



# IMF Working Paper

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Institutional Factors and Financial Sector  
Development: Evidence from  
Sub-Saharan Africa

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**IMF Working Paper**

Monetary and Capital Markets Department

**Institutional Factors and Financial Sector Development: Evidence from  
Sub-Saharan Africa**

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**Abstract**

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The paper assesses the effects of certain institutional factors on financial sector development in Sub-Saharan Africa (SSA). Data Envelopment Analysis (DEA) is applied to determine the extent to which these institutions affect the financial sector, and to suggest which institutions play a more critical role in each country. Results suggest that institutional factors affect financial depth and access to financial services more than asset quality and profitability (measured by nonperforming loans (NPL) and return on equity (ROE)). The results also suggest that depth of credit information has the strongest influence on the NPL ratio, and political stability affects access the most. Based on model findings, policy implications on prioritizing institutional reforms to enhance financial sector development are suggested for individual countries and for country groups.

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## I. INTRODUCTION

This paper analyzes the impact of institutional factors on financial sector development in Sub-Saharan Africa (SSA). Financial sectors in the majority of SSA countries operate within weak institutional environments and are among the least developed in the world. Of the 27 SSA countries in the Global Competitiveness Index of the World Economic Forum, 24 score below 4, placing them among the worst 55 countries. According to the Heritage Foundation Index of Economic Freedom 38 of the 44 SSA countries are considered either “mostly unfree” or “repressed.” At the same time, many SSA countries are undertaking various institutional reforms, crucial for financial sector development. While significant progress has been made, it is important for these countries not only to carry out necessary reforms, but also to set priorities for developing institutions that contribute more to the deepening of their financial sectors. The paper analyzes the impact of four main institutional factors—corruption, political stability, contract enforcement and availability of reliable information—on indicators of financial sector development—financial depth, access to financial services, operational quality, and profitability of the sector—using Data Envelopment Analysis (DEA) methodology, a non-parametric empirical tool, that applies an input-output approach.

The importance of institutions in financial development has been widely discussed in the literature. Many researchers—e.g., Acemoglu, Johnson, and Robinson 2004, Djankov, McLiesh and Shleifer 2007, La Porta, Lopez-de-Silanes, Shleifer, and Vishny 1998, Rajan and Zingales 1998, 2003, Roe and Siegel 2008—have employed empirical techniques to show the link between financial development and certain institutional factors. A new step in this direction would be to quantify the contribution of institutional factors in financial development. It would also be very useful to measure this for each individual country as the effects are unlikely to be universal for all countries.

To study the interaction between institutional factors and financial development, the paper employs the Data Envelopment Analysis (DEA), which allows taking into account the rapid change and unpredictability in the region, reflecting mainly to structural changes and political instability. The paper applies the DEA technique to yield the impacts of institutional factors on the financial sectors in individual cases. Based on the outcomes of the model, the paper presents preliminary general conclusions.

Due to poor data quality in SSA countries, the paper uses various sources of information (Beck, et al 2000 (revised 2009), Doing Business 2008, Finance for All? 2007, Governance Matters 2009, national authorities and IMF staff estimates) to compile a consistent dataset. The analysis is based on information as of 2007, as most of the required indicators were not available for 2008. Due to the limitation on data availability, only 37 of 44 SSA countries have been included in the study.

The paper is structured as follows. Section II, provides a brief review of theoretical and empirical studies on the importance of institutions for financial development. It identifies the

main institutional factors that limit development of financial markets and underscores the importance of addressing these in SSA. It also discusses some studies in this area undertaken for different regions. Section III, tests empirically the impact of institutions on financial sector development in SSA. It introduces the applied modeling technique of operational research, discusses the selection of factors, and performs the tests.<sup>2</sup> Section IV, presents the results, draws some policy implications, and offers directions for future research.

## II. INSTITUTIONS AND FINANCIAL SECTOR DEVELOPMENT

A growing volume of theoretical and empirical work shows that the development of institutions and financial markets are vital to economic growth (Levine 2003, Levine et al. 2000). The relationship between financial development and economic growth is a long-debated issue among economists. Building on works by Bagehot (1873), Schumpeter (1912), Gurley and Shaw (1955), Goldsmith (1969), and McKinnon (1973), recent research (Demetriades and Andrianova 2004, Levine 2003, and Beck 2006) has employed cross-country, panel, industry-level, firm-level, and case-study analyses to demonstrate that financial development promotes long-term economic growth. Some studies go as far as to suggest that developed financial markets are essential for long-term growth (Beck, *et al* 2000, and Acemoglu, *et al* 2004). Hence, a developed and sound financial sector results not only in the availability of financial services, but also contributes to growth. Gelbard and Pereira Leite (1999) empirically demonstrated that there is a strong positive relationship between financial depth and growth in SSA.

Financial sector and economic development are of particular importance for SSA countries. Collier (2006) argues that Africa currently faces its best opportunity for growth since mid-1970s. He also claims that Africa is the most natural resource abundant region after the Middle East. But at the same time there are only two SSA countries (Seychelles–54 and Mali–74) in the first 100, ranked according to the Human Development Index of 2008 (HDI 2008). Moreover, 24 countries out of 25 that have “low human development” are from SSA with high level of poverty influencing human development measures (life expectancy, literacy, educational attainment, and GDP per capita). Hence, efficient utilization of “natural wealth” is critical, and financial sector development can contribute to an efficient allocation of resources.

Theoretical and empirical studies emphasize the need to pay more attention to institutional development as institutions play a vital role in financial sector development. North (1990) offers the following definition for institutions: “Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction.” Institutions determine the costs of acting in different ways in political and economic contexts.

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<sup>2</sup> Appendices I and II introduce the DEA model and describe the definition and sources of data used for the empirical part of the paper.

North (1990) examines the nature of institutions and the consequences of institutions for economic performance and applies his theories to a range of historical examples, including the development of financial markets. Some cross-country studies (Beck, Demirguc-Kunt, and Levine 2004, and Honohan 2003) have shown that countries with better-developed financial intermediaries experience faster declines in measures of both poverty and income inequality, underscoring that the development of financial markets and institutions is helpful in reducing poverty.

Many researchers have shown that the institutional environment has an important impact on the functioning of the financial sector (Tressel and Detragiache 2008, and Demetriades and Fielding 2009). La Porta (La Porta, et al 1997 and La Porta, et al 1998) argues that legal origin determines the level of financial development. He suggests that common law-based systems, originating from English law, are better suited for development of financial markets than civil law systems, arguing that common law has been instrumental in protecting private property than civil law, which aims at addressing corruption in the judiciary and improving the power of the state.

Roe and Siegel (2009) stress the role of political stability in financial sector development. Contrary to works of La Porta, they find that current political instability explains the level of financial development more than historical legal origin. They link political stability to economic growth and financial development, which is close to the ideas of Rajan and Zingales (2003) in exploring political economy as determinants of financial development. In their work Rajan and Zingales (2003) argue that simultaneous opening of both trade and capital account hold is the key to successful financial development. Opening trade and capital account not only fosters competition and reduces inefficiencies, but might also give incumbents new opportunities that will bring them even higher profits to cover any negative effect from higher competition.

Djankov, MacLiesh, and Shleifer (2007) explore credit institutions in 129 countries over 25 years and show that contract rights and enforcement institutions play a big role in the development of financial markets. Their findings show statistical significance of creditors' rights and information sharing institutions for private credit. Acemoglu and Johnson (2005) highlight the importance of property right institutions. They argue that property right institutions have a crucial power in determining long-run growth, investment and financial development, whereas contractual institutions shape financial intermediation and slightly influence growth and financial development.

Studies show that institutional factors are also crucial for financial development in SSA. Demetriades and Fielding (2009) address the lack of information on borrowers, corruption and political instability as main challenges for financial development in eight countries of West Africa. McDonald and Schumacher (2007) point to financial liberalization, stronger legal institutions, legal origin, lower inflation, and increased sharing of information as key contributing factors for financial sector development in SSA. Some studies on Asian countries consider political institutions and political party structures (Zhang 2006), rule of

law, political stability, government effectiveness, and regulatory quality (Gani and Ngassam 2008) as main drivers for financial development. Other studies have a broader coverage. For example, Huang (2005) explores the effect of political liberalization on financial development in 90 developed and developing countries based on political liberalization and freedom indexes. Ito (2006) examines the relationship of institutions and financial development considering financial openness, corruption, and law and order as main challenges. He finds that financial openness stimulates equity market development only if some threshold level of legal development has been attained.

The literature review presented above underscores the importance of institutional reforms for SSA countries. Verriest (2009) points out that changes in the institutional environment are even more sensitive to weak institutional settings such as in African countries. Others (Demetriades, *et al* 2009) argue that financial depth (credit to private sector/GDP) is shallow in SSA countries not because of the lack in the creditworthiness of the borrowers, but because of the lack of developed infrastructure that would enable banks to screen and monitor borrowers. Another consideration in SSA is the heavy dependence on foreign aid, both financial and technical assistance, from various international and/or foreign organizations/donors. Nkusu and Sayek (2004) demonstrate that development of the local financial market positively enhances the impact of aid, which is significantly larger when local financial markets are more developed.

### **III. TESTING FOR THE ROLE OF INSTITUTIONS IN FINANCIAL SECTOR DEVELOPMENT**

#### **A. METHODOLOGY AND DATA**

Different techniques have been applied to measure the role of institutions in promoting financial sector development. They fall into four major categories: cross country regressions—La Porta *et al* 1998, Levine *et al* 2000, and Djankov *et al* 2007; panel techniques—Demetriades and Fielding 2009, McDonald and Schumacher 2007, and Ito 2006; industry/firm level regressions—Rajan and Zingales 1998, and Wurgler 2000; and case studies—Haber 2006, and Haber and Perotti 2008. Some studies (Zoli 2007, and Levine *et al* 2000) apply a combination of these techniques.

Techniques used suffer from some general weaknesses that need to be addressed. The majority of them are based on postulated hypotheses/functional forms that are not derived from a theoretical model or validated. Most of these hypotheses/functional forms are formulated ad-hoc, based on broad institutional factors—e.g., legal origins, law enforcement, creditor rights, accounting practices, information sharing, control of corruption, political stability, and financial openness—that are frequently difficult to define and measure precisely. In some cases the samples/factors used in these techniques are rather narrow.

This paper uses DEA that is non-parametric (a non-statistical analytical tool). This methodology is based on a series of economics and management concepts and uses linear programming for measuring the relative efficiency among similar decision making units

(DMU). These units share the similar technology for transforming similar inputs into outputs (see Appendix I for a more detailed presentation of the DEA). The DEA provides a different approach to data analysis-measurement without ad-hoc assumptions, but based on actual observations. It is non-parametric frontier based approach where the best practice is observed but not estimated. Unlike parametric approaches, the DEA does not impose any functional form between dependant and independent variables. The advantages of DEA are that it works well with small samples, it does not require any assumption to be made about the distribution of inefficiency (unlike the assumptions about the distribution of the error term in parametric approaches) and it does not impose any particular functional form on the data in determining the most efficient (unlike ad-hoc imposed functional forms in parametric approaches) institutions/countries. The DEA assumes that data is error free and differences among the performance of the decision making units are due to different resource/tool mixes and managerial effectiveness<sup>3</sup>.

A number of considerations justify the choice of the DEA technique besides the growing popularity of the model<sup>4</sup> (Emoroujzjad et al (2008) argue that the DEA is becoming more common and essential for a number of diverse management and social science fields). The DEA calculations have the following peculiarities:

- focus on individual observations in contrast to population averages/aggregates;
- simultaneous utilization of multiple outputs and multiple inputs with each being stated in different units of measurement;
- no restriction on the functional form of production/transformation relationship,
- generation of a single aggregate measure of each DMU in terms of its utilization of input factors (independent variables) to ‘produce’ desired outputs (dependent variables);
- generation of specific estimates for desired changes in inputs and/or outputs for projecting DMUs below the efficient frontier onto the efficient frontier;
- value free and without specification or knowledge of priory weights or prices for inputs or outputs;

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<sup>3</sup> The concept of efficiency used in DEA, as well as the illustration of the model, are illustrated in Appendix I.

<sup>4</sup> Not only DEA is gaining popularity, but it is also being used to explore relationships in a wider range of issues. Verriest (2009) used DEA to calculate a weighted composite governance index for SSA countries. Berger and Humphrey (1997) summarized 130 studies covering 21 countries that apply five different frontier approaches to address the implications of efficiency results for financial institutions in government policy, research and managerial performance. They argue that estimate of mean efficiency for an industry is a more reliable guide for policy and research purposes than are the estimated efficiency rankings of individual firms. Thore and Tarverdyan (2009) used DEA to explore the level of decent work (according to ILO Decent Work Agenda) in 61 countries. They use the empirical results to reveal conditions of decent work deficit and possibilities to reduce such deficit.

- focus on revealed best-practice frontiers rather than on central tendency properties of frontiers; and
- Pareto optimality.

The DEA results are very sensitive to the choice of inputs and outputs. In this paper, inputs and outputs are identified by reviewing the literature on the role of institutions in financial development (Baltagi, et al 2007, Demetriades and Fielding 2009, Singh, et al 2009 and McDonald and Schumacher 2007), as well as by considering additional inputs and outputs from different databases. Firstly, we identify institutional factors that could crucially influence financial sector development. Secondly, we search for the best proxy (measure) for each factor (see Appendix II)<sup>5</sup>.

Inputs are described by indicators that proxy the following factors:

- Existence of reliable information—information about customers that will serve as a basis for financial institutions forming judgments and making proper lending decisions.
- Contract enforcement—especially in terms of financial institutions’ rights on underlying collateral.
- Political stability—vital in SSA, especially for foreign investors; some researchers argue that foreign bank presence increases efficiency of domestic banking system (Levine 2001).
- Degree of corruption—major issue in SSA.

Outputs will be presented by indicators describing the following factors:

- Size
- Access
- Profitability
- Asset quality—as in most of SSA countries banks constitute most part of financial system, we take the quality of loans (ratio of NPLs to total loans) as a measure of asset quality.

As most of these factors cannot be directly observed, some composite parameters (proxies) are picked to represent the factors chosen in the model (see Appendix II). It is possible that having proxies might affect the accuracy of the results. Nonetheless, this May be the only way to measure unobservable institutional factors. Throughout the paper banking sector indicators have been used to characterize financial sector development, reflecting the fact

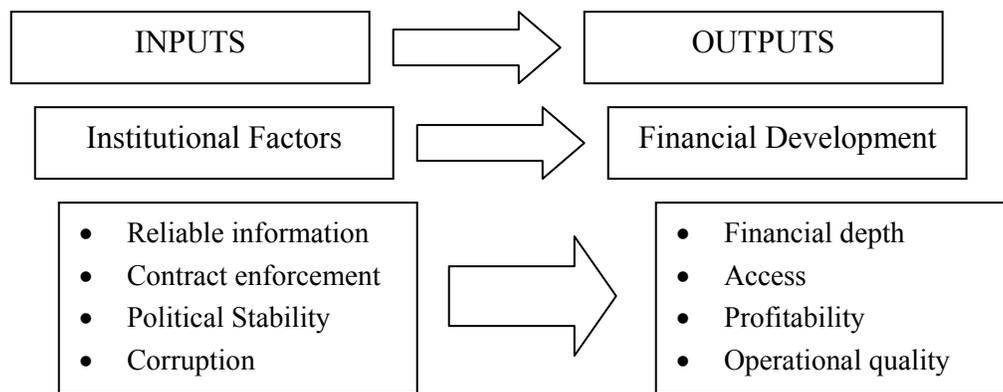
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<sup>5</sup> We do acknowledge that a host of other factors (e.g., legal origin, level of democracy, ownership, poverty, illiteracy, etc.) affect financial sector development, but we limit our selection due to model characteristics.

that banks constitute a very large part of financial sector assets in SSA countries as well as lack of available data for other financial institutions.

DEA measures the relative efficiency of transformation of inputs into outputs—in our case, institutional factors into financial development indicators. This frontier based approach provides a comparison among DMU—SSA countries in this case—in terms of the transformation illustrated in Figure 1. There are a number of other factors that affect financial development and hence their absence in the model might yield ambiguous results.<sup>6</sup> There may also be a bidirectional relationship with the level of development of the financial sector affecting the selected input parameters. To filter these influences a second model based on assumption of equal opportunities is constructed.

Figure 1. Illustration of the DEA



The model is run in two ways. First with the variables described in Appendix II, serving as inputs and outputs to assess how efficient is the financial system given institutional level of selected countries. In the second model a constant (the number 1 is taken in this case) was chosen as the only input and the output is described with the four output measures. The notion of a constant as input represents equal initial opportunities for output in each country (see Lovell 1999) and is used here to assess how “good” the financial sector is. Having the same “starting points” and one composite outcome instead of four outputs, the numeric outcome of the model is used to sort countries based on their financial sector “quality.” Eventually the results of both models are used to assess the role of institutions in financial sector development, by considering the difference of the outcomes from the two models and the input structure.

<sup>6</sup> For example, legal origin, the level of democracy, the efficiency of financial sector and the ownership structure could probably be as good measures of the institutional framework and financial sector development as the ones chosen. However due to the limitation on the number of inputs and outputs, depending on the magnitude of the observation, and data availability not all of them could be included in this paper.

Given the chosen proxies the model with four inputs has the following representation.

$$\begin{aligned}
 \max h_o(u, v) &= u_1 y_{1o} + u_2 y_{2o} + u_3 y_{3o} + u_4 y_{4o} \\
 v_1 x_{1o} + v_2 x_{2o} + v_3 x_{3o} + v_4 x_{4o} &= 1 \\
 u_1 y_{11} + u_2 y_{21} + u_3 y_{31} + u_4 y_{41} - v_1 x_{11} - v_2 x_{21} - v_3 x_{31} - v_4 x_{41} &\leq 0 \\
 u_1 y_{12} + u_2 y_{22} + u_3 y_{32} + u_4 y_{42} - v_1 x_{12} - v_2 x_{22} - v_3 x_{32} - v_4 x_{42} &\leq 0 \\
 \dots & \\
 u_1 y_{137} + u_2 y_{237} + u_3 y_{337} + u_4 y_{437} - v_1 x_{137} - v_2 x_{237} - v_3 x_{337} - v_4 x_{437} &\leq 0 \\
 u_1, u_2, u_3, u_4, v_1, v_2, v_3, v_4 &\geq 0
 \end{aligned}$$

On contrary the second model with a constant as an input will look like:

$$\begin{aligned}
 \max h_o(u, v) &= u_1 y_{1o} + u_2 y_{2o} + u_3 y_{3o} + u_4 y_{4o} \\
 u_1 y_{11} + u_2 y_{21} + u_3 y_{31} + u_4 y_{41} - 1 &\leq 0 \\
 u_1 y_{12} + u_2 y_{22} + u_3 y_{32} + u_4 y_{42} - 1 &\leq 0 \\
 \dots & \\
 u_1 y_{137} + u_2 y_{237} + u_3 y_{337} + u_4 y_{437} - 1 &\leq 0 \\
 u_1, u_2, u_3, u_4 &\geq 0
 \end{aligned}$$

Where:

“o” takes all the values from 1 to 37 as the model is run for each country analyzed.

$y_{1o}$ - is the depth credit information index (Credit Information) for country o

$y_{2o}$ - is the legal rights of borrowers (Legal Rights) for country o

$y_{3o}$ - is the political stability no violence (Political Stability) for country o

$y_{4o}$ - is the control of corruption (Corruption) for country o

$x_{1o}$ - is the total credits/gross domestic product (Financial Depth) for country o

$x_{2o}$ - is a composite measure of access to financial services (Access) for country o

$x_{3o}$ - is the return on equity (ROE) for country o

$x_{4o}$ - is nonperforming loans/total loans (NPL) for country o

$u_r$  and  $v_i$  are virtual multipliers and are unknown variables that are derived from the solution of the model. All data are as of December 31, 2007, though in the case of five countries (*Benin, Central African Republic, Republic of Congo, Eritrea, and Togo*) ROE and in one country (*Eritrea*) NPL for 2006 are taken as the best proxy for missing information (see Appendix III). Another exception applies to the access index that was calculated in 2007, but mostly based on surveys done in 2003–04. As the standard model assumes to have non-negative inputs and outputs, scales of political stability no violence and control of corruption have been changed. At the same time three countries (*Mali, São Tomé and Príncipe, and*

*Togo*) had negative ROE and those numbers were replaced with a very small positive number. As described in Bowlin (1998) that should not affect the outcome of the model.

## B. RESULTS

Results from both models, as well as a comparison are presented in Appendix IV for each individual country. The study includes 37 SSA countries. Other SSA countries (*Chad, Comoros, Congo Democratic Republic of Congo, Equatorial Guinea, Gambia, Guinea, and Guinea-Bissau*) are excluded as a critical mass of data is missing. The interpretation of the results is done on a country-by-country basis. A country could be characterized as fully efficient for any of the two models if, and only if, the performance of chosen institutional factors in affecting financial sector in other countries included in the study do not show that some financial sector development characteristics can be improved, without improving institutional factors. Some outlier results are explained by the high sensitivity of the model to inputs and outputs. Countries are pooled into groups based on the difference of outcomes of two models to make the presentation of results more structured.

First, results are presented for countries, which are fully efficient in the both models. These countries turned out yield prominent results as they are characterized by well-developed institutional factors and have relatively well-developed financial sector. For example, Botswana has a relatively good institutional structure (has the best performance in terms of the Corruption index) and has relatively good outputs (having a high ROE and the lowest NPL ratio). The Republic of Congo and Zimbabwe are more obvious outliers, as they have shallow financial sectors (low Credit/GDP ratio) and all of the binding variables have “extreme” values. A closer look reveals that the Republic of Congo is the worst in SSA with Political Stability and Corruption indices and Zimbabwe is among the worst with very low Credit Information and Political Stability indices.

In the case of South Africa all the indicators are “balanced” (no obvious outliers in data) and hence the country is not an outlier. As a result, out of the first four countries discussed, South Africa stands out as having effective institutional factors in terms of fostering financial development. Factors like Legal Rights, Financial Depth and NPL ratio play very significant role in Botswana, with an institutional structure that has significant effect on the development of the financial system. Since the NPL ratio is much better in Botswana compared to other countries, this may cause some skewiness of the results. The country is leading in terms of efficiency scores because of low corruption, high ROE and low NPL ratio. The other two countries (*Republic of Congo and Zimbabwe*) which have absolute results in both models are outliers (mainly because of high corruption and shallow financial sector); hence no clear results could be derived.

Second, results are presented for countries in which difference of the results from the two models (in absolute value) is more than 0 and less than 0.1. In Côte d’Ivoire the financial sector is underdeveloped. Good control of corruption results in low ROE and high NPL ratio in the country, which is counterintuitive and may be due to poor data quality and/or other county specific factors that determine the level of financial intermediation. Institutional

factors in Swaziland have moderate influence on financial services. In this case Credit Information, Legal Rights, ROE and NPL ratios are significant. For the Central African Republic Political Stability is a critical factor, resulting in poor ROE and NPL ratio (the Central African Republic has one of the worst NPL ratios). Hence the country is an outlier and we cannot make clear statements about the results.

The institutional system in Mauritius has a strong influence on the financial sector. It turns out to be fully efficient in the first model and has relatively well-established institutional factors specified in the model. Kenya holds leading positions in Credit Information and Legal Rights and hence is expected to yield good outputs. However, model results show that Political Stability is an obstacle for Access and NPLs, so even though institutional factors have significant effect on the financial sector development measures, the positive and negative influence of these factors neutralizes the overall influence.

Third, results are presented for countries in which the difference of the results from two models (in absolute value) is in the range between 0.1 and 0.2. For Zambia, the only two factors that are binding are Legal Rights and Political Stability, indicating that they are significant or they are outliers. While these have a significant impact on financial sector development, they are not the sole determinants of financial sector development. As in the case of Kenya, this is a situation where some of the institutions are more developed than others, however their advancement has not fully manifested their impact on the financial sector. Results for Seychelles show that institutional factors have a significant effect on financial sector development. Results indicate that making progress in reducing corruption would have strong positive impact on increasing Access and lowering NPLs in Ethiopia. In Burkina Faso, with relatively good institutions and uneven financial sector characteristics, results show that Credit Information and Corruption are the main constraints for ROE and NPLs which are poor. The situation in Benin and Mali is identical and is very much similar to that in Burkina Faso. The difference between Benin and Mali on one hand and Burkina Faso on the other is that institutions do not affect financial sector development that much in Benin and Mali, suggesting that poor performance of these countries in terms of ROE and NPLs is determined by other factors not included in the model.

Cape Verde is another country which is fully efficient in the first model where institutional factors exert considerable influence on financial sector development. However, high NPL ratio is not explained by any of the institutional factors. In the case of Tanzania, the financial sector is not sensitive to the institutional factors. Although the country ranks high in terms of Legal Rights and Political Stability, it ranks at the bottom in terms of Access. Hence, institutional factors included in the model have a limited impact on financial sector development. Results for Madagascar and Gabon are similar to Tanzania, with both countries fully efficient in the first model. In both countries there is a moderate institutional influence on financial sector development, while indicators of Political Stability and Financial Depth show that these areas are a constraint to financial sector development. Cameroon and Senegal also exhibit similar results, having institutions that affect financial sector development moderately. Credit information is the main constraint on improving ROE and NPL ratios. In

Namibia institutions are very well developed. Although the country's financial sector development measures are high, its institutional measures are even better (relative to other countries and to outputs).

Fourth, results are presented for countries that have a difference of the results from two models (in absolute value) greater than 0.2. In Uganda, the influence of institutions on financial sector development is moderate, with Legal Rights affecting ROE. In Malawi sound Legal Rights and Political Stability characterize the institutional environment. The other two parameters of institutional advancement, however, inhibit financial sector advancement. In Angola there is a moderate influence of institutions on the financial sector development. Credit information, legal rights, and political stability rank high compared to the other countries in the sample and are drives for the overall financial sector characteristics. In Burundi, there is a moderate influence of the institutional factors on financial sector development, but unlike in most other countries Credit Information and Corruption do not shape NPL ratio. Niger and Togo have relatively underdeveloped institutions. However, in both countries institutional factors exert some influence on financial sector development. Still, Access in Niger, like ROE and NPLs in Togo, is not affected by institutional factors.

Nigeria is another outlier. It is fully efficient in the first model and has the largest difference of results of two models. This is largely because Nigeria has one of the worst institutional environments in the sample, except having a high ranking in Legal Rights. For the last subgroup of countries in this group (*Sierra Leone, Eritrea, Mozambique, Lesotho, Liberia, Rwanda, Ghana, and São Tomé and Príncipe*) institutional factors have very limited influence on financial sector development. These are countries where at least one of the institutional factors has high ranking, but it does not really contribute to financial system development. They have average quality institutional structures, but on the other hand they have at least one or two bad financial sector characteristics that may have non-institutional roots. The situation is somehow different in Eritrea, which comes out as fully efficient in the first model, but it is more of an outlier, as the country has an underdeveloped institutional system and the worst NPL ratio.

#### **IV. CONCLUSIONS, POLICY IMPLICATIONS, AND POSSIBLE EXTENSIONS**

This paper has sought to empirically analyze the role of institutional factors in financial sector development in SSA countries. Results from the DEA modeling point to a few general conclusions: (i) for six countries in the sample the influence of institutional factors on financial sector development is strong; (ii) for nine countries this influence is moderate; (iii) for six other countries the effect moderate to weak; and (iv) for twelve countries the influence of institutions on financial sector development is weak. There are four cases that are outliers where no clear conclusions can be drawn.

It is intuitive that institutional factors do influence financial systems through various direct and indirect channels. However, simply because of having very limited resources and a number of constraints (e.g., limited knowledge base, limited financial resources, and cultural

factors) institutions can only be improved slowly. Hence, it is extremely important for policymakers to know which institutional factors are critical for financial sector development. While strategic goals vary from country to country and certain factors can be less, or more important for policymakers, this paper provides some evidence that institutional factors matter, which could help guide the sequencing of institutional reforms to promote financial sector development.

Results show that in general, all four institutional factors included in the model have a similar significance among SSA countries in affecting financial sector development. On the other hand it turned out that, financial sector development is characterized more by the ROE and NPLs, rather than by Financial Depth and Access which may reflect the large variation of these measures in SSA countries. The results imply that improvements in institutional factors in SSA countries would influence Financial Depth and Access more than ROE and NPL.

The results also show that in general the Depth of Credit Information has the strongest impact on NPL. This implies that countries willing to reduce NPL with the help of institutional changes should consider setting up credit registries, increase transparency and amount of shared information. Similarly, in many SSA countries Access is determined mostly by Political Stability and partially by Legal Rights of Borrowers. While this does not hold for all SSA countries, the low level of financial development also depends on non-institutional and other institutional factors not examined in the paper. In some countries (e.g., Kenya and Zambia) there is a large gap regarding the development of institutional factors analyzed in this paper, suggesting that these countries should focus their efforts on improving the weakest ones.

The paper could be extended in a number of ways, in particular related to areas that DEA could yield more detailed results. One extension would be an analysis at a micro level. Bank level analysis would be more suitable for DEA as it would be more precise in terms of measuring financial advancement (dealing with the performance of every bank separately). A bank level analysis would not only give more detailed results and information at a micro level but would also enable to refine the more general results. For example, one could explore if the impact of institutions is approximately the same within a country, or whether there is a modest deviation depending on the ownership structure, size, age, or some other characteristics of banks. A similar analysis could be done for other regions (e.g., North Africa, Middle East, Central Asia, Eastern Asia, and Latin America), or for all developing countries to draw inter and intra regional and country comparisons. A similar analysis could be carried out using other institutional factors and financial sector development measures to test the importance of different institutional characteristics on financial sector development, or to address country specific characteristics. Finally an extension could apply DEA over different time periods to measure the impact of institutional reforms over time.

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### Appendix 1. Data Envelopment Analysis (DEA)

DEA is multi-factor non-parametric analysis that is used to measure the relative efficiency of decision making units (DMU) in input-output terms. This methodology, which was first introduced by Charnes, Cooper, and Rhodes (CCR) (1978) and later extended by Banker, Charnes, and Cooper (BCC) (1984), uses linear programming to map a non-parametric surface frontier over the data points to determine the efficiencies of each decision making unit relative to the frontier. The efficiency scores of DMUs are bounded between zero and one; fully efficient units will have an efficiency score of one. The efficiency score indicates how efficient is a DMU in transforming input factors into output measures, compared to other DMUs incorporated into the study.

In the presence of multiple inputs and outputs efficiency is calculated as follows:

$$\text{Efficiency} = \frac{\text{Weighted\_Sum\_of\_Outputs}}{\text{Weighted\_Sum\_of\_Inputs}}$$

This form of representation brings multiple outputs/multiple inputs situation to one virtual output/one virtual input. For a simple representation of DEA it is assumed that there are  $n$  DMUs to be evaluated. Each DMU uses some amount of  $m$  different inputs to produce  $s$  different outputs. Specifically DMU <sub>$j$</sub>  uses amount  $x_{ij}$  of input  $i$  and produces amount  $y_{rj}$  of output  $r$ . We further assume that  $x_{ij} \geq 0$  and  $y_{rj} \geq 0$  and that each DMU should at least have one positive input and one positive output. The linear programming problem can then be formulated as:

$$\begin{aligned} \max h_o(u, v) &= \sum_r u_r y_{ro} / \sum_i v_i x_{io} \\ \sum_r u_r y_{rj} / \sum_i v_i x_{ij} &\leq 1 \quad j=1, \dots, n; \quad \forall r, i; \quad u_r, v_i \geq 0 \end{aligned} \quad (1)$$

This can easily be converted to a linear programming problem (Charnes et al, 1978).

$$\begin{aligned} \max h_o(u, v) &= \sum_{r=1}^s u_r y_{ro} \\ \sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} &\leq 0 \\ \sum_{i=1}^m v_i x_{io} &= 1 \\ u_r, v_i &\geq 0 \\ j &= 1, \dots, n; \quad \forall r, i \end{aligned} \quad (2)$$

This problem is solved  $n$  times (once for every single DMU) and in the result relative efficiency scores of all DMUs are found. Thereafter every DMU selects combination of inputs and outputs that maximizes its efficiency. The efficiency concept underlying DEA is discussed in Cooper, et al (2004) and is based on the following definition of efficiency: *“A DMU is to be rated as fully (100 percent) efficient on the basis of available evidence if and only if the performances of other DMUs do not show that some of its inputs or outputs can be improved without worsening some of its other inputs or outputs.”*

Notice that if in the solution of problem (2), some DMU obtains an efficiency score of 1, then we can state that it is efficient according to the definition given above.

Several alternative models have been introduced in the DEA literature (see, for instance, Charnes *et al*, 1994 for details). Since the technique was first proposed much theoretical and empirical work has been done. Many studies have been published dealing with applying DEA in real-world situations (Verriest (2009), Lozano-Vivas, et al (2002), Berger and Humphrey (1997), Cherchye (2001) and others).

## Appendix II. Data Description

Factor	Variable	Description	Source
Reliable Information	Depth of Credit Information Index	The depth of credit information index measures rules affecting the scope, accessibility and quality of credit information available through either public or private credit registries	Doing Business
Contract Enforcement	Legal rights of borrowers	The strength of legal rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending	Doing Business
Political Stability	Political Stability No Violence	Measuring perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.	Governance Indicators
Corruption	Control of Corruption	Measuring perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture” of the state by elites and private interests.	Governance Indicators
Size 1/	Private Credit/GDP	Private credit by deposit money banks and other financial institutions/GDP.	Financial Structure Dataset 2009
Access 2/	Composite measure of access to financial services	The composite indicator measures the percentage of the adult population with access to an account with a financial intermediary. Data used is from a household survey on access or constructed as a function of the estimated number and average size of bank accounts.	Finance for All? Policy Research Report
Profitability 1/	Return on Equity	Average return on assets (Net Income/Total Equity).	National authorities and IMF staff estimates
Operational quality 1/	Nonperforming loans / Total Loans	Portion of nonperforming loans in the overall portfolio.	National authorities and IMF staff estimates

1/ Information on some of the countries was missing in these data bases and estimates of national authorities and IMF staff have been taken to complete those holes.

\*2/ This research has been done in 2007, but is based on the results of surveys done in 2003–04.

## Appendix III. Data Used 1/

Countries	Inputs				Outputs				
	Depth Credit Information Index	Legal Rights of Borrowers	Political Stability No Violence	Control of Corruption	Total Credit (Total Advances)/ GDP	Access	Return on Equity	NPLs to Total Gross Loans	
Angola	5	4	2.0376	1.3798	8.3%	24	23.6%	2.9%	
Benin	2	3	2.8815	2.0109	16.4%	32	8.9%	9.0%	
Botswana	5	7	3.3384	3.4029	19.2%	47	60.1%	0.1%	
Burkina Faso	2	3	2.5878	2.1005	14.8%	26	6.8%	19.4%	
Burundi	2	2	1.0777	1.4507	23.1%	17	26.4%	18.8%	
Cameroon	3	3	2.1056	1.5736	8.9%	24	24.8%	13.3%	
Cape Verde	4	3	3.5073	3.2637	44.9%	40	31.4%	13.4%	
Central African Republic	3	3	0.7237	1.5991	6.7%	19	43.8%	30.4%	
Congo, Rep. of	3	3	0.2392	1.2310	2.3%	27	76.0%	3.0%	
Côte d'Ivoire	5	4	3.3376	2.8876	14.1%	24	14.8%	21.4%	
Eritrea	1	2	1.4573	2.0002	26.1%	12	48.2%	44.0%	
Ethiopia	3	4	0.7758	1.8027	18.8%	14	28.4%	10.1%	
Gabon	3	3	2.6996	1.6532	11.1%	39	32.3%	7.0%	
Ghana	1	7	2.7171	2.3321	29.4%	16	26.2%	8.7%	
Kenya	5	10	1.4052	1.5578	23.2%	10	27.4%	14.1%	
Lesotho	1	8	2.5372	2.3069	9.1%	17	31.6%	1.7%	
Liberia	1	4	1.3531	2.0896	12.8%	11	4.4%	16.4%	
Madagascar	1	2	2.4506	2.3512	9.4%	21	60.3%	9.1%	
Malawi	1	8	2.4895	1.7584	13.7%	21	39.6%	4.1%	
Mali	2	3	2.3716	2.0726	14.9%	22	0.0%	10.7%	
Mauritius	3	4	3.2602	2.9068	71.6%	44	26.4%	2.4%	
Mozambique	4	2	2.8696	2.0091	12.8%	12	47.7%	2.6%	
Namibia	5	8	3.3978	2.6862	41.4%	28	44.9%	2.8%	
Niger	2	3	2.0586	1.6135	8.2%	31	14.8%	21.2%	
Nigeria	1	8	0.4281	1.4951	17.2%	14	13.1%	8.4%	
Rwanda	3	2	2.3050	2.4059	10.3%	23	12.4%	18.4%	
São Tomé and Príncipe	1	3	2.7824	2.0206	31.0%	14	0.0%	26.6%	
Senegal	2	3	2.3202	2.0888	20.8%	27	14.3%	18.6%	
Seychelles	1	3	3.5093	2.5349	34.8%	41	23.2%	2.3%	
Sierra Leone	1	4	2.2022	1.4811	4.4%	13	36.1%	31.7%	
South Africa	7	9	2.6770	2.8216	142.1%	46	18.1%	1.4%	
Swaziland	5	6	2.6032	2.0327	18.3%	34	14.1%	6.4%	
Tanzania	1	8	2.4303	2.0586	12.0%	4	29.0%	6.3%	
Togo	2	3	2.0809	1.5229	18.0%	28	0.0%	13.8%	
Uganda	1	7	1.3592	1.7533	7.4%	20	31.4%	4.1%	
Zambia	1	9	2.7347	1.8981	10.1%	14	34.1%	8.4%	
Zimbabwe	1	8	1.2014	1.8981	3.9%	34	73.8%	6.4%	

Summary Statistics

Countries	Inputs				Outputs			
	Depth Credit Information Index	Legal Rights of Borrowers	Political Stability No Violence	Control of Corruption	Total Credit (Total Advances)/ GDP	Access	Return on Equity	NPLs to Total Gross Loans
Minimum	1.00	2.00	0.24	1.23	2.3%	4.00	0.0%	0.1%
Average	2.54	4.76	2.22	2.06	21.4%	24.05	28.3%	11.9%
Median	2.00	4.00	2.43	2.01	14.8%	23.00	26.4%	9.0%
Maximum	7.00	10.00	3.51	3.40	142.1%	47.00	76.0%	44.0%

Note:

1/ The range for the Depth of Credit Information index is from 1 to 7. For the index of Legal Rights of Borrowers the range is 0 to 10. The range for indices of Political Stability and Control of Corruption is 0 to 5. Access can be anything between 0 and 100. In all these cases the higher the index value the better the performance of the country. The other three indicators don't have strict ranges.

### Appendix IV. DEA Results: Impact of Institutions on Financial Sector Development

	With 4 Inputs	With a Constant	Difference	Impact
1 Angola	0.7738	0.51064	0.2632	Moderate
2 Benin	0.8303	0.68142	0.1489	Weak
3 Botswana	1.0000	1.00000	-	Strong/Outlier
4 Burkina Faso	0.6941	0.55391	0.1402	Moderate
5 Burundi	0.7471	0.47121	0.2759	Moderate
6 Cameroon	0.6794	0.51064	0.1687	Moderate/Weak
7 Cape Verde	1.0000	0.85598	0.1440	Strong
8 Central African Republic	0.6612	0.61067	0.0506	Outlier
9 Congo, Rep. of	1.0000	1.00000	-	Outlier
10 Côte d'Ivoire	0.4867	0.51137	(0.0247)	Moderate
11 Eritrea	1.0000	0.76674	0.2333	Weak
12 Ethiopia	0.6026	0.47040	0.1322	Strong
13 Gabon	1.0000	0.82979	0.1702	Moderate
14 Ghana	0.9348	0.49879	0.4360	Weak
15 Kenya	0.5413	0.48089	0.0604	Moderate/Weak
16 Lesotho	0.7531	0.47196	0.2811	Weak
17 Liberia	0.5469	0.23547	0.3115	Weak
18 Madagascar	1.0000	0.83384	0.1662	Moderate/Weak
19 Malawi	0.8476	0.59824	0.2494	Moderate
20 Mali	0.6109	0.46911	0.1418	Weak
21 Mauritius	1.0000	0.94542	0.0546	Strong
22 Mozambique	0.9346	0.69023	0.2444	Weak
23 Namibia	0.6111	0.80861	(0.1975)	Moderate
24 Niger	0.9569	0.65957	0.2973	Moderate/Weak
25 Nigeria	1.0000	0.49986	0.5001	Outlier
26 Rwanda	0.8441	0.48951	0.3546	Weak
27 São Tomé and Príncipe	0.7892	0.30224	0.4870	Weak
28 Senegal	0.7623	0.57614	0.1861	Moderate/Weak
29 Seychelles	1.0000	0.87546	0.1245	Strong
30 Sierra Leone	0.6898	0.49296	0.1969	Weak
31 South Africa	1.0000	1.00000	-	Strong
32 Swaziland	0.7510	0.72416	0.0268	Moderate
33 Tanzania	0.5993	0.44164	0.1577	Weak
34 Togo	0.9233	0.59687	0.3264	Weak
35 Uganda	0.6881	0.48288	0.2052	Moderate
36 Zambia	0.6212	0.49749	0.1238	Moderate/Weak
37 Zimbabwe	1.0000	1.00000	-	Outlier