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FINANCIAL DEEPENING AND ECONOMIC GROWTH IN MOZAMBIQUE

Salvador Vítor de Jesus Emídio

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Prof. Doutor Mohamed Azzim

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Resumo

Neste trabalho de pesquisa empírica, baseado em séries temporais analisamos, num quadro estrutural multivariado, a causalidade entre o desenvolvimento financeiro e o crescimento económico em Moçambique durante um período de 24 anos, de 1980 a 2003. O desenvolvimento do sistema financeiro é medido pelo rácio dos depósitos bancários sobre o PIB nominal e o desenvolvimento económico é medido pelo PIB per capita. Mais especificamente são efectuadas três análises: a primeira, com o auxílio do teste ADF de raízes unitárias, analisa as propriedades das séries temporais, no intuito de detectar se as séries têm raízes unitárias em nível, e se são estacionárias em primeiras diferenças; a segunda examina, no quadro do VAR e do Modelo Vectorial de Correcção de Erros (VECM) desenvolvido por Johansen e Juselius (1990), a relação de longo prazo entre as variáveis; finalmente a terceira analisa os resultados dos testes de exogeneidade fraca e de causalidade (Granger), no sentido de determinar a relação de causalidade entre o desenvolvimento financeiro e o crescimento económico. Os resultados dos testes ADF indicam que todas as variáveis têm raiz unitária em nível mas são estacionárias na primeira diferenciação. Os testes de co-integração sugerem que existe uma relação estável de longo prazo entre o desenvolvimento financeiro e o crescimento económico. E os testes de exogeneidade fraca e de causalidade (Granger) indicam que o crescimento económico está dependente do desenvolvimento do sistema financeiro em Moçambique.

Classificação JEL: O16; F43
Palavras-chave: Desenvolvimento Económico; Crescimento Económico

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Abstract

In this empirical research, based on Mozambican time series data, we examine the causality between financial deepening and economic growth, in a multivariate VAR structure over a period covering 24 years, from 1980 to 2003. Financial deepening is measured by the ratio of bank deposit liabilities to nominal GDP and is modeled with real per capita income as a proxy of economic development. Specifically, three analyses were undertaken. First, the time series properties of the variables were ascertained with the help of augmented Dickey-Fuller (ADF) unit root procedure. Second, the long run relationship between the variables was examined in the context of VAR and VECM framework, developed by Johansen and Juselius (1990). Finally, weak exogeneity test and Granger-causality tests were undertaken to determine the direction of causality between economic development and financial deepening. The results of the ADF tests indicate that all variable contain a unit root in their level but are stationary at their first differences. The cointegration test suggests that there is a long-run relationship between economic growth and financial deepening and weak exogeneity tests and Granger-causality tests indicate that economic development is causally dependent of financial deepening in Mozambique.

JEL-Codes: O16; F43

Key words: Economic Development, Economic Growth

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1. Introduction

Since the mid-1980s, financial liberalization in several African countries has been implemented largely through on-going structural adjustment programs under the Bretton Wood Institutions. Policies have been designed to ensure macroeconomic stability, low inflation and reduced budget deficit, as a prerequisite for financial liberalization. The focus has been on liberalization of interest rates, deregulation of the financial sector, strengthening of the banking system, introduction of new financial instruments, and development of securities markets. These changes are suggested to bring about financial liberalization that Mozambique has procured to implement at various levels. The purpose of this study is to identify factors that, in Mozambique, have contributed to economic growth over the past 24 years, with particular emphasis on the role of the financial deepening on economic growth and the direction of this causality.

A large body of growing empirical literature demonstrates that the development of a financial system has positive effects on the level and efficiency of investment and consequently on the long run rate of economic growth (Fry, 1997). However, the causal relationship across nations, exhibits considerable variations indicating that policies and institutional factors play a critical role in the process of how financial deepening influences economic growth (Demetriades and Hussein, 1996; Arestis and Demetriades, 1997). The influence of the specificity of institutional factors is highlighted by Demetriades and Luintel (1996, 1997) and Demirguç-Kunt and Detragiache (1998) suggesting that clinical analysis of the influence may generate further insights on the role of financial deepening on economic growth and the direction of its causality.

More recently, the issue of causality between financial deepening and economic growth has attracted considerable attention of economists. Causality patterns vary across countries and seem to be correlated with the level of development of the financial sector and with the financial policies implemented by each country. The studies show marked disparities across countries leading Boulila and Trabelsi (2003) to argue that the causality between financial deepening and economic growth

is still very far from being settled and remains unanswered. More importantly Mozambique has systematically been excluded from such cross country studies making the study interesting from a purely clinical perspective.

The aim of this paper is to explore whether there is empirical support for the supply leading preposition that financial deepening leads to economic growth, using time series techniques. The rest of the paper is organized as follows. Section 2 presents a brief economic and financial history of Mozambique. Section 3 deals with the theoretical background. Section 4 reviews the empirical literature. Section 5 presents the variables and data sources. Section 6 discusses the methodology and empirical analysis. The concluding section (7) summarizes the study, provides policy implications, and highlights limitations of the study and potential paths for future research.

2. A brief history of Mozambique

Mozambique is considered one of the poorest countries in the world and has gone through three main structural changes in the last three decades. The first one was the independence from Portugal, which occurred in 1975. An immediate devastating civil war that lasted 16 years destroyed most of the already debilitated infrastructure. The newborn country adhered to the communist ideology, turning to the governments of Soviet Union and East Germany for assistance. The second occurred in 1987/88 when Mozambique opened its borders to the West, letting aside the socialist/communist ideology and embracing the capitalist system. The country adhered to the Breton Wood institutions, starting its structural adjustment program, abandoning definitively the centrally planned economy. The third one was the signing of a peace treaty in 1992. The peace treaty permitted the country to achieve political stability, which led to impressive growth rates in the subsequent years with the assistance of the Breton Wood institutions.

Since independence, a commercial banking system was practically inexistent and bank lending was determined by government priorities rather than by market criteria. Deep banking reforms were implemented in 1992, when the Central Bank was divided in two (Bank of Mozambique and Commercial Bank of Mozambique),

and new commercial banks, with majority private ownership, were authorized to operate in the country to improve the quality and type of financial services provided to the customers. The foreign exchange market was liberalized in that year as well. This was the beginning of Government's implementation of a rigorous program of market oriented reforms and improved economic management, leading to a steady increase in the real Gross Domestic Product (GDP).

Even though more than 60% of Mozambicans live in absolute poverty, are illiterate and the HIV/AIDS infection rate is extremely high, the International Monetary Fund (IMF) and the World Bank (WB) generally regard Mozambique as a successful case of structural adjustment under sound macroeconomic management, because of the excellent economic growth records since the end of the civil war. Nevertheless, it is still one of the world poorest countries in the world with 2003 GDP per capita level of $223 USD (less than one USD per day).

The country has qualified for the enhanced level of debt relief program under the IMF-WB heavily indebted poor countries (HIPC) initiative. Since then the debt servicing improved considerably with enhanced completion point being achieved in 2001, after implementing key policies reforms, political and macroeconomic stability and getting excellent results under the Poverty Reduction Strategy Framework (PRSF) program. Mozambique's status for maintaining a manageable debt service is now considered sustainable by de IMF.

Poverty reduction has also been the central focus of the Government. The Poverty Reduction Strategy Paper (PRSP) began in 2001, for a five-year period, and the results were better than anticipated. The goal is to reduce the incidence of poverty to 60% by 2005 (which has been achieved) and to 50% by 2010. The 2002/03 surveys have shown that poverty declined since 1996/97, from 69.4% to 54.1% in 2005. Clearly, Mozambique is making progress on this issue. The paper is now under revision for the period 2006-2010.

The country is committed to the Southern African Development Community (SADC) free trade treaty and is one of the three countries the "Millennium Challenge Corporation (MCC)" determined to be eligible, for Millennium Challenge Account (MCA) funding, although the country did not meet the selection criteria fully. In recent years exports have risen sharply, mainly due to large foreign investments in an

aluminum refinery and a natural gas pipeline to South Africa. There are some very large projects, namely the development of the Moatize (Tete Province) coalmines, the titanium sands in Moma (north of the country) and Chibuto (in the South), and a hydroelectric dam at Mepanda, that are being implemented mainly to export energy to the Republic of South Africa.

3. Theoretical underpinnings

Since the seminal work of Schumpeter (1911) to more recent times the relationship between a country's financial infrastructure and economic development as been studied by several economic theorists. In the neo-classical view, reducing the rate of interest on money can increase the rate of economic growth. Tobin (1965) developed a monetary growth model, showing that if the return on capital rises relative to the return on money, it encourages a shift from money to capital, higher capital to labor ratios and increases labor productivity. The implications of this reasoning is that governments should reduce the rate of return on money through interest rate ceilings and target low levels of inflation (both of which serve as a tax on real money balances). The inherent assumption of this model is that there is perfect substitutability of money and productive capital.

McKinnon and Shaw (1973) analyzed the benefits of reducing interest rates in developing economies. Their analyses (sometimes referred as Complementary Hypothesis) concluded that alleviating financial restrictions in such countries mainly by allowing market forces to determine real interest rates, can exert a positive effect on growth rates as interest rates rises to its competitive market equilibrium. Thus, they questioned the applicability of the neo-classical approach to developing countries, arguing that low interest rates crowd out high-yielding investments, create a preference for capital-intensive projects, discourage future savings and thereby reduce both the quality and quantity of investments in an economy. Thus, money and capital are complements, rather than substitutes. Productive investment and therefore capital accumulation occurs because large real money stock makes greater amounts of loanable funds available to borrowers. Expanded financial intermediation between savers and investors increases de incentive to save and invest, improving the efficiency of investments (Fry, 1997). In other words, low real deposit rate of interest

shrinks the liabilities of the banking system consequently impeding the supply of investment finance. Thus, rising interest rates to equilibrium levels should increase the rate of economic growth.

This framework of the "repressed" economy has been, for the past three decades, the main analytical basis for studies of the role of the financial sector in economic development. The main argument is that financial repression inhibits the operation of financial intermediaries at their full potential through a set of policies, laws, formal regulations and informal controls imposed by government on the financial sector, which distorts financial prices - interest rates and exchange rates.

High reserve requirements and interest rates ceilings are the main instruments of financial repression. Selective and sectoral credit schemes, as well as capital controls on foreign exchange, are also typical components of financial repression. Financial repression can lead to dualism in which firms that have access to subsidized funding will tend to choose relatively capital-intensive technologies, whereas the others not favored by policy will only be able to implement high-yield projects with short maturity. McKinnon and Shaw assumed that liberalization would stimulate savings with the underlying assumption that savings are responsive to interest rates. Therefore, according to this view, we should expect to see higher saving rates (as well as higher levels of investment and growth) following financial liberalization (Gemech and Struthers, 2003). The World Bank (1989) also defends this view and suggests that efficient financial systems help economic growth, partly by mobilizing additional financial resources and partly by attracting those resources to the best use.

Other adepts of financial liberalization include Obstfeld (1998) and Mishkin (2001). Obstfeld argues that international capital markets can channel world savings to their most productive uses, irrespective of location; Mishkin claims that financial liberalization promotes transparency and accountability, reducing adverse selection and moral hazard, while alleviating liquidity problems in financial markets. Both argue that international capital markets help to discipline policy makers, who might be tempted to exploit an otherwise captive domestic market.

More recently, endogenous growth theorists have been arguing, that financial repression has negative effects on economic growth in the steady state. Among these theorists we can highlight Greenwood and Jovanovic (1990) and Benchivenga and

Smith (1991). These authors developed economic models in which the services provided by financial intermediaries promote economic growth. They observed close links between economic growth and financial market development. According to them, financial intermediaries raise average return to capital by facilitating the allocation of capital to its highest value by pooling funds and acquiring information. Banks engaged in maturity intermediation induce savers to switch from unproductive investment in tangible assets to productive investment in firms. And they also find a two-way causal relationship between economic growth and financial development, i.e., they are jointly determined.

In the 1980s, the McKinnon and Shaw framework was criticized on the argument that raising institutional interest rates might have strong negative effects on savings, investment output and growth. The critics reject openly the negative effects of financial repression policies. The main criticism is based on the fact that developing countries lack effective institutions, thus the government should have some control over the financial sector in order to correct market failures in financial markets, lower the costs of capital to entrepreneurs and improve the quality of loans by selecting the medium-low risk projects (Buffie, 1984). These measures of financial repression, in conjunction with export promotion schemes or preferential credit schemes, could encourage the flow of capital to sectors with beneficial technological spillovers (Stiglitz, 1994, 2000). Demetriades and Luintel (1996) also argue that intervention policies can generate positive effects whenever they are able to successfully address market failure. The World Bank has also changed its initial liberal position by adopting a more regulated approach (World Bank, 1993).

Recent critics of financial liberalization, namely Diaz-Alejandro (1982) also link financial liberalization to macroeconomic instability. They studied financial reforms carried out, in the late 1970s, in some Latin American countries, aimed at ending financial repression. Their results suggest that such reforms lead to widespread bankruptcies, massive government intervention, nationalization of private institutions and low domestic savings. Stiglitz (1994, 2000) argues in favor of certain forms of financial repression, favoring government intervention in financial markets in the form of prudential regulation and supervision. Information asymmetries are endemic to financial markets and transactions, especially in countries with poor corporate

governance and low legal protections. Thus there is no reason to think that financial liberalization, either domestic or international, will be welfare improving. He also argues that repression can have some positive effects such as: targeting the credit towards profitable sectors such as exporters or sectors with high technological spillovers.

Others authors put more emphasis on the relationship between financial liberalization and economic growth and the direction of causality, instead of financial liberalization vs. financial repression. King and Levine (1993a) in their empirical study present a model in which financial sector repression measures have a negative effect on financial intermediation and, consequently on innovative activity and economic growth. They find that some financial indicators were robustly correlated with economic growth, namely de rate of capital accumulation. In accordance with the views of King and Levine (1993a), Jung (1986) and Patrick (1996) also argue that economic development causes financial deepening. They show that it is economic development that induces the expansion of the financial system. When the real side of the economy grows, it exerts a pressure on the demand for money, thus causing the financial system to improve services in order to satisfy that demand. Chandavarkar (1992) follow the same stance. He argues that financial development follows economic growth and this is known as the so-called demand-following view of financial development.

In conclusion, we can loosely group the theoretical literature on the topic, their views and results, into two main categories, as argued by Patrick (1996): supply leading or a demand following approach. The supply leading approach argues that financial activity is considered as a major determinant of real activity where well-developed financial institutions are of extreme importance for economic growth. The demand leading approach argues that economic growth is the motor and financial activity is taken as a result because growing activities require more and more funds for expansion.

4. Review of empirical literature

The empirical literature varies largely in terms of empirical approach and country coverage. A large number of empirical studies across different countries, contexts and time periods have been undertaken. In general two main econometric approaches are used in testing the correlation between financial deepening and economic growth: cross-country or panel data and time series techniques.

To support the hypothesis that financial development leads economic growth, several studies have used cross-sectional techniques and consequently argue that financial repression policies are harmful for economic growth. Among those studies we can highlight the followings: King and Levine (1993b), Demetriades and Hussein (1996), Demetriades and Luintel (1996 and 1997), Fry (1997), Rajan and Zingales (1998), Demirguç Kunt and Maksimovic (1998), Levine and Zervos (1998), Beck, Levine and Loayza (2000).

King and Levine (1993) in a cross-country analysis of 80 countries found that the indicators of financial development were robustly correlated with economic growth. Demetriades and Hussein (1996), in a sample of 16 countries, show that growth causes financial development and not the other way around. Demetriades and Luintel (1996) in a study of the effects of banking sector controls on the process of financial deepening (in India) find that theses controls influence financial deepening negatively and that the causal relationship between economic development and financial deepening is jointly determined. Thus, policies that affect financial deepening may also influence economic growth. Also, Demetriades and Luintel (1997) in another study on India, find evidence that financial repression has substantial direct effects on financial deepening, which are additional to those of the real rate of interest. They reject openly the negative effects of financial repression and claim that interventionist policies may have positive effects whenever they are able to successfully address market failure.

Rajan and Zingales (1998) in a firm and industry level analysis, for a large sample of countries, argue that financial development has a substantial influence on economic growth. Demirguç, Kunt and Maksimovic (1998) in a cross-country study of 30 countries (developed and developing) find that stock market development (financial development) and a well developed legal system facilitates economic

growth. Levine and Zervos (1998) in a cross-country analysis of 80 countries find that all measures of financial development were robustly correlated with future rates of economic growth. And, Beck, Levine and Loayza (2000) in a cross-sectional study and dynamic panel techniques find a strong and positive relationship between the level of financial deepening and long run economic growth.

Nevertheless, all these studies have the limitation of treating all countries as being similar in population, human capital, infrastructure, technologies, etc. These studies use mainly cross-sectional data where variables are averaged over a lengthy period of time thereby hiding the true value of the variables and the way these influence each other (Boulila and Trabelsi, 2003**)**. Consequently, these studies produce inherent statistical inferences that may be biased. Further these studies are unable to establish the causal direction of the relationship between financial deepening and economic growth.

Other studies use time series techniques. The use of these techniques can be traced back to Sims (1972) who tested the causality between income and money in the USA. In the last two decades multivariate techniques have been used to establish the long run relationship between financial deepening and economic growth and the direction of its causality. Among the studies that use time series techniques, we can highlight the following: Demetriades and Luintel (1996 and 1997), Akindoade (2000), Kularatne (2001) Unalmis (2002) and Boulila and Trabelsi (2003).

Demetriades and Luintel (1996 and 1997) conducted their empirical research for India. They conclude that a bi-directional causality exists between financial deepening and economic growth, and financial repression influences financial deepening independently of the real interest rate. Akinboade (2000) in an empirical study of the relationship between financial deepening and economic growth in Tanzania concludes that financial deepening and economic growth are causally independent. Further, he concludes that the relationship is negative and significant during the period of financial liberalization. Kularatne (2001) in an empirical study of the impact of financial deepening on long-run economic growth, in South Africa, applying a VECM structure, asserts that financial deepening, i.e., improved financial intermediation and increased liquidity, promotes economic growth. In this study data limitations did not allow the establishment of the causality between financial

deepening and economic growth. Deren Unalmis (2002) in a study that investigates the direction of the causal relationship between financial deepening and economic growth, in Turkey, asserts that the causality runs from financial deepening to financial growth, in the short-run and in the long-run the tests show two-way causality. Boulila and Trabelsi (2003) use time series techniques to study the issue of causality, using data for a sample of 16 MENA countries. They find that causality runs from the real to the financial sector.

In summary, the evidence from the empirical literature remains largely mixed. From the literature review one can conclude that the issue of the direction of causality between financial liberalization and economic growth can only be clarified by additional empirical research. A summary of some papers using different technique approaches and the corresponding results are summarized in the Appendix – Tables 1 to 3.

5. Data

Assembling an accurate, consistent and appropriate data set for macroeconomic time-series in a country like Mozambique can be frustrating. Furthermore, the available data sets are not long enough to allow a very long-run time series analysis. The data available for Mozambique starts in 1980, which has permitted us a sample of 24 years, not long enough but permitting, under the circumstances, some interesting conclusions.

Economic growth and financial deepening and are characterized by several dimensions and have traditionally been measured by different proxies. Following the theoretical model of Mckinnon and Shaw (1973), we use the domestic real rate of interest **(IR)** as a variable to measure the effect of financial repression. And following the work of Akinboade (2000) we proxy Economic Development through the Real GDP per Capita, measured in domestic currency, Metical - **(ED**); and as proxy of Financial Deepening - the ratio of Bank Deposit Liabilities per capita, which provides information on the extent of financial intermediation and the savings level in the economy **(FD)**; Additionally, we also use the international interest rate **(IRI)** to measure the impact of globalization on the economy. For statistical reasons, all

variables are transformed into natural logarithms, except the real rate of interest **(IR**) and the international rate of interest **(IRI).**

Annual reports of the Bank of Mozambique were used as the data source for Consumer Price Index (CPI) and the Nominal Gross Domestic Product (GDP). The IMF – International Financial Statistics and World Economic Database web site was used as the data source for Population, Bank Deposits Liabilities and International rate of Interest (US six months LIBOR). Descriptive statistics, graphical visualization and histograms of all variables, can be seen in the appendix – table 8 and graphs 1 to 8.

6. Methodology and empirical analysis

The empirical analysis encompasses unit root tests, cointegration and VECM estimation, weak exogeneity tests and finally Granger-causality tests are used.

6.1 Unit Root - ADF Tests

To start with, we investigate the time series properties of the variables used in this study. Performing regression analysis using non-stationary time series variables may invalidate the standard econometric tests and lead to spurious results, causing unreliable correlations within the regression analysis (Granger and Newbold, 1974). The stationary property of individual time series can be examined by Augmented Dick-Fuller (ADF) tests.

The standard Dick-Fuller (DF) test is carried out by estimating equation

$$y_t = py_{t-1} + \varepsilon_t \qquad 6.1.1$$

where yt is the variable of interest, t is the time index, p is a coefficient and ε_t is the error term. After subtracting y_{t-1} from both sides of the equation,

$$\Delta y_t = \alpha y_{t-1} + \mu t \qquad 6.1.2$$

Where: $\alpha = p - 1$ The null and alternative hypotheses may be written as

$$H0 : \alpha = 0$$
$$H1 : \alpha < 0$$

And evaluated, using the conventional *t*-ratio for:

$$t\alpha = \hat{\alpha}/(se(\hat{\alpha})) \qquad 6.1.3$$

Where: $\hat{\alpha}$ is the estimate of α and $se(\hat{\alpha})$ is the coefficient standard error.

Dickey and Fuller (1979) show that under the null hypothesis of a unit root, this statistic does not follow the conventional Student's t-distribution, and they derive asymptotic results and simulate critical values for various test and sample sizes. More recently, McKinnon implemented a much larger set of simulations than those tabulated by Dickey and Fuller. In addition, McKinnon estimates response surfaces for the simulation results, permitting the calculation of Dickey-Fuller critical values for arbitrary sample sizes.

The simple Dickey-Fuller unit root test described above is valid only if the series is an AR (1) process. If the series is correlated at higher order lags, the assumption of white noise disturbances ε_t is violated. The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the *y* series follows an AR (*p*) process and adding *p* lagged difference terms of the dependent variable *y* to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + x'_t\delta + \beta_1\Delta y_{t-1} + \beta_2\Delta y_{t-2} + \ldots + \beta_p\Delta y_{t-p} + \mu t \qquad 6.1.4$$

This augmented specification is then used to test $H1: \alpha < 0$ using the *t*-ratio $t\alpha = \hat{\alpha}/(se(\hat{\alpha}))$. An important result obtained by Fuller is that the asymptotic distribution of the *t*-ratio for α is independent of the number of lagged first differences included in the ADF regression. Moreover, while the assumption that *y* follows an autoregressive (AR) process may seem restrictive, Said and Dickey (1984) demonstrate that the ADF test is asymptotically valid in the presence of a moving average (MA) component, provided that sufficient lagged difference terms are included in the test regression.

Thus, we check the occurrence for the stationary condition of our variables by comparing ADF statistics (t-statistics) obtained, with the McKinnon (1996) critical values. For the case of stationarity, we expect that the ADF statistic to be larger than the McKinnon critical values in absolute value and that it has a minus sign.

The null hypothesis is that the serie is non-stationary (has unit root) against the alternative hypothesis that the series is stationary. The AdF and PP tests where performed. The results are shown in Table 4. Examining the results we see that the null hypothesis cannot be rejected for all variables in the level form. But inversely, for the first differences of all variables, the null hypothesis of a unit root is strongly rejected at 1% level for ED, IR and IRI variables with no constant and no trend, and FD is rejected at 5% level with constant. However, the t-stat value of the variable IR in level is higher, in absolute terms, than the McKinnon critical value for 10% level, which suggests stationarity. Thus we run the PP test to try to clarify this issue. The PP test also indicates that we reject, at 10% level, the null hypotheses of unit root in level, with constant and with constant and trend. But the critical value for IR with no constant and no trend is higher, in absolute terms, than the McKinnon critical value at 1%. Consequently, the behavior of the variable IR is dubious. Nevertheless, as de ADF tests in level show no signs of stationarity for IR with constant and with constant and trend, we presume that the variable is not stationary in level.

As a result we accept that all variables contain a unit root in their level form but are stationary in their first differences, thus enabling us to test for cointegration.

6.2 Cointegration and VECM estimation

Being the variables stationary in first level, we now examine, using time series techniques, if they are cointegrated or not, in order to evaluate if there exists some linear combination of these variables that converges to a long run relationship over time. This study adopts the Johansen multivariate cointegration method (Johansen 1988, 1991, Johansen and Juselius 1990), on the basis of a VAR model.

Consider a vector Y_τ with ***n*** non-stationary variables of interest, defined by a general polynomial distributed lag process given as:

$$Y_t = A_1 Y_{t-1} + \ldots + A_\kappa Y_{t-\kappa} + \varepsilon_t \qquad 6.2.1$$

Where $t = 1,\ldots,T$, and ε_t is a vector of innovations. This is called a Vector Autoregressive (VAR). The VAR can be rewritten as:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{k-1} \Gamma \Delta Y_{t-i} + E_t \qquad 6.2.2$$

where

$$\prod = \sum_{i=1}^{k} A_i - I \quad \text{and} \quad \Gamma_i = -\sum_{j=i+1}^{k} A_j \qquad 6.2.3$$

And I is a ***n*** **x** ***n*** identity matrix. The above model is the Vector Error Correction Model (VECM) and contains information on both the short-run and long-run adjustments to changes in $\boldsymbol{Y_t}$ via de estimates of **Γ** and **Π,** respectively. The number of distinct cointegrating factors that exists among the variables of $\boldsymbol{Y_t}$, ***r***, is given by the rank of **Π.** The matrix **Π** can be factorized as two matrices, ***α*** and ***β***, such that:

$$\Pi = \alpha\beta' \qquad 6.2.4$$

and ***β'***y_t is I(0). *r* is the number of cointegrating relations (the rank) and each column of ***β*** is the cointegrating vector. The elements of ***α*** represent the speed of adjustment to disequilibrium, and ***β*** is a matrix of long-run coefficients. The existence of long-run relationships indicates that, although $\boldsymbol{Y_t}$ is non-stationary, the linear combinations of $\boldsymbol{\beta' Y_t}$ are indeed stationary, and hence the columns of ***β*** form ***r*** distinct cointegrating vectors.

The Johansen method estimates the **Π** matrix from an unrestricted VAR and test whether we can reject the restrictions implied by the reduced rank of **Π.** Following Gonzalo (1994), we can express that this method performs better than other estimation methods, even when the error are non normal distributed and the model is overparametrized by including additional lags in the Error Correction Model (ECM).

Before performing this test we have to determine the number of lags using a VAR system and make a choice on different deterministic trend paths for the data.

Thus we first determine the lag length of the unrestricted VAR and choose the deterministic trend path for the data, using AIC criterion. The tests with lower AIC determine the choice of the lag order and the path of deterministic trend. The model

with lag order 1 is chosen to check our econometric model for the cointegration specification. From the five deterministic trend assumptions for the test that are standard in Eviews, we choose the one that best fits the cointegration equation, which is the one with the intercept and no trend.

To detect the number of cointegrating vectors, ***r***, which is an indicator of the extent of integration among the variables, two types of tests, the trace statistic and the maximum eigen-value statistic, are used. The maximum eigen-value test the null hypothesis of *r* versus the alternative hypothesis of *r*+1 cointegrating relationships and trace test for the null hypothesis of r cointegrating relations against the alternative of k cointegrating relations, for r = 0,1,…,k-1, where k is the number of endogenous variables, to find the number of cointegrating relationships. If at least one cointegration vector exists, it indicates that there is a long run relationship among the variables in the model.

Thus the Johansen's cointegration rank test, which is appropriate for multivariate models, is performed. Once the optimal lag number was defined and a choice on different deterministic trend paths for the data was made, it is necessary to compute the eigen values $\boldsymbol{\lambda}$ of the $\boldsymbol{\Pi}$ matrix in order to obtain the number of distinct cointegrating vectors, by checking the significance level of the $\boldsymbol{\lambda}$. Indeed, the number of $\boldsymbol{\lambda_{is}}$ statistically different from zero will give exactly the number of cointegrating vectors. Both the Maximum Eigenvalue and the Trace test suggest that there is a unique cointegrating vector (see table 5 in appendix).

To summarize, the cointegration test results imply that there is a long-run relationship between financial deepening and economic growth.

6.3 Weak exogeneity tests

By running weak exogeneity tests on the cointegrated function we can determine in which way the causality is observed. The concept of weak exogeneity has been analyzed and elaborated in an influential article of Engle, Hendry and Richard (1983).

Testing the significance of the loading coefficient (adjustment parameters) is typical for modeling the feedback mechanisms in cointegrated VAR models. These significance tests are often called weak exogeneity tests, because certain sets of zero restrictions imply long-run weak exogeneity with respect to the cointegration parameters. The concept of weak exogeneity was defined by Engle, Hendry & Richard (1983) and is closely related to testing the feedback (loading) coefficients. If all but one variable in a system are weakly exogenous, then efficient inference about the cointegration parameters can be conducted in a single equation framework. Choosing valid (weak exogeneity) restrictions is of major importance, because policy implications are sometimes based on the short-run adjustment structure (see e.g. Hendry and Juselius (2001)).

Long-run weak exogeneity refers to the hypothesis that a variable influences the long run development of other variables in the system, but is not influenced by them. Weak exogeneity testing implies a null restriction on the long-term component in the marginal process for ED, FD, IR and IRI.

For the weak exogeneity test, we examine whether the *i-th* row of the short run adjustment matrix is all zero for the null hypothesis of being weak exogeneity. In this case, the *i-th* endogenous variable is said to be exogenous with respect to the cointegrating vector parameters. If the null hypothesis is not rejected, cointegrating relationships does nor feed back onto that variable. Also for the long run cointegrating vector, we apply the restrictions for the long run parameters. Since we have found one cointegrating relationship, the tests are carried out under the assumption of rank 1.

Our results indicate that the variables FD and IR are weakly exogenous. Being ‘weakly exogenous’ means that they have a long run impact and are causing economic development. We also tested the exclusion of these two variables together and found

the same result, i.e., they are jointly weakly exogenous. The results of theses tests for the cointegrating equation can be seen in Table 6.

6.4 Granger causality tests

Finally we also test the causality relations using Granger causality test, which is defined as:

x_t is said to does not Granger-cause y_t, if

$$\mathrm{E}(y_{t+h} \mid \Omega t) = \mathrm{E}(y_{t+h} \mid \Omega t - x_t) \qquad 6.4.1$$

In other words, x_t is said to not Granger-cause y_t if x cannot help predict future y. A necessary and sufficient condition for variable k does not Granger-cause variable j is that $Ó_{jk,\mathrm{i}} = 0$, for i = 1,2, ⋯.

For a bivariate system, y_t, x_t defined by:

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} A_{11}(B) A_{12}(B) \\ A_{21}(B) A_{22}(B) \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} u_{yt} \\ u_{xt} \end{bmatrix} = \begin{bmatrix} \Phi_{11}(B)\Phi_{12}(B) \\ \Phi_{12}(B)\Phi_{12}(B) \end{bmatrix} \begin{bmatrix} u_{yt-1} \\ u_{xt-1} \end{bmatrix} + \begin{bmatrix} u_{yt} \\ u_{xt} \end{bmatrix} \qquad 6.4.2$$

x_t, does not Granger-cause y_t if $\Phi_{12}(B) = 0$, or $\Phi_{12,i} = 0$, for i = 1,2, ⋯. This condition is equivalent to $A_{12,i} = 0$, for i = 1,2,⋯, p. In other words, this corresponds to the restrictions that all cross-lags coefficients are all zeros, which can be tested by Wald statistics.

Determining the causal direction for bivariate system; for ease of illustration, we shall focus upon bivariate AR (1) process so that $\mathrm{A}_{ij}(\mathrm{B}) = \mathrm{A}_{ij}$, i, j = 1,2 as defined above. The results can be easily generalized to AR (p) case. Four possible causal directions between x and y are:

1. Feedback, H_0, $x \leftrightarrow$ y

$$\mathrm{H}_0 = \begin{pmatrix} A_{11} A_{12} \\ A_{21} A_{22} \end{pmatrix}$$

2. Independent, H_1, $x \perp$y

$$H_1 = \begin{pmatrix} A_{11} 0 \\ 0 A_{22} \end{pmatrix}$$

3. x causes y but y does not cause x, H_2, $y \not\rightarrow x$

$$H_2 = \begin{pmatrix} A_{11} A_{12} \\ 0 A_{22} \end{pmatrix}$$

4. y causes x but x does not cause y, H3, $x \not\rightarrow y$

$$H_3 = \begin{pmatrix} A_{11} 0 \\ A_{21} A_{22} \end{pmatrix}$$

To test for evidence of causality between the variables we use this Granger Causality Test. When the variables are cointegrated, Granger causality is equivalent to strong exogeneity. In a system of variables, a variable is said to be Granger-caused by another, if the second one helps in the prediction of the first one, or equivalently, if the coefficients on the lagged are statistically significant. Two-way causation is possible and frequent.

The results obtained (see table 7 in appendix) suggest that causality runs from Financial Deepening and International Interest Rate to Economic Development, being FD strongly exogenous to economic development and to IR and IRI strongly exogenous to ED. From the previous tests of weak exogeneity and from this Granger causality test, it seems now clear that financial deepening is causal of economic development. This can be interpreted as financial deepening helping to determine the prediction of economic growth.

The International Interest Rate Granger causes Economic Development, suggesting that the country is highly sensible to the international financial market. And Financial Deepening Granger causing Internal Rate of interest is an indicator that the McKinnon and Shaw complementary hypothesis is not verified in Mozambique.

7. Concluding remarks and policy implications

In this study we examine the causality between financial deepening and economic growth in Mozambique in a multivariate VAR structure for a sample

covering 24 observations from 1980 to 2003. The paper shows that there is a long-run relationship between financial deepening and economic growth. The results suggest that there are linkages between all variables: per capita income, financial depth, real interest rate and international interest rate. Our results also indicate that financial deepening and the interest rate have a long run impact on economic development independently and jointly.

More importantly it shows that the International Rate of Interest plays an important role on economic development. Being the International Interest Rate Granger causal of economic development, it suggests that the country is highly sensible to the international financial market. So strong legal protection to control the international monetary influxes and out-fluxes should be admissible in order to prevent speculative movements that could, otherwise, have a substantial negative impact on the economy. This is exactly the policy framework adopted by the country. Also Financial Deepening Granger causing Internal Rate of Interest is an indicator that the McKinnon and Shaw complementary hypothesis is not verified in Mozambique

Promoting and reinforcing financial liberalization, including the setting of the interest rate by the market forces are important politic guidelines in order to strengthen economic growth and contribute for the reduction of poverty. Nevertheless, good supervision controls and strong institutional framework is required in order to permit the Government to act promptly.

Our results highlight a number of potentially paths for further research. First, although a time series framework is an appropriate empirical approach to investigate the link between financial deepening and economic growth, a larger data set than the one that is available for Mozambique will be a prerequisite to generalize the results. Thus, it would be desirable to collect monthly data to further strengthen the findings of this study. Along the years to come annual data should also enable the accomplishment of this objective. Second, if additional variables such as domestic credit (separated by private and public) and investment per capita become available, then the influence of investment over GDP and the correlation between private and public credit over economic growth should be subject to a detailed analysis. Third, the analysis of the influence of the newly created stock market on the GDP per capita

level should also be useful. Fourth, it would also be desirable to undertake a comparative analysis of countries that have undergone through similar financial liberalization both in the present and in the past to assess the effectiveness of policy-making in similar settings. These are all fruitful areas for future research.

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Table 1

The following table summarizes several studies, using cross-country or panel data techniques approach, and the corresponding results:

Study	Data	Summary of findings
King & Levine (1993 a,b)	Cross-Country analyses on 80 countries	All measures of financial development were robustly correlated with future rates of economic growth
Levine and Zervos (1998)	Cross sectional sample of 77 countries	Measures of deepening in financial development have a positive and statistically significant relationship to growth in 3 dimensions: output growth, investment growth and productivity growth.
Demirguc, Kut & Maksimovic (1998)	Cross-Country analyses of 30 developed and developing countries	Active stock market and a well-developed legal system facilitate firm growth.
Beck, Levine and Loayza (2000)	Cross sectional study and dynamic panel techniques	Financial intermediaries exert a large, positive impact on total factor productivity growth, which feeds through to overall GDP growth. Strong, positive relationship between the level of financial intermediary development and long run economic growth is not due to simultaneity bias.

Table 2

The following table summarizes two studies, using firm level or industry level techniques approach, and the corresponding results:

Study	Data	Summary of findings
Rajan and Zingales (1998)	Firm Level and industry level analysis for a large sample of countries in a time series framework	Financial Development has a substantial influence on economic growth. Existence of a well-developed financial market in a country provides it with comparative advantage in those industries that are dependent on external finance.
Neusser and Kugler (1998)	Manufacturing sector analysis of OECD countries, using time series techniques.	Finance predicts growth. Financial sector development is cointegrated with manufacturing total factor productivity and manufacturing GDP, respectively. This study as the limitation of not establishing the direction of causality of financial development and economic growth.

The following tables summarize some studies done for individual countries, using time series techniques, and the corresponding results:

Table 3.1

Study	Data/Country	Variables	Method	Summary of findings
Demetriades and Luintel (1996)	Time series study conducted for **India**	. Investment per capita; . Ratio of Bank Deposits Liabilities to nominal GDP; . Real GDP per capita; . Real Interest Rate; . Dummies to measure interest rate controls. . Number of bank branches.	. Unrestricted Error Correction Model (UECM); . Exogeneity tests to demonstrate long run and short-run interactions between financial deepening and economic growth. . Chow tests of parameter stability;	. Deposit rates controls have a significant negative effect on financial deepening whilst a lending rate ceiling has a positive and significant effect. Direct credit programs have also a significant negative effect. . Banking sector controls in India had overwhelming negative effects on financial development, both in the short run and in the long run. . A bi-directional causality exists between financial deepening and economic growth
Demetriades and Luintel (1997)	Time series study conducted for **India** **(**32 annual observations**)**	. Index, constructed using principal components, measuring various types of interest rate controls; . Real interest rate; . Real GDP per capita; . Dummies to measure interest rate controls. . Number of bank branches.	. Unrestricted Error Correction Model (UECM); . Exogeneity tests to demonstrate long run and short-run interactions between financial deepening and economic growth.	. Repressionist policies influence financial deepening independently of the real rate of interest; . Direct effects of financial repression were negative and quite substantial over economic growth; . A bi-directional causality exists between financial deepening and economic growth

Table 3.2

Study	Nature of study	Variables	Methodology	Finding
Akinoboade (2000)	Time series study conducted for **Tanzania,** data set covering the **1966-1996** period.	. Real GDP p/ capita (a proxy for Economic Development); . Real Interest Rate; . DEP – ratio bank deposits liabilities/nominal GNP (a proxy for Financial Deepening); .	. Time series technique, using the Static Ordinary Least Squares (SOLS) and Dynamic Ordinary Least Squares (DOLS), to estimate the relationship between Financial Development and per capita income.	. Negative and significant relationship between financial deepening and economic growth during the overall period; Negative but insignificant relationship between financial deepening and economic growth during the period of financial repression; . The tests for causality suggest that financial development and economic growth are however independent in Tanzania. The rate of interest has a small and positive impact on financial depth during financial liberalization and a small but negative impact during financial repression.
Kularatne (2001)	Time series study conducted for **South Africa,** data set covering the **1954-92** period.	. Ratio of total private credit extension to GDP: . Stock market liquidity; . Real per capita GDP at factor costs; . Measure of investment rate; . Political instability index; . Real domestic short-term interest rate; . Ratio of real government consumption expenditure to real GDP.	. Vector Error Correction Model (VECM) structure;	. Both dimensions of the financial system (financial intermediation and securities) affect economic growth; . Financial system as an indirect effect on GDP via the investment rate; . Feedback effects exist between the real and financial sector.

Table 3.3

Study	Nature of study	Variables	Methodology	Finding
Unalmis (2002)	Time series study conducted for **Turkey,** data set covering the **1970-2001** period.	. Domestic credit as a ratio of GNP; . Private credit as a ratio of GNP; . Private credit as a share of domestic credit; . Broad money supply (M2) as a ratio of GNP; . Total deposits as a ratio of GNP; Change in per capita GNP at constant prices.	. Granger non-causality tests and Vector Error Correction Model (VECM)	. In the short run, causality runs from financial deepening to economic growth; in the long run, there is two-way causality between financial deepening and economic growth.
Boulila and Trabelsi (2003)	Time series study conducted for **16 MENA countries,** data set covering the **1960-2002** period.	. Ratio of M3 to GDP; . Ratio of credit allocated to the private sector; . Ratio o financial savings to GDP; . Real GDP per capita	.Bivariate VAR Structure; .Cointegration; .Granger causality; .Weak exogeneity.	The empirical results display strong evidence in favor of causality running from growth of GDP per capita to financial development, in many countries.

Table 4

Unit root tests (a,b,c)

	ADF Test			Phillips-Perron Tests		
Variables In Levels	Constant	Constant & Trend	None	Constant	Constant & Trend	None
ED	0.58(0)	-2,46(0)	1,27(0)	0,20(2)	-2,55(3)	1,00(2)
FD	-0,02(0)	-3,31(0)	0,31(0)	-0,14(2)	-1,86(3)	2,09(2)
IR	-1,87(1)	-2,98(1)	-1,82(1)***	-2,79(1)***	-3,62(3)***	-2,96(2)*
IRI	-1,64(5)	-2,07(5)	-1,32(5)	-1,38(6)	-2,11(6)	-2,44(6)**
Variables in 1st Diff	Constant	Constant & Trend	None	Constant	Constant & Trend	None
DED	-3,39(0)**	-4,14(0)**	-3,26(0)*	-3,36(1)**	-4,14(1)**	-3,22(1)*
DFD	-3,59(0)**	-3,46(0)***	-0,89(0)	-3,58(1)**	-3,44(1)***	-1,76(1)***
DIR	-6,95(0)*	-6,89(0)*	-7,12(0)*	-8,81(9)*	-11,25(13)*	-8,92(9)*
DIRI	-4,53(1)*	-3,34(1)**	-4,26(1)*	-4,51(1)*	-4,55(1)*	-4,09(1)*

a) For the McKinnon critical values, we consider %1, %5 and %10 level critical values for the null hypothesis of a unit root for both unit root tests.

b) The numbers in parenthesis are the lags used for the ADF stationary test augmented up to a maximum of 8 lags, and the automatic bandwidth using Newey-West bandwidth selection method. The choice of the optimum lag for the ADF test was decided on the basis of minimizing the SIC criterion. ADF is the augmented Dickey-Fuller test with critical values based on Mackinnon (1996). A significant test statistic indicates the rejection of the null hypothesis in favor of stationarity.

c) *, ** and ***, indicate the rejection of the null hypothesis of a unit root for the 1%, 5% and 10% level, respectively.

Table 5

Cointegration Rank Test

Series: EC, FD, IR, IRI

Lags interval (in first differences): 1 to 1

Trace Test-

Hypothesized No. Of CE(s)	EigValue	Trace Stat	5% Crit Value	1% Crit Value
none *(**)	0,80	57,92	47,21	54,46
At most 1	0,51	21,74	29,68	35,65
At most 2	0,22	6,02	15,41	20,04
At most 3	0,02	0,48	3,76	6,65

*(**) denotes rejection of the hypothesis at the 5% and 1% levels; Trace test indicates 1 cointegration equation at both 5 % and 1% level

Max Eigenvalue Test

Hypothesized No. Of CE(s)	EigValue	Max EigValue	5% Crit Value	1% Crit Value
None	0,80	36,19	27,07	32,24
At most 1	0,51	15,72	20,97	25,52
At most 2	0,22	5,54	14,07	18,63
At most 3	0,02	0,48	3,76	6,65

*(**) denotes rejection of the hypothesis at the 5% and 1% levels; Max-eigenvalue test indicates 1 cointegration equation at both 5 % and 1% levels

Both the Maximal Eigen Value and the Trace test suggest there is a unique Cointegrating Vector (CE).

Table 6

Weak Exogeneity Tests

Likelihood Ratio tests

Variable		LR Statistic	DF	Probability
ED	a(11)=0	11,47	1	0,00
FD	a(21)=0	0,59	1	0,44 (*)
IR	a(31)=0	3,62	1	0,06 (*)
IRI	a(41)=0	9,73	1	0,00
ED,IRI	a(11)=a(41)=0	13,98	2	0,00
FD,IR	a(21)=a(31)=0	3.66	2	0,16 (*)

a(ij)=0 means the *i-th* endogenous variable's adjustment coefficient (error correction term) in the *j-th* cointegrating relation equals zero. And b(ij)=0 means the *j-th* endogenous variable in the i-*th* cointegrating relation is zero. For the restrictions tests we considerer de 5% significance level.

(*) Indicates that variables FD and IR are weakly exogenous

Table 7

Granger causality Tests

Pairwise Granger Causality
Sample 1980 2003
Lags: 1

Null Hypothesis	Obs.	F-Stat.	Prob.
ED does not Granger Cause FD	22	1,36	0,28
FD does not Granger Cause ED		5,75	0,01
ED does not Granger Cause IR	22	6,06	0,01
IR does not Granger Cause ED		0,14	0,86
ED does not Granger Cause IRI	22	2,39	0,12
IRI does not Granger Cause ED		5,52	0,01
FD does not Granger Cause IR	22	3,43	0,06
IR does not Granger Cause FD		2,33	0,12
FD does not Granger Cause IRI	22	3,19	0,06
IRI does not Granger Cause FD		0,74	0,49
IR does not Granger Cause IRI	22	2,22	0,13
IRI does not Granger Cause IR		0,92	0,41

Table 8

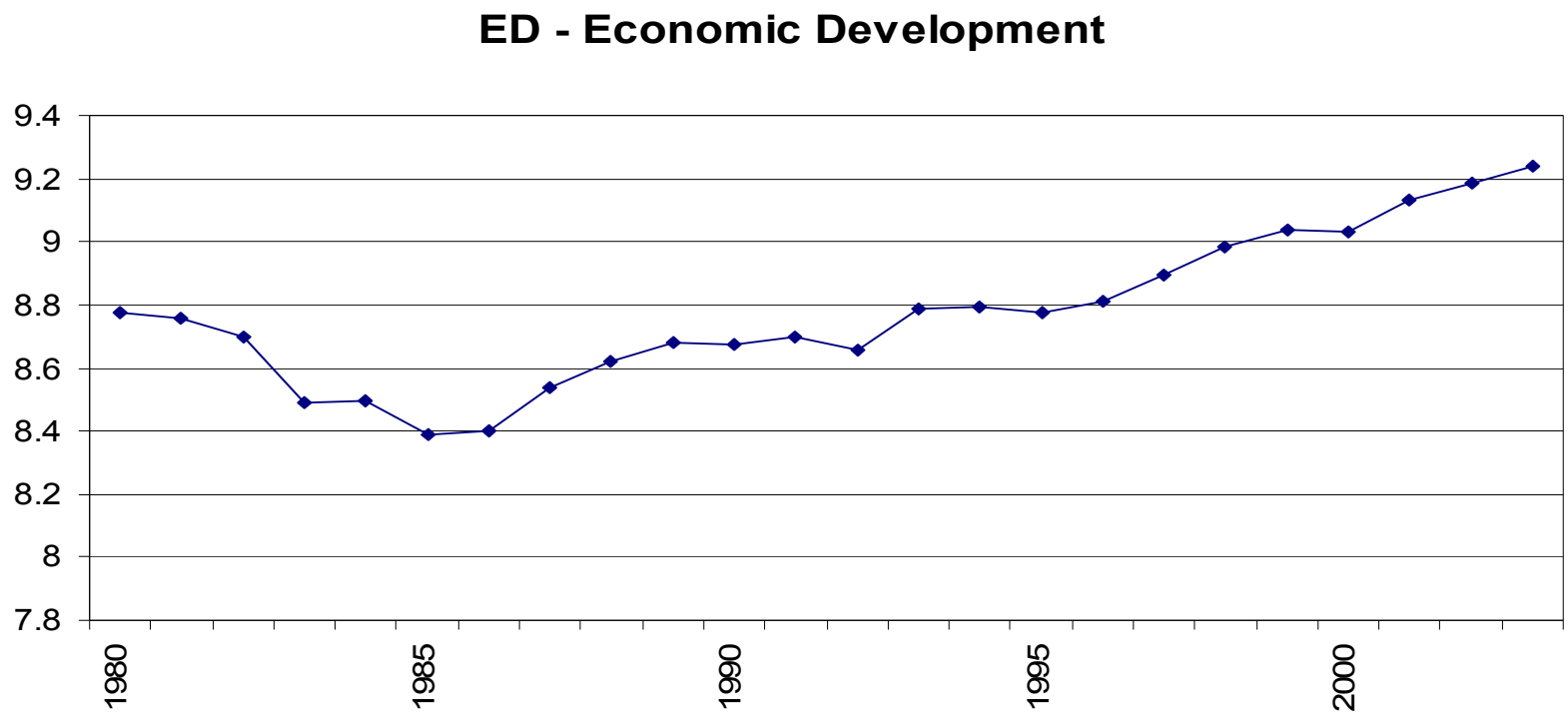
Descriptive statistics of all four variables:

	ED	FD	IR	IRI
Mean	8.77	1.44	-8.34	9.25
Median	8.76	1.66	-1.65	8.50
Maximum	9.23	2.71	28.40	18.50
Minimum.	8.38	0.18	-139.30	4.00
Std. Dev.	0.23	0.94	32.76	3.36
Skewness[1]	0.31	-0.09	-2.67	1.01
Kurtosis[2]	2.37	1.35	11.78	4.12
Jarque-Bera	0.79	2.75	105.81	5.38
Probability[3]	0.67	0.25	0.00	0.06
Observations	24	24	24	24

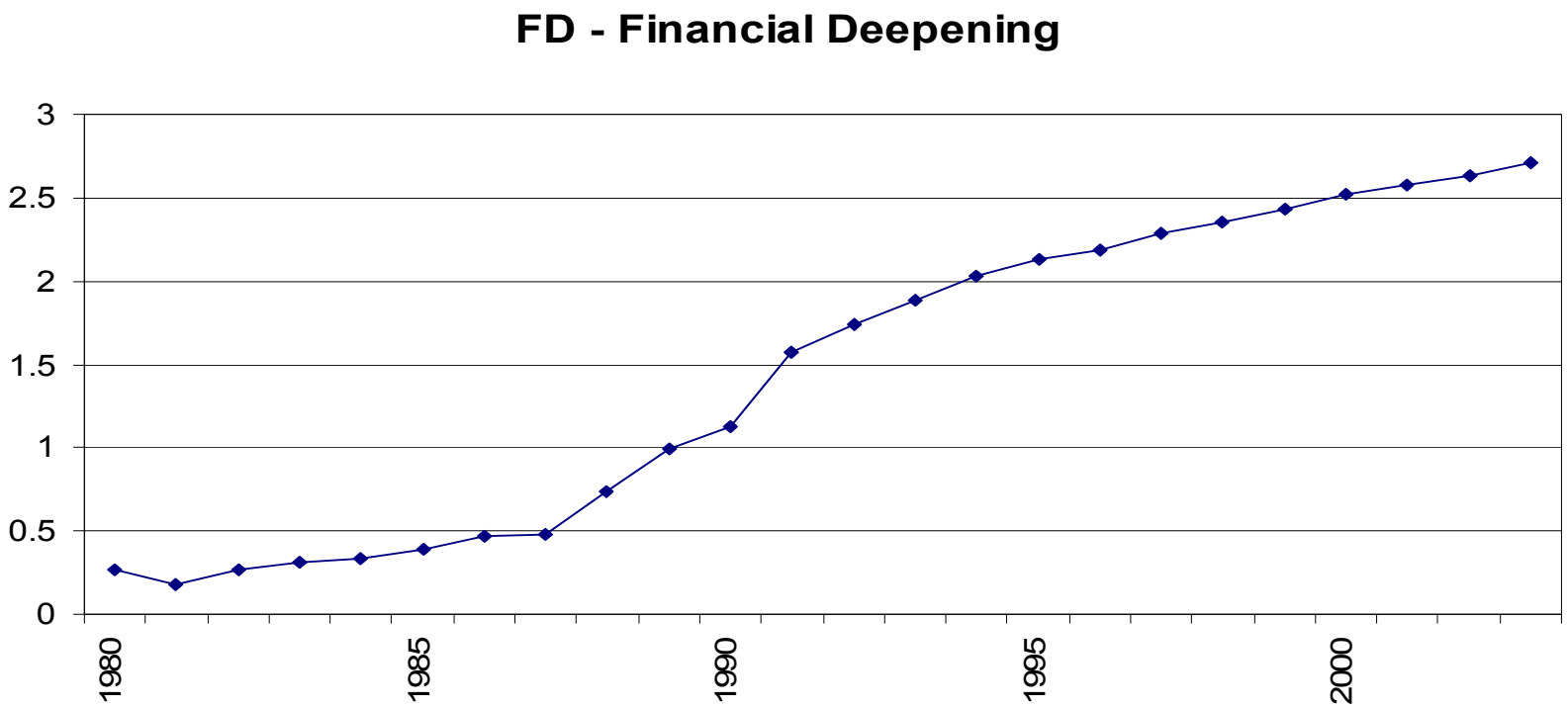
Based on the ***probability*** values of the variables, we reject normal distribution at the 1% significance level for IR and at the 10% significance level for IRI.

[1] The Skewness of a symmetric distribution, such as the normal distribution, is zero.
[2] The Kurtosis of a symmetric distribution, such as the normal distribution, is 3.
[3] Probability – the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis (H0: ~N), indicates that a small probability value leads to the rejection of the null hypothesis of a normal distribution.

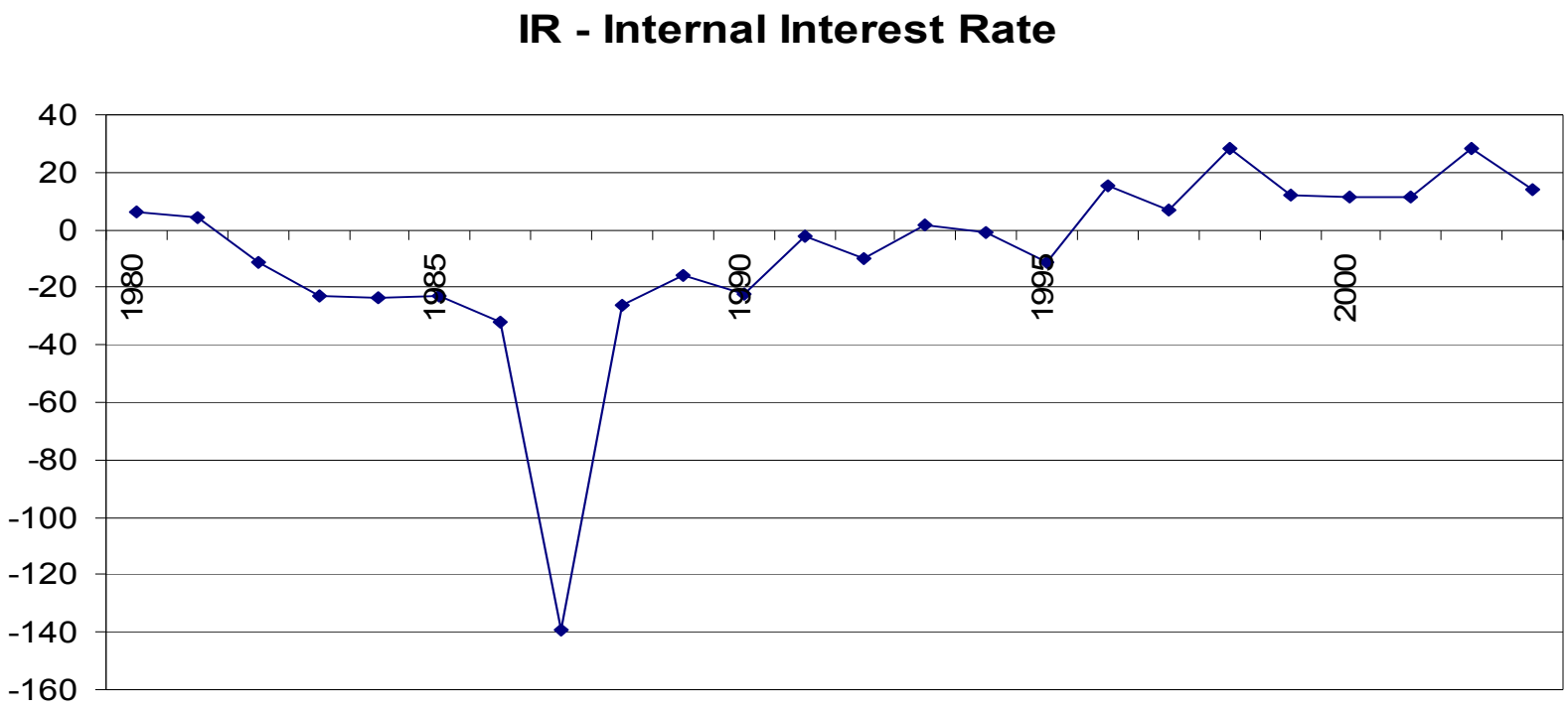
Graph 1 – ED – Economic Development



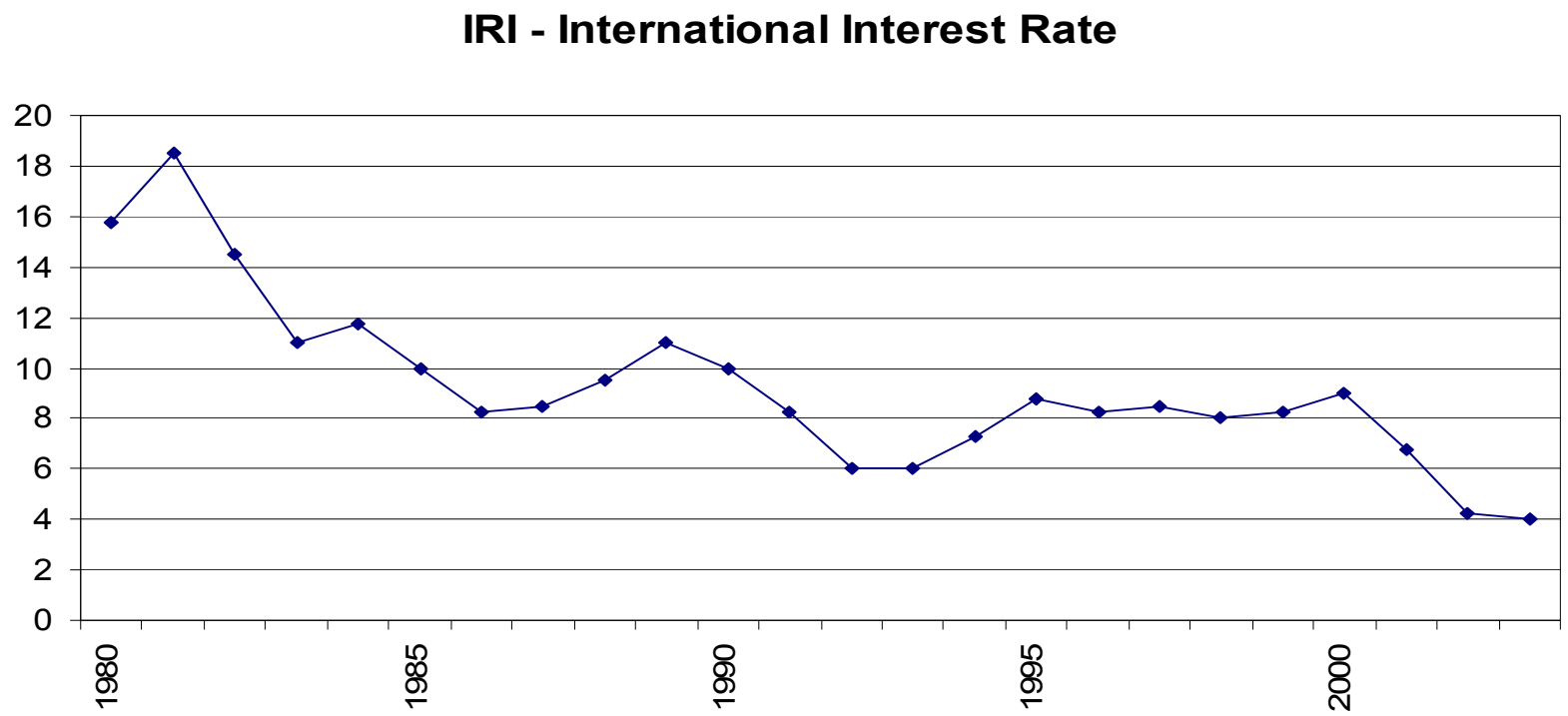
Graph 2 – FD – Financial Deepening



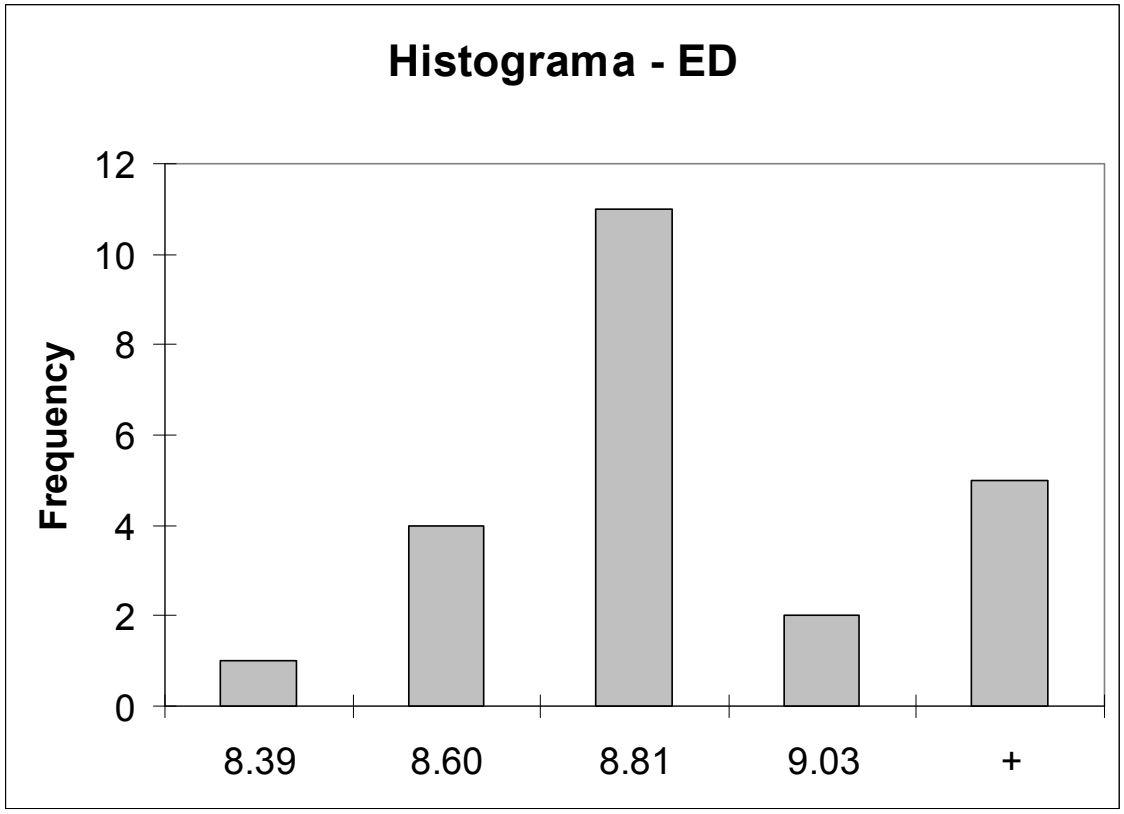
Graph 3 – IR -Internal Interest Rate



Graph 4 – IRI -International Interest Rate

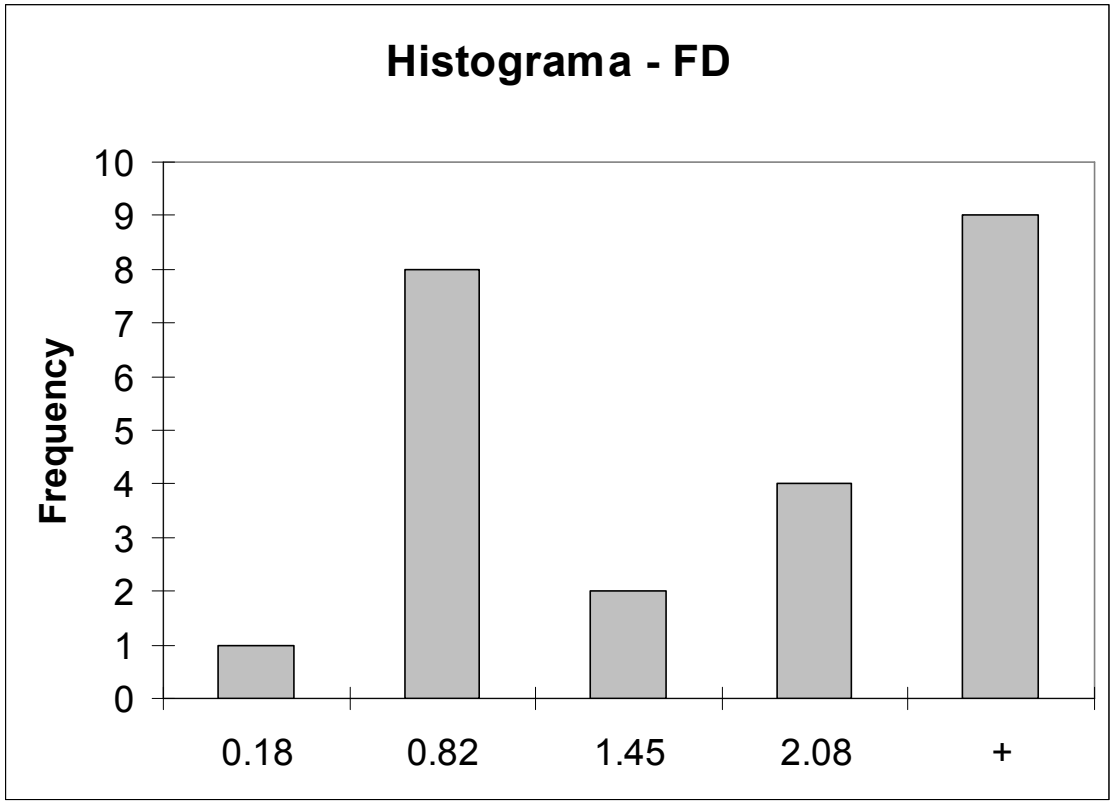


Graph 5 - Histogram and descriptive statistics of Economic Development (ED):



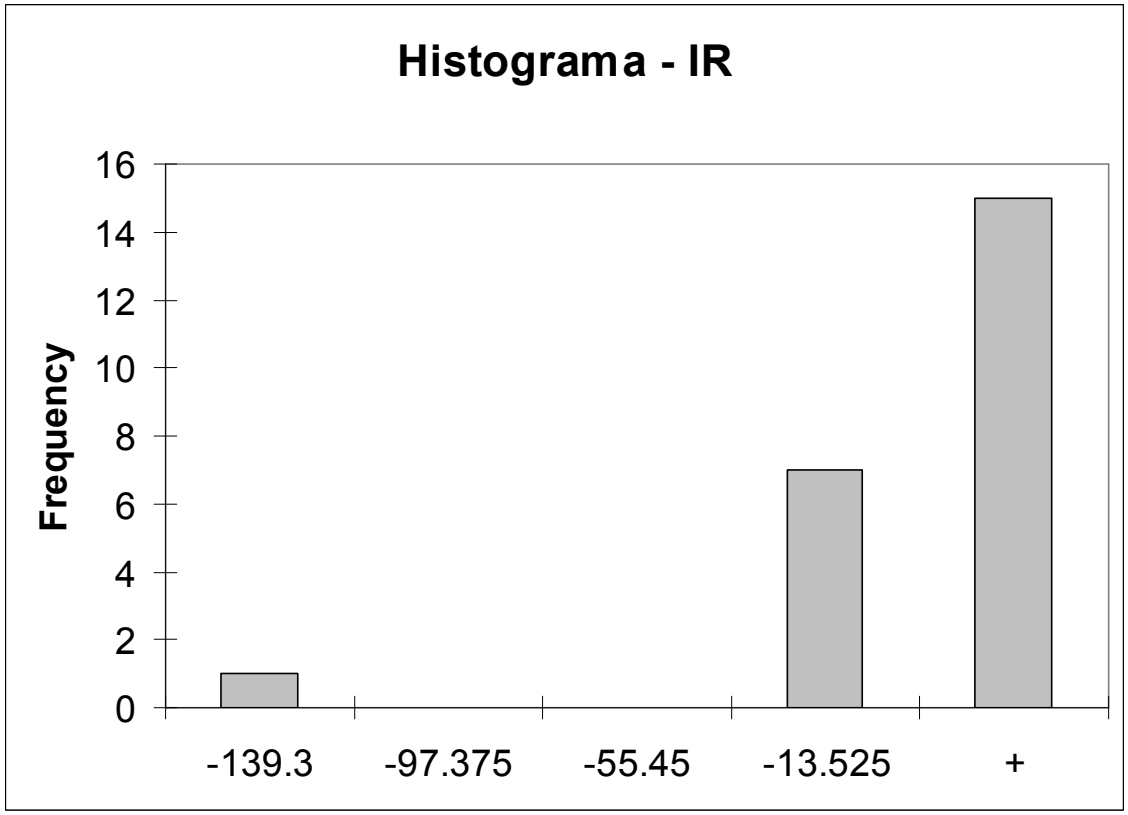
Series:	ED
Sample:	1980 : 2003
Observ.:	24
Mean	8.77
Median	8.76
Maximum	9.24
Minimum	8.39
Std. Dev.	0.24
Skewness	0.32
Kurtosis	2.37
Jarque-Bera	0.79
Probability	0,67

Graph 6 - Histogram and descriptive statistics of Financial Deepening (FD):



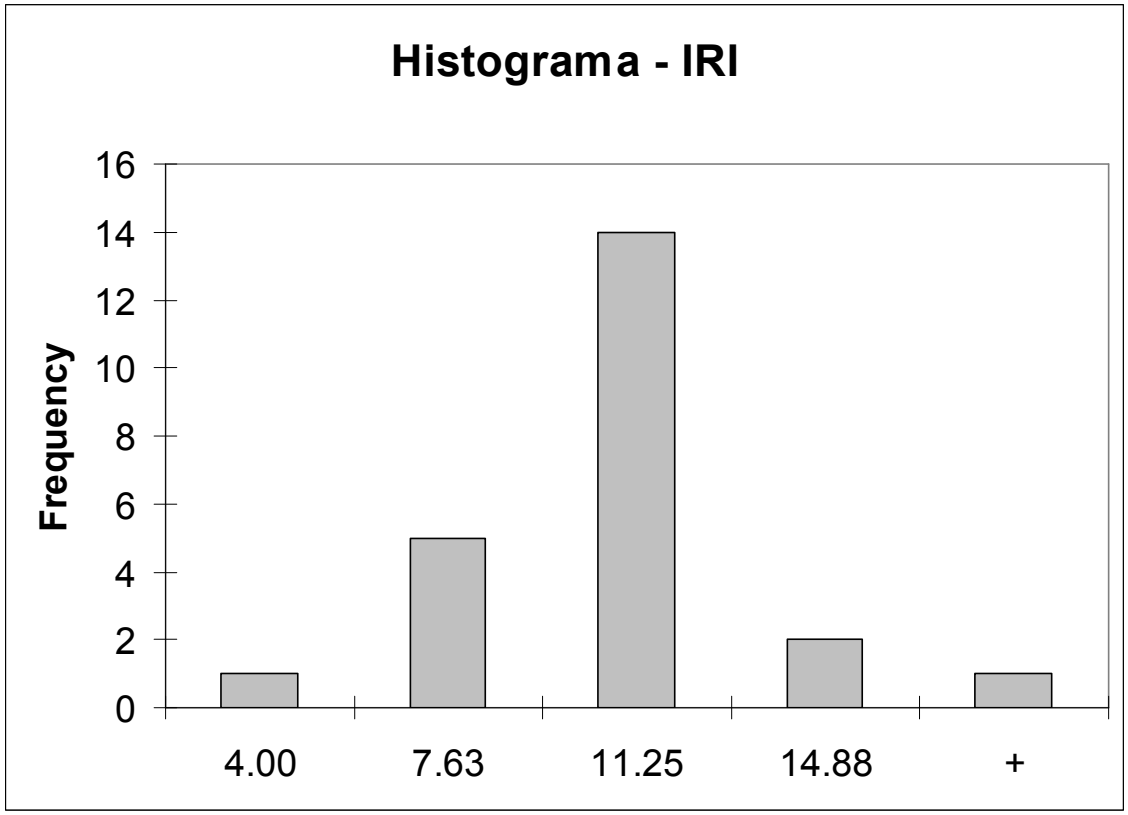
Series:	FD
Sample:	1980 : 2003
Observ.:	24
Mean	1.44
Median	1.66
Maximum	2.71
Minimum	0.18
Std. Dev.	0.94
Skewness	-0.09
Kurtosis	1.35
Jarque-Bera	2.75
Probability	0.25

Graph 7 - Histogram and descriptive statistics of Internal Rate of Interest (IR):



Series:	IR
Sample:	1980 : 2003
Observ.:	24
Mean	-8.34
Median	-1.65
Maximum	28.40
Minimum	-139.30
Std. Dev.	32.77
Skewness	-2.68
Kurtosis	11.78
Jarque-Bera	105.82
Probability	0,00

Graph 8 - Histogram and descriptive statistics of International Rate of Interest (IRI):



Series:	IRI
Sample:	1980 : 2003
Observ.:	24
Mean	9,25
Median	8,50
Maximum	18,50
Minimum	4,00
Std. Dev.	3,36
Skewness	1,02
Kurtosis	4,12
Jarque-Bera	5,39
Probability	0,07