | GDP per capita (constant 2000 US$) | Gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without | WDI database |

| | |
|---|---|
| | making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant U.S. dollars. |

## 2.2 Sample

In order to provide a comparative analysis, a group of non-oil mining economies is used as a benchmark.[7] Unlike growth models that incorporate natural resources in growth models in a general way, by simply lumping mining (metals and minerals) and oil (and gas) economies together for analysis, the current paper differentiates between oil and non-oil resource abundant economies. The division is interesting for several reasons: (i) mining and oil production may have 'a different footprint in terms of their environmental, social, and economic effects' in an economy (Weber-Fahr (2002)) (ii) even though oil economies are high investment economies, they typically tend to have a lower quality of investment, which might be an indication of low financial activity, hence generally poor economic performance (Nili & Rastad, 2007). Therefore, it is highly likely that the quality of investment varies according the type of resource extracted.

The sample comprises forty-four developing economies (listed in the appendix). Annual data are obtained for the period between 1984 and 2003. The period is chosen purely on the basis of the availability of a comprehensive set of data for the economies under study.[8] Two financial indicators are used in the paper, namely; domestic credit to the private sector (Privy) and for comparison, the commonly used measure of financial depth, M2/GDP.

## 3.0 Stylized facts

**Table 2 :Financial indicators for non-oil countries 1984-2003**

| Variable | Mean (%) | S.D. (%) | Minimum (%) | Maximum (%) | Observations |
|---|---|---|---|---|---|
| CREDIT | 67.15 | 106.28 | -172.74 | 640.04 | 658 |
| PRIVY | 48.25 | 82.79 | 0.00 | 607.17 | 658 |
| DEPTH | 52.25 | 59.32 | 0.82 | 390.38 | 659 |

Source: Author's calculations based on data from World Development Indicators database. All financial indicators are measured as a % of GDP.

Tables 2 and 3 present weighted averages of each of the financial indicators constructed using the share of each country's GDP per capita on the group's total GDP per capita. The weighted averages are used so as to reflect the relative importance of each country to the group's GDP. For all the financial indicators used here, non-oil mining economies tend to outperform oil economies in terms of the development of their financial systems. The finance-growth literature asserts that financial development indicators predict subsequent growth, capital accumulation and improves the efficiency of capital accumulation (Levine, 1997; King & Levine, 1993a). If this is true, then relative to underdeveloped financial institutions, mature financial institutions would have a positive contribution to efficient use of resources. Therefore, a non-oil economy would have relatively high growth coupled with high quality investments.

[7] The definition of mining is adopted from Weber-Fahr (2002). Mining includes metals and minerals but excludes oil and gas. Furthermore, mining activities encompass underground, open-pit mining, large and small scale operations as well as artisan miners.

[8] Given that most of the variables used here are derived from the WDI database, the sample adopted could be extended to include more recent years. Notwithstanding, the paper doesn't extend the sample because of the need to control for the effects of political and legal framework on economic growth. The measure of political and legal framework is published by ICGR and the authors only have access for the period considered.

**Table 3 : Financial indicators for oil countries 1984-2003**

| Variable | Mean (%) | S.D. (%) | Minimum (%) | Maximum (%) | Observations |
|---|---|---|---|---|---|
| CREDIT | 40.95 | 48.13 | -11.85 | 203.22 | 220 |
| PRIVY | 41.81 | 50.52 | 0.43 | 203.65 | 220 |
| DEPTH | 46.08 | 57.94 | 0.70 | 234.88 | 220 |

Source: Author's calculations based on data from World Development Indicators database. All financial indicators are measured as a % of GDP.

## 4.0 Methodology

The work of Levine (1997) has provided a sound theoretical approach to underpin most studies, identifying capital accumulation and technological innovation channels from finance to growth. Figure 1 in the appendix summarises this theoretical approach. The finance-growth literature identifies the role of financial institutions on economic performance by determining whether the institutions are able to carry out their functions. Similarly, mainstream growth literature has incorporated finance into growth theory. For instance, Romer (1986) and Lucas Jr. (1988) exploit the capital accumulation channel to argue that the functions carried out by the financial system will, through their influence on the rate of capital formation, affect the steady-state growth rate.

The financial system affects capital formation by either "reallocating savings among different capital producing technologies" or by changing the savings rate (Levine, 1997, p. 691).[9] However, the direction of change in the saving rate is ambiguous in the sense that financial development is capable of altering the saving rate, both positively and negatively.[10] The development of a financial system equips households (savers) with better insurance against "endowment shocks" and a better way of diversifying the rate of return risk; while simultaneously making consumer credit more cheaply and readily available. A well-developed financial system is also capable of narrowing the wedge between the interest received by savers/lenders (households) and that paid by borrowers (firms) (Pagano, 1993).

With the theory outlined above in mind, a dynamic framework is used to measure the change in growth rates of GDP per capita over time to changes in the variables of interest. To start, the following panel regression (using income *levels)* is used:[11]

$$y_{i,t} = \alpha\, y_{i,t-1} + \beta' x_{it} + \eta_i + \varepsilon_{i,t} \qquad /\alpha/ < 1;\; i = 1,2,...,N;\; t = 1,2,...,T \tag{1}$$

Where: $y$ is real GDP per capita, $x$ is a set of explanatory variables, $\eta_i$ is an unobserved country-specific effect, $\varepsilon_{i,t}$ is the error term and subscripts $i$ and $t$ are the country and time effects, respectively. Data is averaged over non-overlapping four year periods (i.e. 1984-1987; 1988-1991; 1992-1995; 1996-1999; 2000-2003) so that there are 5 periods per country. Therefore, subscript t represents one of the 5 periods.

[9] The accumulation of saving is particularly important when dealing with mineral economies because it (a) provides a "cushion" to aid adjustment through downswings and (b) delays the rate at which the windfall is absorbed by encouraging investment in financial, physical or human capital (Gelb & Associates, 1988; Humphreys et al., 2007).

[10] Circumstances under which financial development affects saving rates negatively is outlined in Pagano (1993). For instance, households' limited accessibility to credit market may reduce the saving rate by encouraging dissaving, thus economic growth.

[11] Usually a growth framework is chosen over a levels framework in order to capture the conditional convergence effect (through the log of initial income) which is often found in empirical growth models. The economic intuition behind this is the steady state distribution of income levels. If economies are not in their steady states, the transitional dynamics of the Neo-classical model are captured by the inclusion of the 'initial' income level in a growth regression.

Numerous econometric problems are likely to arise from estimating equation (1): (i) Country characteristics that are time invariant (or fixed effects) such as geography may be correlated with the explanatory variables; (ii) explanatory variables such as investment and financial development are potentially endogenous. Since financial development may cause growth and vice-versa, these regressors are highly likely to be correlated with the error term; (iii) autocorrelation arises because of the presence of a lagged dependent variable ( $y_{it-1}$); (iv) the panel data set consists of a larger country dimension (N=44) and a short time dimension (T=5).

To solve problem (i) (i.e. get rid of country-specific effect) a *first difference* dynamic panel estimator developed by Arellano and Bond (1991) and Holtz-Eakin et al. (1988) is the conventional method used in growth studies (Nili & Rastad, 2007; Caselli et al., 1996). Thus equation (1) becomes

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (2)$$

By taking the first differences, a new problem arises, the lagged explained variable, $y_{it-1} - y_{it-2}$ is correlated with the lagged error term, $\varepsilon_{i,t} - \varepsilon_{i,t-1}$. To deal with this problem (i.e. problem (iii)), an instrumental variables estimator is used; which is also meant to tackle, among other things, the likely endogeneity of explanatory variables (i.e. problem (ii)). Finally the Arellano and Bond (1991) estimators are designed for dynamic panel models with a large N and small T (i.e. they are intended to tackle problem (iv)).

Assuming that the error term, $\varepsilon$ , is not serially correlated and that the explanatory variables are weakly exogenous, then the following Arellano and Bond (1991) moment conditions are applied

$$E[y_{i,t-s}(\Delta\varepsilon_{i,t})] = 0 \text{ for } t \geq 2;\ s \geq 2 \quad (4)$$

$$E[X_{i,t-s}(\Delta\varepsilon_{i,t})] = 0 \text{ for } t \geq 2;\ s \geq 2 \quad (5)$$

The *first differenced* GMM estimator is based on these moment conditions. However, the *first differenced* estimator is surrounded by both statistical and theoretical problems. Theoretically, we are concerned with determining the cross-country link between financial development and economic growth, which the *difference* estimator removes. From the statistical point of view, Blundell and Bond (1998) demonstrate that lagged levels of persistent explanatory variables are weak instruments for the differenced regression equation. Monte Carlo simulations (e.g. Hayakawa, 2007; Blundell & Bond, 1998) show that the weakness of instruments in the context of *first differenced* GMM estimations may lead to biased and imprecise for small samples (T=5 or 6).

Consequently, a *system* GMM estimator is used to moderate the potential biases and inaccuracies associated with the *first differenced* estimator. The estimator mixes in a *system*, the regression in levels with the regression in differences (Blundell & Bond, 1998; Arellano & Bover, 1995). The instruments for the latter regression are the same as those in equations (4) and (5) while the former regression uses lagged differences of the corresponding variables as instruments. In addition to the assumptions made under the *first differenced* estimation, it is assumed that country specific effects and explanatory variables are not correlated. Accordingly, the following moment conditions are used for the regression in levels:

$$E[Y_{i,t-s}(\eta_i + \varepsilon_{i,t})] = 0 \quad (6)$$

$$E[X_{i,t-s}(\eta_i + \varepsilon_{i,t})] = 0 \quad (7)$$

Therefore, to improve upon the *first differenced* estimator we employ moment conditions given in (4) – (7) to produce efficient and consistent parameter estimates. The validity of the extra moment conditions (6) and (7) (thus the consistency of the *system* GMM estimator) can be determined using a standard Sargan test of over-identifying restrictions or the difference-in-Sargan proposed by Arellano and Bond (1991). Moreover, we need to examine whether the error terms exhibit second order serial correlation or not. The *system* estimator is only consistent if the no second order serial correlation assumption is not violated.[12]

For the *first differenced* GMM estimator, the one-step and the two-step GMM estimators are asymptotically equivalent. If not, the two-step estimator is more efficient, and is always so for the *system* estimator. Disappointingly, Monte Carlo studies have revealed that the efficiency gain is usually small and that the drawback with the two-step GMM estimator is that it converges to its asymptotic distribution comparatively slowly. Moreover, the asymptotic standard errors related to the two-step *system* GMM estimators can be seriously biased downwards for finite samples, hence give unreliable direction for inference. The one-step *system* estimator is not affected by this problem. The difference is mainly due to the matrix used to weight the moment conditions. For the one-step estimator, the weight matrix is independent of the model parameters, while the two-step estimator uses a consistent estimate of the moment conditions' covariance matrix (constructed using the residuals from the first step) to weigh them. An initial consistent estimate of the model parameters is used to find the weight matrix.

For the two-step *system* GMM estimators, Windmeijer (2005) discovered that there is a vast difference among the estimated asymptotic variance and the finite sample. He estimated this difference, thus leading to 'finite sample corrected estimates of the sample' Windmeijer (2005, p. 26). Subsequently, he conducted a Monte Carlo study that demonstrated that the correction leads to more accurate inference by competently estimating the finite sample variance of the two-step *system* GMM estimator.

The paper uses STATA's 'xtabond2' command that calculates a finite-sample correction of the two-step *system* estimator. The 'corrected' two-step *system* GMM will be used in this paper because of its efficiency, while the relatively less efficient one-step *system* GMM estimators will be reported for comparison.

As mentioned earlier, the issue that often arises when applying GMM to small samples is the use of too many instruments (e.g. Roodman, 2007; Beck & Levine, 2004), so the idea here is to contain the instrument set. Roodman (2007) classified the problems of not containing the instrument set into two: (i) the classical problem concerns instrumenting estimators in general. Too many instruments will lead to the problem of 'over fitting of endogenous variables' falling short of eradicating their endogenous component. (ii) The modern problem concerns the use of sample moments to estimate an optimal weighting matrix for the (over) identifying moments between the error terms and the instruments. Taken together, these problems may deceive researchers into believing that their results are valid (due to weakened specification tests), while in actual fact they are invalid. Therefore, the paper attempts to solve the problem by using Roodman (2007)'s method of 'collapsing' the instrument set and by including one additional control variable at a time as in Beck and Levine (2004).[13] The former procedure combines instruments by way of adding them into smaller sets. Therefore, instead of using the standard difference moment conditions in (4) and (5) we impose the following conditions:

$$E[y_{i,t-s}\Delta\varepsilon_{it}] = 0 \text{ for every } s \geq 2 \tag{8}$$

[12] Since the test is applied to differenced error terms, the error term will most likely exhibit first order serial correlation even if the original error term does not. This is anticipated since $\Delta\varepsilon_{i,t} = \varepsilon_{i,t} - \varepsilon_{i,t-1}$ and $\Delta\varepsilon_{i,t-1} = \varepsilon_{i,t-1} - \varepsilon_{i,t-2}$ both have $\varepsilon_{i,t-1}$ thus the second order serial correlation in first difference is important in uncovering serial correlation in levels.

[13] The other commonly used method of containing the instrument set is limiting the lag length to the second lag. The shortcoming of these alternative methods is that unlike the one used here, which potentially preserves more information; they tend to lose some information.

$$E[x_{i,t-s}\Delta\varepsilon_{it}]=0 \text{ for every } s\geq 2 \quad (9)$$

The 'collapsed' instrument set contains one instrument for every lag distance and instrumenting variable (second lag of y, third lag of y, and so on), and zeros for missing values. Specifically, the paper attempts to determine the relationship between financial development and investment and their role in influencing economic performance. To achieve this, a growth regression model similar to Nili and Rastad (2007) is used. The dependent variable is the logarithm of real per capita GDP. The right hand variables include two interaction terms; firstly, the interaction between log of investment and that of financial development indicator to capture the relationship between financial development and investment; secondly, the interaction between the logs of investment, financial development indicator and an oil dummy to capture the potential differences between oil and non-oil economies, as well as a set of variables that act as conditioning variables. Specifically they include ones typically used in finance-growth equations (e.g. Shan, 2005); they include the logarithms of government size, inflation rate, openness to trade, and rule of law.

The first interaction effect serves an important role in that a well developed financial institution has been documented to be linked to the efficiency of investment, thus economic growth. The second interaction effect is intended to account for the differing levels of investment and financial development between oil and non-oil economies. Oil economies are expected to have higher levels of investment financed directly through oil revenues rather than efficiently through financial institutions.

The growth equation for country *i* at period *t* used can be summarized as:

$$Y_{it}=\beta_0+\beta_1(I_{it}\times F_{it})+\beta_2(I_{it}\times F_{it}\times \text{oil}_i)+\beta_3\,\text{control variables}_{it}+\alpha Y_{it-1}+\varepsilon_{it} \quad (10)$$

Equation (10) suggests that the level of financial development influences investment, hence economic growth. The more developed financial institutions are, the better the quality of investment and the more effective the latter on economic growth.

$$\frac{\partial Y}{\partial F}=\beta_1 I_{it}+\beta_2 I_{it}\times \text{oil}$$
$$=(\beta_1+\beta_2\times \text{oil})\,I_{it} \quad (11)$$

The magnitude of $\beta_1$ indicates the significance of investment on economic growth, since it is expected that higher financial development be related to higher capital accumulation, hence economic growth, this coefficient is expected to be positive. $\beta_2$ captures the difference in the effect of financial development on investment between oil and non-oil economies, it is expected to carry a negative sign since oil economies are expected to have less efficient financial institutions than the control group.

## 5.0 Results

Tables 4 and 5 show the results for a two-step variance corrected *system* GMM estimator and a one-step *system* GMM estimator, respectively. In all the regressions the lagged dependent variable is significant, implying that indeed a dynamic model is justified for the analysis at hand. The coefficient of $\beta_1$ shows that financial development is capable of effectively transforming capital accumulation into economic growth. Furthermore, $\beta_2$ indicates that the effect is lower in oil economies. For instance, regression 1 in table 4 reveals that the impact of a one percent increase in financial development-induced investment leads to a 0.029-0.031=-0.2% decrease in growth of oil economies. While the same change leads to a 0.029=2.9% increase in economic growth of non-oil economies.

**Table 4 :Two-step variance corrected *system* GMM estimator (PRIVY)**

| Regressors | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Constant | -0.200 | -0.980 | -0.251 | -1.813 | -0.892 |
| | (0.47) | (0.55) | (0.43) | (0.09)*** | (0.40) |
| Log (per capita GDP) $_{t-1}$ | 1.010 | 1.260 | 1.006 | 1.061 | 1.095 |
| | (0.00)* | (0.00)* | (0.00)* | (0.00)* | (0.00)* |
| Privy × invest | 0.029 | 0.084 | 0.018 | 0.023 | 0.051 |
| | (0.00)* | (0.01)* | (0.02)** | (0.34) | (0.09)*** |
| Privy × invest × oil | -0.031 | -0.084 | -0.014 | -0.042 | -0.039 |
| | (0.06)*** | (0.10)*** | (0.06)*** | (0.07)*** | (0.20) |
| Government size [a] | | | | 0.508 | |
| | | | | (0.13) | |
| Openness to trade [a] | | -0.348 | | | |
| | | (0.21) | | | |
| Rule of law [a] | | | | | -0.158 |
| | | | | | (0.40) |
| Inflation [b] | | | 0.077 | | |
| | | | (0.033)** | | |
| Hansen test of joint validity of instruments (p-value) [c] | 0.478 | 0.854 | 0.783 | 0.272 | 0.501 |
| Serial correlation test (p-value) [d] | 0.370 | 0.445 | 0.253 | 0.214 | 0.483 |
| F-test for joint significance (p-value) | (0.00)* | (0.00)* | (0.00)* | (0.00)* | (0.00)* |
| Countries | 44 | 44 | 44 | 44 | 42 |
| Observations | 176 | 176 | 172 | 176 | 168 |

*,**,*** indicate statistical significant at the 1%. 5% and 10% respectively. P-values are in parenthesis. The variables used in the interaction term were first converted to logs. All the regression estimation includes time dummies for the different periods (not reported). [a] Variable is included as log(variable). [b] Variable is included as log(1+ variable) to dampen the effects of outliers (Bekaert et al., 2001). [c] The null hypothesis is that there is no correlation between the instruments used and the residuals. [d] The null hypothesis is that the errors of the first-difference regression do not exhibit second order serial correlation.

**Table 5: One-step *system* GMM estimator (PRIVY)**

| Regressors | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Constant | -0.233 | -1.201 | -0.356 | -1.852 | -0.246 |
| | (0.42) | (0.33) | (0.39) | (0.09)* | (0.78) |
| Log (per capita GDP) $_{t-1}$ | 1.015 | 1.332 | 1.005 | 1.053 | 1.080 |
| | (0.00)* | (0.00)* | (0.00)* | (0.00)* | (0.00)* |
| Privy × invest | 0.031 | 0.065 | 0.023 | 0.019 | 0.022 |
| | (0.02)** | (0.08)*** | (0.02)** | (0.33) | (0.61) |
| Privy × invest × oil | -0.032 | -0.132 | -0.019 | -0.038 | -0.089 |
| | (0.22) | (0.10)*** | (0.12) | (0.07)*** | (0.19) |
| Government size [a] | | | | 0.551 | |
| | | | | (0.14) | |
| Openness to trade [a] | | -0.330 | | | |
| | | (0.37) | | | |
| Rule of law [a] | | | | | -0.185 |
| | | | | | (0.25) |
| Inflation [b] | | | 0.114 | | |
| | | | (0.26) | | |
| Hansen test of joint validity of instruments (p-value) [c] | 0.478 | 0.854 | 0.783 | 0.272 | 0.501 |
| Serial correlation test (p-value) [d] | 0.454 | 0.435 | 0.388 | 0.294 | 0.503 |
| F-test for joint significance | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| (p-value) | (0.00)* | (0.00)* | (0.00)* | (0.00)* | (0.00)* |
| Countries | 44 | 44 | 44 | 44 | 44 |
| Observations | 176 | 176 | 172 | 176 | 172 |

*,**,*** indicate statistical significant at the 1%, 5% and 10% respectively. P-values are in parenthesis. The variables used in the interaction term were first converted to logs. All the regression estimation includes time dummies for the different periods (not reported). [a] Variable is included as log(variable). [b] Variable is included as log(1+ variable) to dampen the effects of outliers (Bekaert et al., 2001). [c] The null hypothesis is that there is no correlation between the instruments used and the residuals. [d] The null hypothesis is that the errors of the first-difference regression do not exhibit second order serial correlation.

In both instances, the results show stronger evidence that through their link with investment; financial institutions have a statistically and economically positive impact on economic growth, this outcome is consistent with studies such as Beck and Levine (2004); Levine et al. (2000).[14] Secondly, there is strong evidence (especially on the basis of corrected *system* GMM) to support our assertion that the effectiveness of financial development on investment might be lower for oil economies. This outcome is a plausible explanation as to why these economies have lower economic growth in spite of their relatively higher investment levels, suggesting that the high investment is associated with higher oil revenues rather than high financial development.

The results are consistent with Nili and Rastad (2007) as well as Gylfason and Zoega (2001)'s theory that the quality rather than quantity of investment is important. The results are not due to possible biases from over fitting, simultaneity, country-specific effects nor omitted variables. Furthermore, the specification tests lead us not to reject the null of no second order serial correlation in the differenced error term and all the instruments used are adequate.

The regressions were also repeated for the commonly used financial indicator that measures financial depth.[15] Regardless of the variant of *system* GMM used, relative to the other financial indicator, regressions involving domestic credit to the private sector produce sharper results (i.e. results in table 4 and 5). The results imply that domestic credit plays a more important role than financial depth—a result consistent with theories that emphasize the important role of financial development in economic growth through its effect on capital accumulation. The results are not unexpected since domestic credit to the private sector provides a better measure of financial activity by accurately characterizing the actual amount of funds routed into the private sector. Hence it is more related to investment and growth. In spite of differences in the results, overall, financial development cannot be dismissed as being irrelevant or even harmful to economic growth via its link to investment.[16] Still, the corrected *system* GMM estimator gives sharper results than the other estimator.

Inferences are based on the *system* two-step variance corrected GMM and the one-step *system* GMM are given for comparison (as mentioned before, the latter is the most commonly used estimator for inferences). The estimator chosen for making inferences in this paper is documented to give more accurate inference in finite samples by competently estimating the finite sample variance of the two step *system* GMM estimator. Our results support this assertion. The chosen estimator gives sharper results than the one-step *system* GMM results. The one-step *system* results in table 5 are consistent with Beck and Levine (2004) in that they give a more 'cautious assessment' of the role of financial development in economic growth. Furthermore, the value of the corrected standard errors lies between those of the system one-step and the two-step *system* GMM estimators.[17]

---

[14] As a sensitivity test, the equations 1 to 5 of table 5 were re-estimated without the interaction between domestic credit to the private sector, investment and the oil dummy. The estimation of the 'new' equations did not change the conclusions concerning the interaction between investment and domestic credit to the private sector.

[15] The results are available upon request

[16] The two equations where this interaction term is insignificant, is only so at the 11% level of significant.

[17] The standard errors for the corrected estimator are higher than those of the one-step *system* GMM estimator but lower than those of the two-step *system* GMM estimator. The system two-step estimators were calculated and irrespective of

## 6.0 Conclusion

The paper examines the role played by financial development on economic performance of oil vis-à-vis non-oil economies. Two econometric approaches were used. The first is an alternative two-step variance corrected *system* GMM estimator proposed by Windmeijer (2005) that gives more accurate inference in finite samples. The second estimator is the relatively less efficient one-step *system* GMM that is commonly used for making inferences, and is intended only for comparison purposes.

For both estimators, the results support the commonly held theory that financial development will, through its effect on capital accumulation, influence economic performance. Additionally, there is some evidence to support the assertion that the potency of financial development on investment is lower for oil economies. This outcome offers an explanation for their lower economic growth in spite of (apparently) relatively higher investment, suggesting that the high levels of investment are of lower quality ('lower spillover') aimed at generating higher oil revenues. The policy implication is that for natural resource endowments to work for such economies, investment on its own is not enough unless it is accompanied by a well developed financial system that channels the returns from resource abundance into highly productive, long-run drivers of economic growth.

## References

Arellano, M. and S. Bond, 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies, Vol. 5 (8): 277-297.

Arellano, M. and O. Bover,1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics, Vol. 68 (1): 29-51.

Auty, R. M. 1993. Sustaining development in mineral economies: The resource curse thesis. London: Routledge.

Auty, R. M. 2001. The political state and the management of mineral rents in capital-surplus economies: Botswana and Saudi Arabia. Resources Policy, Vol. *27*: 77-86.

Auty, R. M. 2007. Natural resources, capital accumulation and the resource curse. Ecological Economics, Vol. 61(4): 627-34.

Barro, R. J. 1997. Determinants of economic growth: A cross-country empirical study Cambridge, Massachusetts: The MIT Press.

Barro, R. J. and X. Sala-i-Martin, 1995. Economic growth. New York: McGraw Hill.

Beck, T. and R. Levine, 2004. Stock markets, banks, and growth: Panel evidence. Journal of Banking and Finance, Vol. 28(3): 423-442.

Bekaert, G., C. R. Harvey, and C. Lundblad, 2001. Emerging equity markets and economic development. Journal of Development Economics, Vol. 66(2): 465-504.

Bencivenga, V. R. and B. D. Smith, 1991. Financial intermediation and endogenous growth. Review of Economic Studies, Vol. 58: 195-209.

Benhabib, J. and M. M. Spiegel, 2000. The role of financial development in growth and investment. Journal of Economic Growth, Vol. 5: 341-360.

Blundell, R. and S. Bond, 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, Vol. 87(1): 115-143.

Bond, S., A. Hoeffler and J. Temple, 2001. GMM estimation of empirical growth models. CEPR Discussion Paper (no. 3048).

Boschini, A. D., J. Pettersson and J. Roine, 2007. Resource curse or not: A question of appropriability. Scandinavian Journal of Economics, Vol. 109(3): 593-617.

Caselli, F., G. Esquivel and F. Lefort, 1996. Reopening the convergence debate: A new look at cross-country growth empirics. Journal of Economic Growth, Vol. 1: 363-389.

the financial indicator or the regression specification used, the explanatory variables are significant. The two-step *system* GMM estimator results are available upon request.

Denizer, C. A., M. F. Iyigun and A. Owen, 2002. Finance and macroeconomic volatility. Contributions to Macroeconomics, Vol. 2(1): 1-30.
Graff, M. 2003. Financial development and economic growth in corporatist and liberal market economies. Emerging Markets Finance and Trade, Vol. 39(2): 47-69.
Greenwood, J. and B. Jovanovich, 1990. Financial development, growth, and the distribution of income. The Journal of Political Economy, Vol. 98(5): 1076-1107.
Gylfason, T. and G. Zoega, 2001. Natural resources and economic growth: The role of investment. Retrieved August 2006, from http://www.ems.bbk.ac.uk/faculty/Zoega/pdf/Natinvest31.pdf
Hayakawa, K. 2007. Small sample bias properties of the system GMM estimator in dynamic panel data models. Economics Letters, Vol. 95(1): 32-38.
Hoeffler, A. 2001. Openness, investment and growth. Journal of African Economies, Vol. 10(4): 470-497.
Holtz-Eakin, D., W. Newey and H. S. Rosen, (1988). Estimating vector autoregressions with panel data. Econometrica, Vol. 56(6): 1371-1395.
Humphreys, M., J. D. Sachs and J. E. Stiglitz (Eds.), 2007. Escaping the resource curse. New York: Columbia University Press.
Isham, J., M. Woolcock, L. Pritchett and G. Busby, 2005. The varieties of resource experience: Natural resource export structures and the political economy of economic growth. World Bank Economic Review, Vol. 19(2): 141-74.
King, R. G. and R. Levine, 1993a. Finance and growth: Schumpeter might be right. The Quarterly Journal of Economics (August): 717-737.
King, R. G. and R. Levine, 1993b. Finance, entrepreneurship, and growth. Journal of Monetary Economics, Vol. 32: 513-542.
Lederman, D. and W. F. Maloney, 2008. In search of the missing resource curse. The World Bank, Policy Research Working Paper (no. WPS4766).
Levine, R. 1997. Financial development and economic growth: Views and agenda. Journal of Economic Literature, Vol. 35(2): 688-726.
Levine, R., N. Loayza and T. Beck, 2000. Financial intermediation and growth: Causality and causes. Journal of Monetary Economics, Vol. 46: 31-77.
Levine, R. and S. Zervos, 1993. Looking at the facts: What we know about policy and growth from cross-country analysis. World Bank Working Paper, WPS 1115.
Levine, R. and S.Zervos, 1998. Stock markets, banks and economic growth. American Economic Review, Vol. 88(3): 537-558.
Lucas Jr., R. (1988). On the mechanics of economic development. Journal of Monetary Economics, Vol. 22: 3-42.
Manzano, O. and R. Rigobon, 2007. Resource curse or debt overhang? In D. Lederman and W. Maloney (Eds.), Natural resources, neither curse nor destiny (pp. 41-70). Washington, D.C.: Palo Alto, CA: Stanford Economics and Finance, an imprint of Stanford University Press.
McKinnon, R. I. 1973. Money and capital in economic development. Washington, D.C.: The Brookings Institution.
Neusser, K. and M. Kugler, 1998. Manufacturing growth and financial development : Evidence from OECD countries. The Review of Economics and Statistics, Vol. 80(4): 638-646.
Nili, M. and M. Rastad, 2007. Addressing the growth failure of the oil economies: The role of financial development. The Quarterly Journal of Economics and Finance, Vol. 46: 726-740.
Pagano, M. 1993. Financial markets and growth: An overview. European Economic Review, Vol. 37: 613-622.
Romer, P. 1986. Increasing returns and long-run growth. Journal of Political Economy, Vol. 94(5): 1002-1037.
Roodman, D. 2007. A short note on the theme of too many instruments (pp. 1-32): Center for Global Development.
Sachs, J. D., and A. M. Warner, 2001. Natural resources and economic development: The curse of natural resources. European Economic Review, Vol. 45: 827-838.

Saint-Paul, G. 1992. Technological choice, financial markets and economic development. European Economic Review, Vol. 36: 763-781.
Schumpeter, J. A. 1911. The theory of economic development: An inquiry into profits, capital, credit, interest and the business cycle (R. Opie, Trans. Vol. XLVI). Cambridge, Massachusetts: Harvard University Press.
Shan, J. 2005. Does financial development 'lead' economic growth? A vector auto-regression appraisal. Applied Economics, Vol. 37: 1353-1367.
Shan, J., A. G.Morris and F. Sun, 2001. Financial development and economic growth: An egg-and-chicken? Review of International Economics, Vol. 9(3): 443-454.
Shaw, E. S. 1973. Financial deepening in economic development. New York: Oxford University Press.
Torvik, R. 2007. Why do some resource abundant countries succeed while others do not? Paper presented at the Oxcarre Launch conference, Oxford, England.
Weber-Fahr, M. 2002. Treasure or trouble? Mining in developing countries: World Bank and International Financial Corporation
Windmeijer, F. 2005. A finite sample correction for the variance of linear efficient two-step GMM estimators. Journal of Econometrics, Vol. 126(1): 25-51.

## Appendix

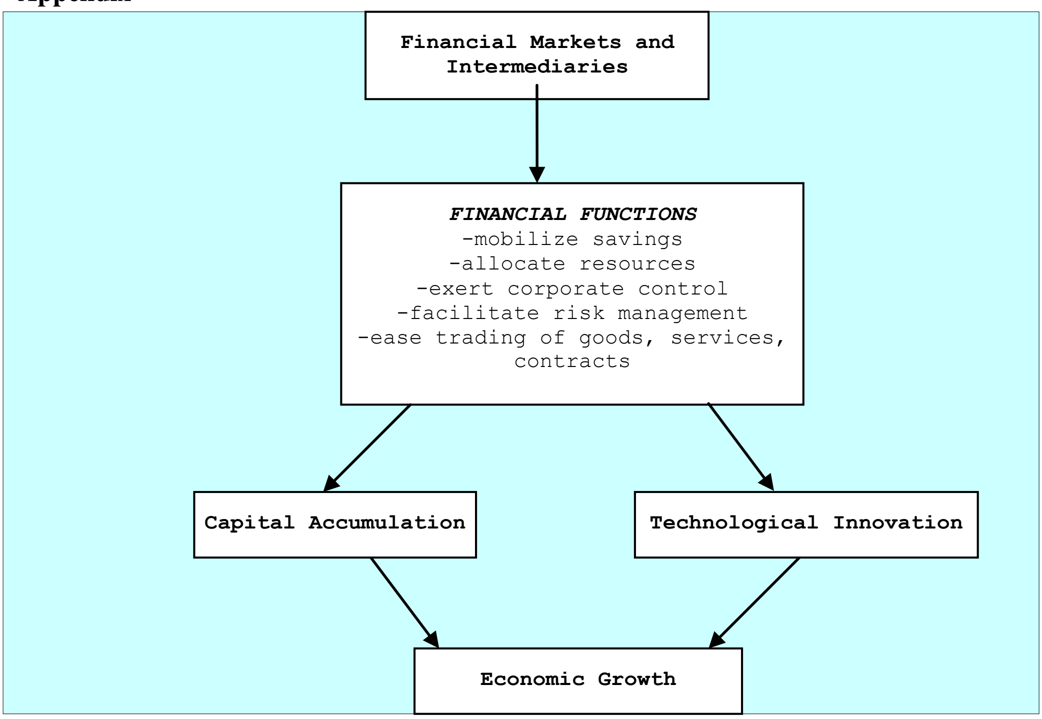


Figure 1 **A Theoretical Approach to Finance and Growth**
Source: Levine (1997)

**Table A1: List of oil countries**

| | | | |
|---|---|---|---|
| Algeria | Iran | Saudi Arabia | |
| Congo, Rep. | Nigeria | Trinidad & Tobago | Venezuela |
| Gabon Iran | Oman | United Arab Emirates | |

The countries are a subset (excludes Brunei & Kuwait due to data limitations) of those used by Nili & Rastad (2007)

**Table A2: List of non-oil countries**

| | | | |
|---|---|---|---|
| Bahrain | Dominican Rep. | Jordan | Senegal |
| Bolivia | Ecuador | Madagascar | Sierra Leone |
| Botswana | Egypt | Malaysia | South Africa |
| Brazil Gabon | Mali | Suriname | |
| Burkina Faso | Ghana | Mauritania | Togo |
| Cameroon | Guyana | Mexico | Tunisia |
| Central African. | India | Morocco | Zambia |
| Chile Indonesia | Niger | Zimbabwe | |
| China Jamaica | Peru | | |

The list is heavily drawn from Weber-Fahr (2002)‘s list of mining economies for the period 1990-99. The countries excluded here are those that did not have all the data needed in the analysis