

FINANCIAL, ECONOMIC, BANKING SECTOR AND INSTITUTIONAL DEVELOPMENT AND PRODUCTIVITY

The Institute of Economics and Social Sciences
of
Bilkent University

by
GÖKÇE ÖZCAN

145722

In Partial Fulfillment of the Requirements for the Degree
of
MASTER OF ARTS
in
THE DEPARTMENT OF ECONOMICS
BILKENT UNIVERSITY
ANKARA
November 2004

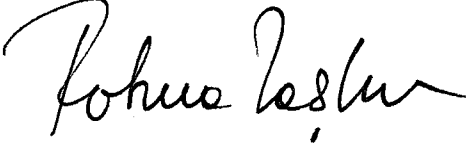
To my family



I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Associate Professor Fatma Taşkın

Supervisor



I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

Assistant Professor Ümit Özlale

Examining Committee Member



I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

Assistant Professor Zeynep Önder

Examining Committee Member



Approval of the Institute of Economics and Social Sciences

Professor Erdal Erel

Director



ABSTRACT

FINANCIAL, ECONOMIC, BANKING SECTOR AND INSTITUTIONAL DEVELOPMENT AND PRODUCTIVITY

Özcan, Gökçe

Masters of Arts, Department of Economics

Supervisor: Fatma Taşkın

November 2004

This thesis explores the links between Malmquist Productivity Index (and its two components, namely efficiency change and technological change) and the banking sector, economic, financial development and institutional variables. Results show that there is a positive link between the banking, economic and financial variables and the productivity indexes. Also, data show that cross-country differences in legal and accounting systems play significant role in the improvement of the productivity indexes- Malmquist Index and its two components, efficiency change and technical change.

Keywords: Productivity, Malmquist Index

ÖZET

FINANSAL, EKONOMİK, BANKACILIK SEKTÖREL VE KURUMSAL GELİŞİM VE ÜRETKENLİK

Özcan, Gökçe

Mastır, İktisat Bölümü

Tez Yöneticisi: Fatma Taşkın

Eylül 2004

Bu tez, Malmquist Üretkenlik Göstergesi (ve bu göstergenin iki bileşeni olan verimlilik değişimi ve teknolojik değişim) ile bankacılık sektörü, ekonomik, finansal ve kurumsal değişimin arasındaki ilişkiyi incelemektedir. Sonuçlar göstermiştir ki, bankacılık, ekonomik, finansal ve de kurumsal değişkenler ile bu üretkenlik göstergeleri arasında pozitif bir ilişki vardır. Ayrıca, veriler ülkeler arası kanuni ve muhasebe sistemleri arasındaki farkların bu üretkenlik göstergelerinin gelişiminde belirgin bir rol oynadığını sergilemiştir.

Anahtar Kelimeler: Üretkenlik, Malmquist Göstergesi

ACKNOWLEDGEMENTS

Although this thesis is the output of my studies at Bilkent University Economics Department Graduate Program, it is certain that all my previous education helped in some ways to complete this thesis. Therefore, I would like to thank everybody who has had a contribution in this journey; my teachers, my friends, and especially to my family for their endless support.

However, if I have to name one person to acknowledge here, that would definitely be Fatma Taşkın, my supervisor in this study. Her assistance and support - both academically and personally- have been the most important factor for me to finish this thesis and get my degree. I consider myself very lucky since I have had the chance to work with her and get to know her.

CONTENTS

1	CHAPTER 1 - INTRODUCTION	1
1.1	Supporters of the View	1
1.2	Supporters of the Opposing View	2
1.3	Purpose of the Paper	3
2	CHAPTER 2 - MALMQUIST PRODUCTIVITY INDEX	4
2.1	Description of Malmquist Productivity Index	4
2.2	Calculation of Malmquist Productivity Index	7
3	CHAPTER 3 - DATA AND METHODOLOGY	9
4	CHAPTER 4 - DESCRIPTION OF THE VARIABLES	11
4.1	Banking Development Variables	11
4.1.1	Claims on Governments (<i>claimgov</i>)	11
4.1.2	Claims on Private Sector (<i>claimpriv</i>)	12
4.1.3	Domestic Credit Provided by Banking Sector (<i>dcredbybank</i>)	12
4.1.4	Domestic Credit Growth Rate (<i>dcredgrwrate</i>)	12
4.1.5	Financing From Abroad (<i>finabroad</i>)	12
4.1.6	Gross Private Capital Flows (<i>grprcapflow</i>)	13
4.1.7	Liquid Liabilities (<i>liquid</i>)	13
4.1.8	Credit to Private Sector (<i>privcred</i>)	13
4.1.9	Total Domestic Financing (<i>totaldomfin</i>)	14
4.2	Economic Variables	14
4.2.1	Total Central Government Debt (<i>centgovdebt</i>)	14
4.2.2	Foreign Direct Investment, Net Inflows - % of GDP (<i>fordin-</i> <i>flow</i>)	15

4.2.3	Foreign Direct Investment, Net Inflows (<i>fdirirascap</i>)	15
4.2.4	Gross Capital Formation Growth (<i>gcapfgrowth</i>)	15
4.2.5	GDP Growth (<i>gdpgrowth</i>)	16
4.2.6	Gross Capital Formation (<i>grocapform</i>)	16
4.2.7	Inflation, Consumer Prices (<i>infconsprice</i>)	17
4.2.8	Inflation, GDP Deflator (<i>infgdpdeflator</i>)	17
4.2.9	Initial Per Capita Income (<i>initpcinc</i>)	17
4.2.10	Openness (<i>openness</i>)	17
4.2.11	Per Capita GNP Growth (<i>pcgnpgrowth</i>)	17
4.2.12	Real Interest Rate (%) (<i>realintrate</i>)	18
4.2.13	Tax Revenue (<i>taxrevenue</i>)	18
4.2.14	Unemployment (<i>unemployment</i>)	18
4.3	Financial Sector Variables	18
4.3.1	Listed Domestic Companies (<i>lisdomcomp</i>)	19
4.3.2	Market Capitalization of Listed Companies (<i>marketcap</i>)	19
4.3.3	Portfolio Investment, Bonds (<i>portinxbonds</i>)	19
4.3.4	Portfolio Investment, Equity (<i>portinxequity</i>)	19
4.3.5	Stocks Traded, Turnover Ratio (<i>turnover</i>)	19
4.3.6	Stocks Traded, Total Value (<i>valuetraded</i>)	20
4.4	Institutional Variables	20
4.4.1	Accounting Standards (<i>account</i>)	21
4.4.2	Creditor Rights (<i>creditor</i>)	22
4.4.3	Enforcement (<i>enforce</i>)	22
4.4.4	Education Coefficient of Efficiency (<i>edueffcoef</i>)	23
4.4.5	Illiteracy Rate, Adult Total (<i>illiteracy</i>)	23
4.4.6	Research and Development Expenditure (<i>research</i>)	23
5	CHAPTER 5 - EMPIRICAL RESULTS	25
5.1	Malmquist Index Values	25
5.2	Estimations	27

5.3	Single Variable Estimations	28
5.3.1	Malmquist Index Single Variable Estimation Results . . .	29
5.3.2	Efficiency Change Single Variable Estimation Results . . .	30
5.3.3	Technical Change Single Variable Estimation Results . . .	31
5.4	Multi-Variable Estimations	32
5.4.1	Malmquist Index Multi Variable Estimation Results	33
5.4.2	Efficiency Change Multi Variable Estimation Results . . .	34
5.4.3	Technical Change Multi Variable Estimation Results . . .	35
6	CHAPTER 6 - ESTIMATION OUTPUTS	38
6.1	Malmquist Index Single Variable Estimation	38
6.2	Efficiency Change Single Variable Estimation	39
6.3	Technical Change Single Variable Estimation	41
6.4	Malmquist Index Multi-Variable Estimation	42
6.5	Efficiency Change Multi-Variable Estimation	44
6.6	Technical Change Multi-Variable Estimation	45
7	CHAPTER 7 - CONCLUSION	47
8	BIBLIOGRAPHY	49

1 INTRODUCTION

Relationship between better functioning financial structure - the mix of financial contracts, markets and institutions- and economic growth has been subject to many research papers. Do well functioning financial structure (stock markets, banks, legal environment) promote long-run growth? Economists hold different opinions regarding the importance of the financial structure for economic growth. Researchers who claim that well functioning financial structure promote long-run growth argue that with the help of debt contracts and financial intermediaries, economic agents ameliorate the economic consequences of informational asymmetries and they provide proper resource allocation. On the other hand, researchers who claim that finance is a relatively unimportant factor in economic development argue that higher returns from better resource allocation may depress saving rates enough such that overall growth rates actually slow with enhanced financial development.

1.1 Supporters of the View

Hamilton (1789) argued that "banks were the happiest engines that ever were invented" for spurring economic growth. Schumpeter (1912) argues that financial intermediaries are essential for technological innovation and economic development since they help mobilizing savings, evaluating projects, monitoring managers, managing risks, and facilitating transactions. Schumpeter (1912) also states that well-functioning banks spur technological innovation by identifying and funding the entrepreneurs with the best chances of successfully implementing innovative products and production processes. Bagehot (1873) and Hicks (1969) say that financial system played a crucial role in igniting industrialization in England by facilitating the mobilization of capital for "immense works". Goldsmith

(1969) and McKinnon (1973) empirically show the close relationship between financial and economic development for a few countries.

Besides the historical focus on banking, there is an expanding theoretical literature on the links between stock markets and long-run growth. Levine (1991) and Bencivenga (1991) et al. show models where more liquid stock markets decrease the propensity not to invest in long-duration projects because investors can sell their stocks before the project matures if they need their savings. Therefore, liquidity facilitates investment in longer-run, higher-return projects that boost productivity growth.

Similar consequences are obtained by Devereux (1994) et al. and Obstfeld (1994) about stock markets in the existence of greater international risk sharing through internationally integrated stock markets. Greater international risk sharing induces a portfolio shift from safe, low-return investments to high-return investments, thereby accelerating productivity growth.

1.2 Supporters of the Opposing View

In contrast to the idea that financial structure and economic growth are linked, there is support for the opposing view that finance is a relatively unimportant factor in economic development.

Adams (1819) states that banks harm the "morality, tranquility, and even wealth" of nations. Lucas (1988) argues that the ties between financial and economic development is "badly over-stressed". The debate also exists about whether greater stock market liquidity actually encourages a shift to higher-return projects that stimulate productivity growth. Since more liquidity makes it easier to sell shares, some argue that more liquidity reduces the incentives of shareholders to undertake the costly task of monitoring managers (Shleifer (1986) et al.; Bhidé (1993)). In turn, weaker corporate governance impedes effective resource allocation and slows productivity growth.

1.3 Purpose of the Paper

In the view of the papers stated above, the objective of the paper is to address the question of economic growth and financial development from another perspective. Traditionally, real per capita GDP growth or real per capita capital stock growth have been used as a dependent variable. This paper replaces economic growth with a specific productivity measure, Malmquist index introduced by Fare et al (1994). The index is further decomposed into two component measures, efficiency change (diffusion) and technical change (innovation). The paper examines the role of banking, financial, economic and institutional factors on the development of the above productivity measures. The empirical analysis is conducted on a group of countries, which includes developed and developing countries. Most of the OECD countries (with the exception of Mexico and Turkey) are included in the first group. The developing countries are selected from a group of countries, which had some financial liberalization and reform experience. Panel data approach is utilized to expose the relationship between the productivity and efficiency measures and the indicators of banking, financial, economic and institutional factors.

The plan of the study is as follows: Section two describes the Malmquist productivity index measures, section three gives details of data and methodology, section four reports the empirical results and section five concludes.

2 MALMQUIST PRODUCTIVITY INDEX

2.1 Description of Malmquist Productivity Index

In this study a Malmquist index introduced by Fare et al. (1994) is used to measure the productivity growth between two groups of countries (developed and developing countries). To define the Malmquist index of productivity change, it is assumed that for each time period $t = 1, \dots, T$, the production technology S^t models the transformation of inputs, $x^t \in \mathbb{R}_+^N$, into outputs, $y^t \in \mathbb{R}_+^M$. In mathematical representation this can be expressed as:

$$S^t = \{(x^t, y^t) : x^t \text{ can produce } y^t\} \quad (1)$$

The output distance function at t is defined as:

$$D_0(x^t, y^t) = \inf\{\theta : (x^t, y^t/\theta) \in S^t\} \quad (2)$$

$$= (\sup\{\theta : (x^t, y^t/\theta) \in S^t\})^{-1} \quad (3)$$

This function is defined as the reciprocal of the "maximum" proportional expansion of the output vector y^t , given inputs x^t . Output distance function is equal to one if and only if (x^t, y^t) is on the boundary or frontier of technology. In our calculations, the country with the distance function equal to one constructs the best practice world frontier and the distance of individual countries is computed according to this world frontier. This is illustrated in Figure 1. In the figure, observed production at t is interior to the boundary of technology at t , so (x^t, y^t) is not technically efficient. The distance function gives the reciprocal of the greatest proportional increase in outputs given inputs, such that output is still feasible. In Figure 1, given x^t , maximum feasible production is at (y^t/θ^*) . The value of the

distance function for our observation in terms of distances on the y-axis is $0a/0b$, which is less than 1.

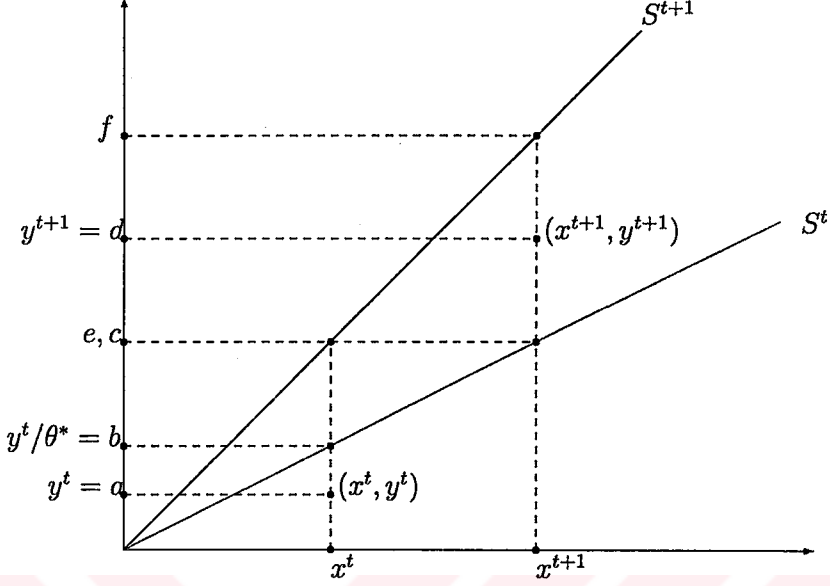


Figure 1 - The Malmquist Output-Based Index of Total Factor Productivity and Output Distance Function

To define the Malmquist index, one needs to define distance functions with respect to two different time periods such as $D_0^t(x^{t+1}, y^{t+1}) = \inf\{\theta : (x^{t+1}, y^{t+1}/\theta) \in S^t\}$. This distance function measures the maximal proportional change in outputs required to make (x^{t+1}, y^{t+1}) feasible in relation to the technology at t . Similarly, distance function that measures the maximal proportional change in output required to make (x^t, y^t) feasible in relation to the technology at $t + 1$ is given as $D_0^{t+1}(x^t, y^t) = \inf\{\theta : (x^t, y^t/\theta) \in S^{t+1}\}$.

Malmquist productivity index is defined in two different ways depending on whether period t or period $t + 1$ is the reference technology:

$$M^t = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \text{ or } M^{t+1} = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)}. \quad (4)$$

In order to avoid choosing arbitrary benchmark, Malmquist productivity change index is defined as the geometric mean of the two type indexes given above:

$$M_0^t(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)} \right]^{1/2} \quad (5)$$

Equivalent way of writing this expression is

$$M_0^t(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \left[\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right]^{1/2} \quad (6)$$

where the ratio outside the brackets measures the change in relative efficiency (i.e., is from maximum potential production) between years t and $t + 1$. The geometric mean of the two ratios inside the brackets captures the shift in technology between the two periods evaluated at x^t and x^{t+1} . In this expression, efficiency change is given as:

$$\frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \quad (7)$$

and technical change is given as:

$$\left[\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right]^{1/2} \quad (8)$$

For values greater than one, efficiency change component will indicate that the country has improved its relative technical efficiency during the period considered and experienced diffusion of technology. Technical change component measures the shift in frontier between two periods. A value greater than one will indicate that there is technical progress along the input and output mix of the country. The Malmquist index, which displays the changes in the productivity, is the product of these measures. While index values greater than one show improvement in the productivity over time, values smaller than one indicate deterioration in performance.

The decomposition is illustrated in Figure 1 where technical advance has occurred between the years t and $t + 1$. In terms of the distances along the y-axis, the Malmquist Index becomes

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \left(\frac{0d}{0f} \right) \left(\frac{0b}{0a} \right) \left[\left(\frac{0d/0e}{0d/0f} \right) \left(\frac{0a/0b}{0a/0c} \right) \right]^{1/2} \quad (9)$$

$$= \left(\frac{0d}{0f} \right) \left(\frac{0b}{0a} \right) \left[\left(\frac{0f}{0e} \right) \left(\frac{0c}{0b} \right) \right]^{1/2} \quad (10)$$

2.2 Calculation of Malmquist Productivity Index

In our study, Malmquist productivity index is calculated by using non-parametric programming techniques. The aggregate output measure is GDP of the countries between years 1970 – 1991, input measures are capital and labor. These values are compiled from The Penn World Tables (2002).

In our model, we assume that there are $k = 1, 2, \dots, K$ countries using $n = 1, 2, \dots, N$ inputs, $x_n^{k,t}$, at each time period $t = 1, 2, \dots, T$. These inputs produce $m = 1, 2, \dots, M$ outputs, $y_m^{k,t}$. In the model we assume that capital and labor are the input variables and the GDP of each country is our output value.

The reference technology in period t is constructed from the data set as:

$$S^t = \left\{ \begin{array}{ll} (x^t, y^t) : y_m^t \leq \sum_{k=1}^K z^{k,t} y_m^{k,t} & m = 1, \dots, M \\ \sum_{k=1}^K z^{k,t} x_n^{k,t} & n = 1, \dots, N \\ z^{k,t} \geq 0 & k = 1, \dots, K \end{array} \right\}$$

where constant returns to scale is assumed.

There are four different linear programming problems to calculate the productivity of a country between years t and $t+1$:

1) $D_0^t(x^t, y^t)$, 2) $D_0^{t+1}(x^{t+1}, y^{t+1})$, 3) $D_0^t(x^{t+1}, y^{t+1})$, 4) $D_0^{t+1}(x^t, y^t)$. So for each $k' = 1, \dots, K$ these four linear programming problem can be defined as:

$$1) \left(D_0^t(x^{k',t}, y^{k',t}) \right)^{-1} = \begin{cases} \max \theta^{k'} \\ \text{subject to} \\ \theta^{k'} y_m^{k',t} \leq \sum_{k=1}^K z^{k,t} y_m^{k,t} & m = 1, \dots, M \\ \sum_{k=1}^K z^{k,t} x_n^{k,t} \leq x_n^{k',t} & n = 1, \dots, N \\ z^{k,t} \geq 0 & k = 1, \dots, K \end{cases}$$

$$2) \left(D_0^{t+1}(x^{k',t+1}, y^{k',t+1}) \right)^{-1} = \begin{cases} \max \theta^{k'} \\ \text{subject to} \\ \theta^{k'} y_m^{k',t+1} \leq \sum_{k=1}^K z^{k,t+1} y_m^{k,t+1} & m = 1, \dots, M \\ \sum_{k=1}^K z^{k,t+1} x_n^{k,t+1} \leq x_n^{k',t+1} & n = 1, \dots, N \\ z^{k,t+1} \geq 0 & k = 1, \dots, K \end{cases}$$

$$3) \left(D_0^t(x^{k',t+1}, y^{k',t+1}) \right)^{-1} = \begin{cases} \max \theta^{k'} \\ \text{subject to} \\ \theta^{k'} y_m^{k',t+1} \leq \sum_{k=1}^K z^{k,t} y_m^{k,t} & m = 1, \dots, M \\ \sum_{k=1}^K z^{k,t} x_n^{k,t} \leq x_n^{k',t+1} & n = 1, \dots, N \\ z^{k,t} \geq 0 & k = 1, \dots, K \end{cases}$$

$$4) \left(D_0^{t+1}(x^{k',t}, y^{k',t}) \right)^{-1} = \begin{cases} \max \theta^{k'} \\ \text{subject to} \\ \theta^{k'} y_m^{k',t} \leq \sum_{k=1}^K z^{k,t+1} y_m^{k,t+1} & m = 1, \dots, M \\ \sum_{k=1}^K z^{k,t+1} x_n^{k,t+1} \leq x_n^{k',t} & n = 1, \dots, N \\ z^{k,t+1} \geq 0 & k = 1, \dots, K \end{cases}$$

In order to find out the Malmquist productivity index, we need to solve the above equations.

3 DATA AND METHODOLOGY

As mentioned above, the countries are grouped into 2 groups, which are developed countries (Canada, U.S.A., Japan, Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Norway, Spain, Sweden, U.K., Australia) and developing countries (Nigeria, Zimbabwe, Mexico, Argentina, Chile, Venezuela, India, Korea, Greece, Turkey, Philippines, Taiwan, Thailand, Colombia). For these countries, Malmquist productivity index and its components, efficiency change index and technical change index are calculated. In order to find these indexes, the equations defined above need to be solved. These equations are solved by using GAMS (General Algebraic Modeling System (2002)) for each time period between 1970 and 1990. So for each country, we need to solve 61 linear programming problems, which makes totally $30 * 61 = 1830$ problems. The Malmquist productivity index and its components are the dependent variables of our regression models.

Regressors, on the other hand, are grouped into 4 groups. Banking development variables include claims on government, claims on private sector, domestic credit provided by banking sector, domestic credit growth rate, financing from abroad, gross private capital flows, liquid liabilities, credit to private sector, total domestic financing. Economic variables are total central government debt, foreign direct investment-net inflows (% of GDP), foreign direct investment-net inflows (% of gross capital formation), gross capital formation growth, GDP growth, gross capital formation, inflation-consumer prices, inflation-GDP deflator, initial per capita income, openness, per capita GNP growth, real interest rate, tax revenue, unemployment. Financial sector variables are defined as listed domestic companies, market capitalization of listed companies, portfolio investment-bonds, portfolio investment-equity, turnover ratio of stocks traded, total value of stocks traded. Finally institutional variables are accounting standards, creditor rights,

enforcement of contracts, coefficient of education efficiency, illiteracy rate, research and development expenditures. The detailed explanation of these variables is given in Chapter 4. These data are compiled from World Bank's "World Development Indicators" (2000) and IMF's "International Financial Statistics" (2002). Some of the institutional variables such as accounting standards, creditor rights and enforcement of contracts have been directly taken from Levine et al (2000).



4 DESCRIPTION OF THE VARIABLES

4.1 Banking Development Variables

Since banking sector constitutes a very important part of the financial sector of a country, we believe that productivity measures (Malmquist index and its two components- efficiency change and technical change) and the efficiency of the banking sector are closely related. Data regarding the banking sector variables are taken from World Bank's "World Development Indicators" Database (2000). The variables that are classified as banking sector variables and the descriptions are:

4.1.1 Claims on Governments (*claimgov*)

claimgov include the claims on governments and other public entities (this corresponds to IFS line 32an + 32b + 32bx + 32c) that usually comprise direct credit for specific purposes such as financing of the government budget deficit or loans to state enterprises, advances against future credit authorizations, and purchases of treasury bills and bonds, net of deposits by the public sector. Public sector deposits with the banking system also include sinking funds for the service of debt and temporary deposits of government revenues. Money and quasi money (M2) comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. The data are given as annual growth as percentage of M2.

4.1.2 Claims on Private Sector (*claimpriv*)

Claims on private sector (IFS line 32d (2002)) include gross credit from the financial system to individuals, enterprises, nonfinancial public entities not included under net domestic credit, and financial institutions not included elsewhere. Money and quasi money (M2) comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. The data are given as annual growth as percentage of M2.

4.1.3 Domestic Credit Provided by Banking Sector (*dcredbybank*)

Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions are savings and mortgage loan institutions and building and loan associations. The data are given as percentage of GDP.

4.1.4 Domestic Credit Growth Rate (*dcredgrwrate*)

Domestic credit growth rate gives the growth rate of domestic credit. The data are given as percentage change from the previous year.

4.1.5 Financing From Abroad (*finabroad*)

Financing from abroad (obtained from nonresidents) refers to the means by which a government provides financial resources to cover a budget deficit or allocates financial resources arising from a budget surplus. It includes all government liabilities—other than those for currency issues or demand, time, or savings deposits with government—or claims on others held by government and changes in

government holdings of cash and deposits. Government guarantees of the debt of others are excluded. Data are shown for central government only and are given as percentage of GDP.

4.1.6 Gross Private Capital Flows (*grprcapflow*)

Gross private capital flows are the sum of the absolute values of direct, portfolio, and other investment inflows and outflows recorded in the balance of payments financial account, excluding changes in the assets and liabilities of monetary authorities and general government. The indicator is calculated as a ratio to GDP converted to international dollars using purchasing power parities. Data are given as percentage of GDP.

4.1.7 Liquid Liabilities (*liquid*)

Liquid liabilities are also known as broad money, or M3. They are the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travellers checks, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents. Data are given as percentage of GDP.

liquid is a typical measure of 'financial depth' and thus of the overall size of the financial intermediary sector (Levine et al. (1993)). Many researchers use this measure of financial depth (Goldsmith (1969); McKinnon (1973)).

4.1.8 Credit to Private Sector (*privcred*)

Credit to private sector refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable that establish a claim for repayment. For some countries these claims include credit to public enterprises. Data are given as percentage of GDP. Credit to private sector isolates credit issued to private sector,

as opposed to credit issued to governments, government agencies. The measure is used by Levine et al. (2000), and it is found that while credit to private sector does not directly measure the amelioration of information and transaction costs, higher levels of credit to private sector indicates higher levels of financial services and therefore greater financial intermediary development.

4.1.9 Total Domestic Financing (*totaldomfin*)

Domestic financing (obtained from residents) refers to the means by which a government provides financial resources to cover a budget deficit or allocates financial resources arising from a budget surplus. It includes all government liabilities—other than those for currency issues or demand, time, or savings deposits with government—or claims on others held by government and changes in government holdings of cash and deposits. Government guarantees of the debt of others are excluded. Data are shown for central government only. Data are given as percentage of GDP.

4.2 Economic Variables

Economic variables are the measures of the macroeconomic economic indicators. Investment decisions are affected by the macroeconomic balances, so technological advances are affected by the economic variables given below. However, not only the technological change, but also the efficiency change depends on the economic variables. Unless otherwise stated, data are taken from World Bank's "World Development Indicators" (2000), and the descriptions are given below:

4.2.1 Total Central Government Debt (*centgovdebt*)

Total debt is the entire stock of direct, government, fixed term contractual obligations to others outstanding at a particular date. It includes domestic debt (such as debt held by monetary authorities, deposit money banks, nonfinancial public enterprises, and households) and foreign debt (such as debt to international

development institutions and foreign governments). It is the gross amount of government liabilities not reduced by the amount of government claims against others. Because debt is a stock rather than a flow, it is measured as of a given date, usually the last day of the fiscal year. Data are shown for central government only. Data are given as percentage of GDP.

4.2.2 Foreign Direct Investment, Net Inflows - % of GDP (*fordinflow*)

Foreign direct investment is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows in the reporting economy. Data are given as percentage of GDP.

4.2.3 Foreign Direct Investment, Net Inflows (*fodirascap*)

Foreign direct investment is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows in the reporting economy. Gross capital formation (gross domestic investment) is the sum of gross fixed capital formation, changes in inventories, and acquisitions less disposals of valuables. Data are given as percentage of gross capital formation.

4.2.4 Gross Capital Formation Growth (*gcapfgrowth*)

Gross capital formation growth is the annual growth rate of gross capital formation based on constant local currency. Aggregates are based on constant 1995 U.S. dollars. Gross capital formation (gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level

of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are given as annual percentage growth.

4.2.5 GDP Growth (*gdpgrowth*)

Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 1995 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are given as annual percentage.

4.2.6 Gross Capital Formation (*grocapform*)

Gross capital formation (gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are given as percentage of GDP.

4.2.7 Inflation, Consumer Prices (*infconsprice*)

Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a fixed basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Data are given as annual percentage.

4.2.8 Inflation, GDP Deflator (*infgdpdeflator*)

Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. Data are given as annual percentage.

4.2.9 Initial Per Capita Income (*initpcinc*)

initpcinc is the per capita income value for 1970 which is the initial year of the study. These values are compiled from The Penn World Tables (2002).

4.2.10 Openness (*openness*)

Openness is the ratio of exports plus imports (absolute values) divided by the GDP. Data are taken from The Penn World Tables (2002).

4.2.11 Per Capita GNP Growth (*pcgnpgrowth*)

Annual growth rate of GNP per capita based on constant local currency. Aggregates are based on constant 1995 U.S. dollars. GNP is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are given as annual percentage.

4.2.12 Real Interest Rate (%) (*realintrate*)

Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.

4.2.13 Tax Revenue (*taxrevenue*)

Tax revenue comprises compulsory, unrequited, non-repayable receipts for public purposes collected by central governments. It includes interest collected on tax arrears and penalties collected on nonpayment or late payments of taxes and is shown net of refunds and other corrective transactions. Data are shown for central government only. Data are given as percentage of GDP.

4.2.14 Unemployment (*unemployment*)

Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country. Data are given as percentage of total labor force.

4.3 Financial Sector Variables

The variables classified as financial sector variables are the ones related with the stock market and its components. Levine et al. (1998) find that even after controlling for many factors associated with growth, stock market liquidity (and banking development) is positively and robustly correlated with contemporaneous and future rates of economic growth, capital accumulation, and productivity growth. Furthermore, they report that, since measures of stock market liquidity and banking development both enter the growth regressions significantly, the findings suggest that banks provided different financial services from those provided by stock markets. Thus, to understand the relationship between the financial system and long-run growth more comprehensively, theories in which both stock markets and banks arise and develop simultaneously while providing different bundles of financial services to the economy. Variables in this group cover the ones studied

by Levine et al. (1998). Data have been compiled from World Bank's "World Development Indicators (2000)" and the descriptions are:

4.3.1 Listed Domestic Companies (*lisdomcomp*)

Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. This indicator does not include investment companies, mutual funds, or other collective investment vehicles.

4.3.2 Market Capitalization of Listed Companies (*marketcap*)

Market capitalization (also known as market value) is the share price times the number of shares outstanding. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. Data are given as percentage of GDP.

4.3.3 Portfolio Investment, Bonds (*portinvbonds*)

Portfolio bond investment consists of bond issues purchased by foreign investors. Data are in current U.S. dollars. (PPG + PNG) (NFL, current US)

4.3.4 Portfolio Investment, Equity (*portinvequity*)

Portfolio investment flows are net and include non-debt-creating portfolio equity flows (the sum of country funds, depository receipts, and direct purchases of shares by foreign investors). Data are in current U.S. dollars. (DRS, current US)

4.3.5 Stocks Traded, Turnover Ratio (*turnover*)

Turnover ratio is the total value of shares traded during the period divided by the average market capitalization for the period. Average market capitalization is calculated as the average of the end-of-period values for the current period and the previous period. Data are the percentage values. Turnover measures the

volume of domestic equities traded on domestic exchanges relative to the size of the market. High turnover is often used as an indicator of low transaction costs.

4.3.6 Stocks Traded, Total Value (*valuetraded*)

Stocks traded refers to the total value of shares traded during the period. Data are given as percentage of GDP. This variable is also included in the study by Levine et al. (1998). While not a direct measure of trading costs or the uncertainty associated with trading on a particular exchange, theoretical models of stock market liquidity and economic growth directly motivate total value of stocks traded (Levine (1991); Bencivenga et al. (1991)). Total value of stocks traded measures trading volume as a share of national output and should therefore positively reflect liquidity on an economy-wide basis. Total value of stocks traded may be importantly different from turnover ratio of stocks traded as shown by Demirguc-Kunt and Levine (1996). While total value of stocks traded captures trading relative to the size of the economy, turnover ratio of stocks traded measures trading relative to the size of the stock market. Thus, a small, liquid market will have a high turnover ratio of stocks traded but small total value of stocks traded (Levine et al. (1998)).

4.4 Institutional Variables

In addition to the set of variables explained so far, we also examine whether differences in particular legal and regulatory system characteristics help explain cross-country differences in the level of financial intermediary development. The degree to which financial intermediaries can acquire information about firms, write contracts, and have those contracts enforced will influence the ability of those intermediaries to identify worthy firms, exert corporate control, manage risk, mobilize savings, and ease exchanges. As argued by LaPorta et al. (1997), the legal and regulatory system will fundamentally influence the ability of the financial system to provide high-quality financial services. Levine et al. (2000) state that

countries with legal and regulatory systems that give a high priority to creditors receiving the full present value of their claims on corporations have better functioning financial intermediaries than countries where the legal system provides weaker support to creditors. Levine et al. (2000) also argue that contract enforcement seems to matter even more than the formal legal and regulatory codes. Countries that efficiently impose compliance with laws tend to have better developed financial intermediaries than countries where enforcement is more lax. The paper also shows that information disclosure matters for financial development. Countries where corporations publish relatively comprehensive and accurate financial statements have better developed financial intermediaries than countries where published information on corporations is less reliable. Data of the variables accounting standards, creditor rights and enforcement are taken directly from Levine et al. (2000). The remaining ones are compiled from World Bank's "World Development Indicators (2000)".

4.4.1 Accounting Standards (*account*)

Information about corporations is critical for exerting corporate governance and identifying the best investments. Accounting standards that simplify the interpretability and comparability of information across corporations will simplify financial contracting. Furthermore, financial contracts that use accounting measures to trigger particular actions can only be enforced if accounting measures are sufficiently clear, Levine et al. (2000). Accounting standards, from LaPorta (1997), is an index of the comprehensiveness of company reports. The maximum possible value is 90 and the minimum is 0. This index is calculated according the information on general accounting, income statements, balance sheets, funds flow statement, accounting standards, and the stock data in company reports by The Center for International Financial Analysis and Research in 1990.

4.4.2 Creditor Rights (*creditor*)

The degree to which the legal system supports the rights of creditors will fundamentally influence financial contracting and the functioning of financial intermediaries. Specifically, legal systems differ in terms of the rights of creditors to (i) repossess collateral or liquidate firms in the case of default, (ii) remove managers in corporate reorganizations, and (iii) have a high priority relative to other claimants in corporate bankruptcy.

Creditor rights is a cumulative index of three creditor rights indicators and can be written as $\text{creditor rights} = C1 - C2 - C3$ where C1 equals one if secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm. C1 equals 0 if non-secured creditors, such as the government or workers get paid before secured creditors. C2 is an index which is equal to one if a country's laws impose an automatic stay on the assets of firms upon filing a reorganization petition. C2 equals to 0 if this restriction does not appear in the nation's legal codes. The restriction would prevent creditors from gaining possession of collateral or liquidating a firm to meet a loan obligation. C3 equals one if firm managers continue to administer the firm's affairs pending the resolution of reorganization processes, and zero otherwise. In some countries, management stays in place until a final decision is made about the resolution of claims. In other countries, a team selected by the creditors replaces management. If management stays pending resolution, this reduces pressure on management to pay creditors Levine et al. (2000).

Creditor rights takes on values between 1 (best) and -2 (worst). It is expected that countries with higher values of creditor rights to have stronger creditor rights and better-developed financial intermediaries, all else equal.

4.4.3 Enforcement (*enforce*)

The effectiveness of the legal system in enforcing contracts will materially influence financial sector activities. The variable intended to reflect the effectiveness

of the legal system, enforcement, is an average of two measures. The first one is an assessment of the law and order tradition of the country that ranges from 10, strong law and order tradition, to 1, weak law and order tradition. The second measure is an assessment of the risk that a government can modify a contract after it has been signed and the measure ranges from 10, low risk of contract modification, to 1, high risk of contract modification. Both of these measures are constructed by International Country Risk Guide (ICRG). The countries with very high values of enforcement, values greater than 9, are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Japan, Norway, Sweden, Switzerland, United Kingdom and United States (Levine et al. (2000)).

4.4.4 Education Coefficient of Efficiency (*edueffcoef*)

Coefficient of efficiency refers to the ideal number of pupil-years required to produce graduates from a given cohort (in the absence of repetition and dropout) as a percentage of the actual number of pupil-years spent to produce the same number of graduates. The values are given as ideal years to graduate as percentage of actual. Together with illiteracy rate and research expenditures, this variable controls for the education efficiency of a country which matters for especially the technological change in the long run.

4.4.5 Illiteracy Rate, Adult Total (*illiteracy*)

Adult illiteracy rate is the percentage of people ages 15 and above who cannot, with understanding, read and write a short, simple statement on their everyday life. The values are given as percentage of people age 15 and above.

4.4.6 Research and Development Expenditure (*research*)

Expenditures for research and development are current and capital expenditures (including overhead) on creative, systematic activity intended to increase the stock of knowledge. Included are fundamental and applied research and exper-

imental development work leading to new devices, products, or processes. Values are given as the percentage of gross national income.



5 EMPIRICAL RESULTS

5.1 Malmquist Index Values

The application of the above methodology provides for each country, the Malmquist productivity index (MALM) and its components, efficiency change index (EFFCH) and technical change index (TECHCH) for each pairs of years in the sample. Then geometric averages of each index are computed for the entire 1970 – 1990 periods to show the average annual performance developments in productivity growth and its components for a particular country. For each index, a value greater than one indicates an average annual improvement in the performance of the country and a value less than one shows deterioration in performance. The mean MALM, EFFCH, TECHCH indices for all countries, and for developed and developing countries are reported in the table below:

	MALQI	EFFCH	TECHCH
All countries	1.001706	1.007005	0.995568
Developed countries	1.006482	1.004051	1.002877
Developing countries	0.996248	1.010382	0.987215

Table 1 - Mean Malmquist Index and Its Decomposition

The mean Malmquist productivity index with a value slightly greater than one (1.001706) indicates that for all countries in the sample there has been productivity gain on the average. Between the two groups of countries, there is a productivity gain in developed countries (0.06482% per year); there is a productivity loss in developing countries (0.03752% per year).

Developing countries have on average a higher efficiency change index, which indicates that this set of countries approach the "best practice" frontier at a faster rate than high-income countries, and hence the catch-up process works in

the low-income countries. However, this set of countries are suffering from loss of productivity due to the other source of productivity growth-technical change (innovation)- which is in fact the main source of productivity growth for high-income countries (0.2877% technical change gain for developed countries and 1.2785% technical change loss for developing countries).

Average Malmquist indexes and their decompositions as efficiency change and technical change over the 1970 – 1990 periods can be seen below. Also averages among the groups of countries can be seen Table 2.



	AVR.MALQI	AVR.EFFCH	AVR.TECHCH
AUSTRALIA	1.011983	1.000042	1.012235
AUSTRIA	0.990482	0.996060	0.994797
BELGIUM	1.014931	1.006911	1.008576
CANADA	1.016914	1.006744	1.010277
DENMARK	0.997950	0.999899	0.998403
FINLAND	1.027909	1.014082	1.014338
FRANCE	1.006581	1.002622	1.004457
GERMANY	1.017870	1.006526	1.011722
IRELAND	1.004261	1.012053	0.993048
ITALY	1.002628	1.010269	0.992800
JAPAN	0.989763	0.997027	0.993144
NORWAY	1.029006	1.011576	1.018052
SPAIN	0.988486	0.996598	0.992378
SWEDEN	1.004581	0.998952	1.006337
U.K.	0.996825	1.005452	0.991931
U.S.A.	1.003531	1	1.003531
GROUP1 AVR.	1.006482	1.004051	1.002877
ARGENTINA	0.981376	0.994987	0.986410
CHILE	0.986861	1.003575	0.982977
GREECE	0.996587	1.005245	0.992079
INDIA	1.005538	1.019658	0.990170
KOREA	0.997101	1.013135	0.986055
MEXICO	1.000589	1.011257	0.990202
NIGERIA	0.979193	1	0.979193
TURKEY	0.997735	1.013057	0.986584
VENEZUELA	0.976858	0.986492	0.990484
ZIMBABWE	1.013336	1.033693	0.981932
COLOMBIA	1.003397	1.016394	0.988577
PHILIPPINES	1.007051	1.024270	0.984612
TAIWAN	0.997249	1.006082	0.992048
THAILAND	1.004599	1.017489	0.989677
GROUP2 AVR.	0.996248	1.010381	0.987214
OVERALL AVR.	1.001706	1.007005	0.995568

Table 2 - Malmquist Index and Its Decomposition for all countries

5.2 Estimations

As mentioned above, the purpose of the study is to find relationship between productivity measures and the groups of variables. This relationship can be ex-

pressed as:

$$\begin{aligned} \text{Productivity measure}_i = f(\text{banking sector development indicators}_i, \\ \text{economic condition indicators}_i, \\ \text{financial sector variables}_i, \\ \text{institutional variables}_i) \end{aligned} \quad (11)$$

In order to find the proper variables in the equation, first single variable estimations are performed. Four different types of estimations varying according to the intercept and weighting (common intercept-no weighting, common intercept cross section weights, fixed effects-no weighting, fixed effects-cross section weights) are reported for all the regressions.

Given the regression model $y_{it} = \alpha_i + \beta'x_{it} + \epsilon_{it}$, common intercept model takes the individual effects, α_i , same for all pool members. However, when fixed effects model is used, α_i is taken to be group specific constant term. (There is also another approach, random effects approach, which treats intercepts as random variable across pool members. This approach is not included in the analysis.)

The different types of weighting styles used are no weighting and cross section weights models. In the no weighting model, all observations are given equal weight; on the other hand, in the cross section weights model, weights are estimated in the preliminary regression with equal weights and then are applied in weighted least squares in the second round.

5.3 Single Variable Estimations

In order to see which variables enter the regression significantly, first estimations are conducted with single explanatory variables in the following regression:

$$\text{Productivity}_{it} = \beta_{1i} + \beta_{2i}\text{Explanatory variable} + \epsilon_{it}$$

The significance and signs of the four group of variables; banking sector development, economic conditions, financial sector development measures and institutional factors are examined. As the dependent variables, the productivity

measured by the Malmquist indexes and their decompositions into technical efficiency and technological change indexes are used. For each explanatory variable four different regressions are estimated. These are common intercept and fixed effect models which either assumes the same intercept for all the countries in the sample or a different intercept for each country. These regressions are estimated again either with unweighted error variances or weighted error variances. Sections 7.1, 7.2 and 7.3 report the results for these single equation estimations. In the table only the probability values for the following hypothesis:

$$H_0 : \beta_i = 0$$

$$H_1 : \beta_i \neq 0$$

are reported for each explanatory variable. In evaluating the results, probability values less than 0.10 are considered to be significant (i.e. the probability of the coefficient being equal to zero is less than 0.10). Positive coefficients indicate a positive correlation between the dependent variable and the given variable; a negative sign for the coefficients indicate a negative correlation between the dependent variable and the variable.

5.3.1 Malmquist Index Single Variable Estimation Results

As can be seen from the Tables 3, 4, 5 and 6 (Section 7.1), domestic credit by banking sector, growth rate of domestic credit, total domestic financing and liquid liabilities have significant coefficients in two or more estimations types. Gross private capital flows, and credit to private sector have significant coefficients in one of the four different estimation types. Overall the size of the banking sector and especially the availability, liquidity and credit seem to have some determining power on the overall productivity of the countries.

Among the economic variables many of them have statistically significant coefficients in single equation estimations. The variables that are significant in all estimation types are gross capital formation, foreign direct investment, openness and tax revenues. These are indicative of the fact that the accumulation of cap-

ital and the increase in the amount of capital stock increase the productivity of capital and labor use in the economies. The share of foreign direct investment, real interest rates and unemployment seem to have significant effects on the productivity changes. Other economic variables such as GDP growth rate and per capita GDP growth, and only in one regression initial per capita income, indicate that the convergence have some influence on productivity.

For the case of financial variables, the expected effect is not as direct as in the case of economic variables. Financial development measures will not also show the availability of liquidity for investment purposes in the economy like the banking sector variables does. But financial sector development measures are indicators of how well the market that transfer savings in the economy to loanable funds is working and hence the indirect measures of the opportunity of investment. Among the variables included into the single equation estimations, the number of listed companies and turn over ratio of the stocks traded are found significant in two of the regressions. Market capitalization measure and value of the stock traded have significant coefficients in one of the regressions estimated to explain the changes in the productivity.

In terms of the institutional measures, research turn out to have a strong significant effect on the productivity, with statistically significant coefficient in all four different regression estimations. Good accounting standards, the degree to which the legal system supports the creditors rights, efficiency in education, enforcement of the legal system and illiteracy turned out to have significant impact on the productivity levels in the economy.

5.3.2 Efficiency Change Single Variable Estimation Results

When we perform the similar analysis for efficiency change, we find the results given in Tables 7, 8, 9 and 10 (Section 7.2). As can be seen from the table, among banking sector variables, growth rate of domestic credit and credit to private sector have significant coefficients in two estimation types. In addition to these, gross private capital flow have a significant coefficient in one of the four different

estimation types.

Among the economic variables, gross capital formation, initial per capita income, openness, per capita GDP growth are significant in two estimation types. Moreover, GDP growth and tax revenue have significant coefficients in one of the estimation types.

When we consider the financial sector variables, we see that, similar to Malmquist index single variable estimation results, number of listed domestic companies, turnover ratio of stocks traded and total value of stocks traded enter the equation significantly.

For the case of institutional variables, all the variables (except research expenditure) have significant coefficients. This suggests the importance of institutional regularization on the efficiency change of a country.

5.3.3 Technical Change Single Variable Estimation Results

Similar to Malmquist index and efficiency change, single variable estimations are performed for technical change. The results for technical change single variable estimation are given in Tables 11, 12, 13 and 14 (Section 7.3).

When we look at the banking sector variables, we see that gross private capital flow, liquid liabilities, credit to private sector and total domestic financing have significant coefficients in two or more estimation types.

Among the economic variables, central government debt, gross private capital formation, initial per capita income, openness, tax revenue and unemployment have significant coefficients in two or more estimation types. In addition to these, GDP growth enters the equation significantly in one of the four estimation types.

In terms of financial sector variables, number of listed domestic companies, market capitalization and total value of stocks traded are significant in one or two estimation types. This suggests that these variables have an impact on the technical change.

Finally, for institutional variables, creditor rights, education coefficient, enforcement and research expenditure have significant coefficients. Different from

efficiency change, research expenditure is significant in all four types of estimations and this suggests that research expenditure is a factor that boosts innovation.

5.4 Multi-Variable Estimations

After searching for the single variables which are significant in explaining the productivity indexes given, we tried to find the combination of these variables to explain the productivity indexes. In this case, regression equation looks like the following one:

$$\begin{aligned} \text{Productivity}_{it} = & \beta_{1i} + \beta_{2i}\text{explanatory variable} + \beta_{3i}\text{explanatory variable} + \dots \\ & \dots \beta_{ki}\text{explanatory variable} + \epsilon_{it} \end{aligned} \quad (12)$$

Very similar to the single variable estimations, the significance and signs of the four group of variables; banking sector development, economic conditions, financial sector development measures and institutional factors are examined and the productivity measured by the Malmquist index and its decompositions are used as dependent variables. For each explanatory variable four different regressions are estimated. These are common intercept and fixed effect models which either assumes the same intercept for all the countries in the sample or a different intercept for each country. These regression are estimated again either with unweighted error variances or weighted error variances. Sections 7.4, 7.5 and 7.6 report the results for these multi equation estimations. In the tables, only the probability values for the following hypothesis:

$$H_0 : \beta_i = 0$$

$$H_1 : \beta_i \neq 0$$

are reported for each explanatory variable. In evaluating the results, probability values less than 0.10 are considered to be significant (i.e. the probability of the coefficient being equal to zero is less than 0.10). Positive coefficients indicate a positive correlation between the dependent variable and the given variable;

a negative sign for the coefficients indicate a negative correlation between the dependent variable and the variable.

5.4.1 Malmquist Index Multi Variable Estimation Results

As can be seen from the Tables 15, 16 and 17 (Section 7.4), many combinations of the variables are tested whether they are significant or not. First the double combinations of variables of the same group are tested. After getting the results of these combinations, complete equations that explain the Malmquist Index are searched for.

For the double variable estimations, domestic credit provided by banking sector together with gross private capital flows, domestic credit provided by banking sector together with credit to private sector, domestic credit provided by banking sector together with total domestic financing, domestic credit growth rate together with total domestic financing, gross private capital flows together with liquid liabilities, liquid liabilities together with total domestic financing, domestic credit growth rate together with claims on private sector are significant in explaining the Malmquist index as banking sector variables. Among economic variables, we tried the combinations of the variables which gave significant results in single estimations. When we look at the results in Table 16 (Section 7.4), we see that almost all of the combinations that we tried are significant in at least one type of estimations. That is, the combinations of central government debt, foreign direct investment, net inflow of foreign investment, GDP growth, openness, per capita GDP growth, real interest rate and tax revenue give significant results. In terms of financial sector variables, we see that number of listed domestic companies together with market capitalization, number of listed domestic companies together with turnover ratio of stocks traded, number of listed domestic companies together with total value of stocks traded, number of listed domestic companies together with portfolio bond investment, number of listed domestic companies together with portfolio equity investment, market capitalization together with portfolio bond investment, market capitalization together with portfolio equity investment,

market capitalization together with total value of stocks traded, portfolio bond investment together with total value of stocks traded are significant in explaining the Malmquist index as financial sector variables.

After having the idea of possible significant variables, and after trying many combinations, we found two most significant equations given below:

$$1. \text{ "MALM. INDEX} = -0.0006dc_{redbybank} + 0.0001openness - 0.0010realintrate + 0.0008valuetraded"$$

where domestic credit by banking sector and real interest rate have the negative coefficients and openness and the total value of stocks traded have the positive coefficients. This first equation suggests that the openness and the total value of stocks traded positively effect the Malmquist index. On the other hand the real interest rate and domestic credit by banking sector has negative impact on the Malmquist index.

$$2. \text{ "MALM. INDEX} = 0.0005liquid + 0.0002openness - 0.0008realintrate + 0.0006valuetraded"$$

where liquid liabilities, openness and total value of stocks traded have positive coefficients but real interest rate has a negative coefficient. This equation suggests that liquid liabilities, openness and total value of stocks traded are positively correlated with Malmquist index, and real interest rate is negatively correlated with the Malmquist Index.

5.4.2 Efficiency Change Multi Variable Estimation Results

When we perform the similar analysis for efficiency change, we find the results given in Tables 18, 19 and 20 (Section 7.5). As can be seen from the table, domestic credit by banking sector together with domestic credit growth rate are significant among banking sector variables in explaining the efficiency change. When economic variables are considered, we see that, GDP growth together with gross capital formation, gross capital formation together with per capita GDP

growth, gross capital formation together with openness and openness together with per capita GDP growth have significant coefficients among economic variables. For financial sector variables, number of listed domestic companies together with turnover ratio of stocks traded and portfolio equity investment together with total value of stocks traded are significant in explaining the efficiency change.

After observing these significant variables and trying many combinations, we found the following most significant equation:

$$\text{"EFF.} = 0.0003dcredbybank - 0.0005liquid - 0.0008infconsprice - 0.0001grocapform + 0.0002lisdomcomp + 0.0004valuetraded\text{"}$$

In this equation, domestic credit by banking sector, number of listed domestic companies and total value of stocks traded have positive coefficients; liquid liabilities, inflation (consumer prices) and gross capital formation have negative coefficients. So, this regression equation explains that domestic credit by banking sector, number of listed domestic companies and total value of stocks traded are positively correlated with the efficiency component but liquid liabilities, inflation (consumer prices) and gross capital formation are negatively correlated with the efficiency component.

5.4.3 Technical Change Multi Variable Estimation Results

Similar to Malmquist index and efficiency change, multi variable estimations are performed for technical change. The results for technical change multi variable estimations are given in Tables 21, 22 and 23 (Section 7.6). As can be seen from the table, domestic credit by banking sector together with gross private capital flows, domestic credit by banking sector together with credit to private sector, domestic credit by banking sector together with total domestic financing, domestic credit by banking sector together with gross private capital flows, gross private capital flows together with liquid liabilities, gross private capital flows together with credit to private sector and credit to private sector together with total domestic financing have significant coefficients in explaining technology change in terms of banking sector variables. When we consider the economic variables, we

see that central government debt together with tax revenue, GDP growth together with gross capital formation, GDP growth together with real interest rate, GDP growth together with unemployment, gross capital formation together with real interest rate and gross capital formation together with unemployment are significant in explaining the technology change. In terms of financial sector variables, number of listed domestic companies together with market capitalization, number of listed domestic companies together with portfolio equity investment, market capitalization together with portfolio bond investment, market capitalization together with total value of stocks traded and portfolio equity investment together with total value of stocks traded have significant coefficients.

After having the idea of possible significant variables, and after trying many combinations, we found three most significant equations given below:

$$1. \text{ TECHNOLOGY} = -0.0007\text{liquid} + 0.0010\text{grocapform} - 0.0005\text{lisdcomp}$$

where liquid liabilities and number of listed domestic companies are negatively, gross capital formation is positively correlated with the technology component.

$$2. \text{ TECHNOLOGY} = 0.0005\text{dcredbybank} - 0.0003\text{realinrate} - 0.0008\text{lisdcomp}$$

where real interest rate and number of listed domestic companies are negatively, domestic credit by banking sector is positively correlated with technology component.

$$3. \text{ TECHNOLOGY} = 0.0003\text{dcredbybank} + 0.0004\text{unemployment} + 0.0010\text{turnover}$$

where all the components are positively correlated with the technology component.

When we examine the regression equations for technology component of the Malmquist index, we are unable to find as good equations as we did for Malmquist index and the efficiency component. Among the regression equations we tried

for technology component, domestic credit by banking sector, liquid liabilities, unemployment, gross capital formation and number of listed domestic companies are the significant ones.



6 ESTIMATION OUTPUTS

6.1 Malmquist Index Single Variable Estimation

BANKING SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Claims on Government	0.2484	0.4116	0.6506	0.8988
Claims on Private Sector	0.6189	0.5392	0.8033	0.9141
Domestic Credit by Banking Sector	0.6165	0.7768	<i>0.0963</i>	<i>0.0000</i>
Growth Rate of Domestic Credit	<i>0.0114</i>	<i>0.0151</i>	0.2374	0.2693
Financing From Abroad	0.3117	0.8688	0.5635	0.8456
Gross Private Capital Flow	0.4635	0.5309	0.2485	<i>0.0582</i>
Liquid Liabilities	0.4880	0.9644	0.0947	<i>0.0000</i>
Private Credit	0.5352	0.9114	0.2505	<i>0.0141</i>
Total Domestic Financing	<i>0.3297</i>	<i>0.0101</i>	0.4294	<i>0.0002</i>

Table 3 - Malmquist Index Banking Sector Single Variable Estimations

ECONOMIC VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Central Government Debt	<i>0.0474</i>	<i>0.0001</i>	<i>0.0005</i>	<i>0.0000</i>
Foreign Investment (as a share)	0.1525	<i>0.0552</i>	<i>0.0058</i>	<i>0.0017</i>
Foreign Investment (inflows)	<i>0.1080</i>	<i>0.0510</i>	<i>0.0811</i>	<i>0.0724</i>
Growth of Gross Capital Formation	0.5243	0.4081	0.5100	0.4011
GDP Growth	<i>0.0078</i>	0.9472	<i>0.0140</i>	0.6253
Gross Capital Formation	<i>0.0000</i>	<i>0.0000</i>	<i>0.0000</i>	<i>0.0000</i>
Inflation-Consumer Price	0.1784	0.2793	0.8975	0.9621
Inflation-GDP Deflator	0.2081	0.3206	0.9446	0.9990
Initial Per Capita Income	0.2209	<i>0.0000</i>	0.2234	0.2512
Openness	<i>0.0045</i>	<i>0.0013</i>	<i>0.0284</i>	<i>0.0004</i>
Per Capita GDP Growth	<i>0.0018</i>	0.3066	<i>0.0130</i>	0.4085
Per Capita GNP Growth	<i>0.0018</i>	0.3066	<i>0.0130</i>	0.4085
Real Interest Rates	0.4896	<i>0.0006</i>	<i>0.0177</i>	<i>0.0301</i>
Tax Revenue	<i>0.0049</i>	<i>0.0015</i>	<i>0.0070</i>	<i>0.0000</i>
Unemployment	0.2076	<i>0.0568</i>	<i>0.0000</i>	<i>0.0000</i>

Table 4 - Malmquist Index Economic Single Variable Estimations

FINANCIAL SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Listed Domestic Companies	0.4087	0.1178	0.4216	0.0000
Market Capitalization	0.5451	0.1455	0.8228	0.0001
Portfolio Investment (Bonds)	0.9555	0.9289	0.9292	0.9701
Portfolio Investment (Equity)	0.5841	0.3669	0.7625	0.4756
Turnover Ratio (Stock Markets)	0.0120	0.0384	0.2503	0.2819
Value Traded (Stock Markets)	0.6942	0.4117	0.6778	0.0000

Table 5 - Malmquist Index Financial Sector Single Variable Estimations

INSTITUTIONAL VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Accounting Standards	0.7920	0.5193	NA	NA
Creditor Rights	0.0263	0.0000	NA	NA
Education Coefficient	0.3808	0.0381	NA	NA
Enforcement	0.4939	0.0000	NA	NA
Illiteracy Rate	0.8997	0.6728	0.7348	0.0121
Research Expenditure	0.0240	0.0667	0.0948	0.0015

Table 6 - Malmquist Index Institutional Single Variable Estimations

6.2 Efficiency Change Single Variable Estimation

BANKING SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Claims on Government	0.7297	0.8014	0.9564	0.9942
Claims on Private Sector	0.8841	0.6757	0.5259	0.9065
Domestic Credit by Banking Sector	0.1433	0.1788	0.7611	0.9920
Growth Rate of Domestic Credit	0.0972	0.2505	0.1133	0.6064
Financing From Abroad	0.7157	0.9743	0.5618	0.9589
Gross Private Capital Flow	0.0382	0.4928	0.8622	0.9897
Liquid Liabilities	0.3420	0.7515	0.1583	0.8408
Private Credit	0.0901	0.0719	0.8477	0.9728
Total Domestic Financing	0.7201	0.6790	0.5262	0.9151

Table 7 - Efficiency Change Banking Sector Single Variable Estimations

ECONOMIC VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Central Government Debt	0.7460	0.7911	0.6860	0.9975
Foreign Investment (as a share)	0.7985	0.8769	0.2101	0.6385
Foreign Investment (inflows)	0.7838	0.6332	0.2771	0.6858
Growth of Gross Capital Formation	0.8832	0.5257	0.9453	0.9915
GDP Growth	<i>0.0352</i>	0.4498	0.2877	0.9262
Gross Capital Formation	<i>0.0292</i>	0.4817	<i>0.0641</i>	0.4061
Inflation-Consumer Price	0.7173	0.8693	0.8392	0.9767
Inflation-GDP Deflator	0.6259	0.8714	0.9461	0.9927
Initial Per Capita Income	<i>0.0494</i>	<i>0.0000</i>	NA	NA
Openness	0.2666	<i>0.0134</i>	<i>0.0414</i>	0.7343
Per Capita GDP Growth	<i>0.0227</i>	0.2659	<i>0.0623</i>	0.6820
Per Capita GNP Growth	<i>0.0227</i>	0.2659	<i>0.0623</i>	0.6820
Real Interest Rates	0.5325	0.3844	0.4979	0.9362
Tax Revenue	<i>0.1100</i>	0.9183	0.4949	0.8421
Unemployment	0.7875	0.6852	0.2490	0.6163

Table 8 - Efficiency Change Economic Single Variable Estimations

FINANCIAL SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Listed Domestic Companies	0.2678	<i>0.0003</i>	0.9289	0.2199
Market Capitalization	0.8145	0.9738	0.8431	0.9815
Portfolio Investment (Bonds)	0.9059	0.6343	0.9098	0.9903
Portfolio Investment (Equity)	0.2982	0.1943	0.3759	0.4013
Turnover Ratio (Stock Markets)	<i>0.0097</i>	<i>0.0007</i>	0.2897	0.7349
Value Traded (Stock Markets)	0.8458	0.7542	0.5744	<i>0.1040</i>

Table 9 - Efficiency Change Financial Sector Single Variable Estimations

INSTITUTIONAL VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Accounting Standards	0.8716	<i>0.0290</i>	NA	NA
Creditor Rights	<i>0.0073</i>	<i>0.0000</i>	NA	NA
Education Coefficient	<i>0.1076</i>	<i>0.0076</i>	NA	NA
Enforcement	0.2942	<i>0.0000</i>	NA	NA
Illiteracy Rate	0.7918	0.1649	<i>0.0843</i>	0.6868
Research Expenditure	0.2734	0.1657	0.3057	0.9117

Table 10 - Efficiency Change Institutional Single Variable Estimations

6.3 Technical Change Single Variable Estimation

BANKING SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Claims on Government	0.3858	0.3109	0.6043	0.5899
Claims on Private Sector	0.4991	0.3762	0.7092	0.6426
Domestic Credit by Banking Sector	0.0522	0.0190	0.1728	0.0001
Growth Rate of Domestic Credit	0.2740	0.0806	0.6851	0.9999
Financing From Abroad	0.4221	0.4759	0.1950	0.2714
Gross Private Capital Flow	0.0034	0.0369	0.2713	0.0522
Liquid Liabilities	0.0844	0.0502	0.8753	0.0090
Private Credit	0.0234	0.0149	0.3559	0.0135
Total Domestic Financing	0.5037	0.1326	0.1077	0.0033

Table 11 - Technical Change Banking Sector Single Variable Estimations

ECONOMIC VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Central Government Debt	0.1050	0.0040	0.0029	0.0000
Foreign Investment (as a share)	0.2724	0.4172	0.1283	0.6301
Foreign Investment (inflows)	0.2088	0.2864	0.5233	0.6824
Growth of Gross Capital Formation	0.4076	0.9081	0.4526	0.8543
GDP Growth	0.4785	0.0680	0.1507	0.2033
Gross Capital Formation	0.0358	0.0000	0.0000	0.0000
Inflation-Consumer Price	0.2803	0.2550	0.7413	0.7391
Inflation-GDP Deflator	0.3832	0.2755	0.8905	0.7508
Initial Per Capita Income	0.0070	0.0001	NA	NA
Openness	0.0786	0.0401	0.8954	0.0703
Per Capita GDP Growth	0.3441	0.3271	0.5457	0.1845
Per Capita GNP Growth	0.3441	0.3271	0.5457	0.1845
Real Interest Rates	0.8680	0.2944	0.5579	0.1932
Tax Revenue	0.0000	0.0000	0.0002	0.0000
Unemployment	0.1180	0.0309	0.0000	0.0000

Table 12 - Technical Change Economic Single Variable Estimations

FINANCIAL SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Listed Domestic Companies	0.8622	0.1284	0.2280	0.0000
Market Capitalization	0.2739	0.0035	0.6086	0.0388
Portfolio Investment (Bonds)	0.8458	0.5098	0.8054	0.4820
Portfolio Investment (Equity)	0.5559	0.4457	0.4865	0.4539
Turnover Ratio (Stock Markets)	0.9588	0.5870	0.9801	0.9040
Value Traded (Stock Markets)	0.4459	0.0049	0.9635	0.7709

Table 13 - Technical Change Financial Sector Single Variable Estimations

INSTITUTIONAL VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
Accounting Standards	0.7322	0.9570	NA	NA
Creditor Rights	0.0001	0.0579	NA	NA
Education Coefficient	0.0000	0.0459	NA	NA
Enforcement	0.0000	0.0587	NA	NA
Illiteracy Rate	0.3049	0.7842	0.1119	0.2950
Research Expenditure	0.0245	0.0017	0.0146	0.0029

Table 14 - Technical Change Institutional Single Variable Estimations

6.4 Malmquist Index Multi-Variable Estimation

BANKING SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>dcredbybank + dcredgrurate</i>	0.8354 / 0.0129	0.9138 / 0.0157	0.1145 / 0.2321	0.0000 / 0.1943
<i>dcredbybank + grprcapflow</i>	0.5438 / 0.5268	0.6879 / 0.5920	0.8157 / 0.3119	0.0764 / 0.0554
<i>dcredbybank + liquid</i>	0.8966 / 0.6955	0.5040 / 0.5697	0.9738 / 0.3026	0.4732 / 0.0523
<i>dcredbybank + privcred</i>	0.9461 / 0.7925	0.1748 / 0.1814	0.1336 / 0.4845	0.0000 / 0.0044
<i>dcredbybank + totaldomfin</i>	0.5230 / 0.3365	0.2199 / 0.0079	0.4217 / 0.5864	0.0661 / 0.0015
<i>dcredgrurate + grprcapflow</i>	0.0565 / 0.5323	0.0755 / 0.5562	0.5172 / 0.2253	0.6569 / 0.0494
<i>dcredgrurate + liquid</i>	0.0163 / 0.8945	0.0093 / 0.6213	0.2643 / 0.1717	0.2727 / 0.0001
<i>dcredgrurate + privcred</i>	0.012 / 0.9145	0.0097 / 0.5151	0.2764 / 0.3316	0.2304 / 0.0147
<i>dcredgrurate + totaldomfin</i>	0.0077 / 0.3536	0.0604 / 0.0147	0.1070 / 0.3579	0.4652 / 0.0026
<i>grprcapflow + liquid</i>	0.4981 / 0.3944	0.3808 / 0.8209	0.2626 / 0.9660	0.0170 / 0.0138
<i>grprcapflow + privcred</i>	0.7176 / 0.3924	0.8324 / 0.4780	0.3441 / 0.6478	0.0772 / 0.6029
<i>grprcapflow + totaldomfin</i>	0.7091 / 0.5518	0.7482 / 0.5837	0.0245 / 0.6873	0.1730 / 0.0287
<i>liquid + privcred</i>	0.8851 / 0.5784	0.6917 / 0.5716	0.1779 / 0.9254	0.0006 / 0.7265
<i>liquid + totaldomfin</i>	0.8815 / 0.6714	0.1740 / 0.0762	0.1417 / 0.9276	0.0358 / 0.0363
<i>privcred + totaldomfin</i>	0.7363 / 0.3394	0.4148 / 0.0112	0.5229 / 0.3868	0.1407 / 0.0001
<i>dcredgrurate + finabroad</i>	0.0181 / 0.4655	0.0464 / 0.9020	0.1258 / 0.6002	0.4813 / 0.7990
<i>dcredgrurate + claimgov</i>	0.6963 / 0.2780	0.1370 / 0.8436	0.6591 / 0.1750	0.6246 / 0.9080
<i>dcredgrurate + claimpriv</i>	0.0331 / 0.3453	0.0278 / 0.2886	0.0782 / 0.0924	0.0927 / 0.1848
<i>totaldomfin + finabroad</i>	0.1422 / 0.3442	0.0046 / 0.9046	0.3978 / 0.5151	0.0005 / 0.8940
<i>totaldomfin + claimgov</i>	0.7116 / 0.2020	0.4471 / 0.3959	0.6596 / 0.5800	0.6040 / 0.8395
<i>totaldomfin + claimpriv</i>	0.8122 / 0.5643	0.5031 / 0.5357	0.6536 / 0.8598	0.6048 / 0.9344

Table 15 - Malmquist Index Banking Sector Multi-Variable Estimations

ECONOMIC VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>centgovdebt + fordirascap</i>	0.2719 / 0.7418	0.0554 / 0.5682	0.0061 / 0.3811	0.0003 / 0.6293
<i>centgovdebt + fordirinflow</i>	0.0728 / 0.9053	0.0003 / 0.7261	0.0021 / 0.6317	0.0000 / 0.9194
<i>centgovdebt + gdpgrowth</i>	0.0217 / 0.0586	0.0000 / 0.1271	0.0002 / 0.0930	0.0000 / 0.2115
<i>centgovdebt + openness</i>	0.2609 / 0.0717	0.0047 / 0.4088	0.0032 / 0.5747	0.0000 / 0.2542
<i>centgovdebt + pcgdpgrowth</i>	0.0120 / 0.0057	0.0000 / 0.0361	0.0002 / 0.0251	0.0000 / 0.0411
<i>centgovdebt + realinrate</i>	0.9162 / 0.3179	0.2531 / 0.0008	0.0016 / 0.9229	0.0000 / 0.2237
<i>centgovdebt + tazrevenue</i>	0.1840 / 0.2229	0.0008 / 0.7939	0.0007 / 0.5928	0.0012 / 0.2922
<i>fordirascap + fordirinflow</i>	0.7126 / 0.9750	0.0438 / 0.1059	0.0051 / 0.0393	0.0000 / 0.0001
<i>fordirascap + gdpgrowth</i>	0.1700 / 0.0014	0.0677 / 0.2941	0.0080 / 0.0034	0.0018 / 0.2706
<i>fordirascap + grocapform</i>	0.3902 / 0.0026	0.2633 / 0.0000	0.0407 / 0.0000	0.0077 / 0.0000
<i>fordirascap + openness</i>	0.1362 / 0.0016	0.0406 / 0.0012	0.0106 / 0.3095	0.0042 / 0.0030
<i>fordirascap + pcgdpgrowth</i>	0.0710 / 0.0002	0.0021 / 0.0116	0.0041 / 0.0072	0.0002 / 0.0467
<i>fordirascap + realinrate</i>	0.3860 / 0.1351	0.7240 / 0.0504	0.0936 / 0.0011	0.1951 / 0.4713
<i>fordirascap + tazrevenue</i>	0.2095 / 0.0118	0.0705 / 0.0042	0.0076 / 0.1773	0.0050 / 0.0066
<i>fordirascap + unemployment</i>	0.1921 / 0.1046	0.0839 / 0.0104	0.9462 / 0.0000	0.9682 / 0.0000
<i>gdpgrowth + grocapform</i>	0.0741 / 0.0000	0.1101 / 0.0000	0.0045 / 0.0000	0.0010 / 0.0000
<i>gdpgrowth + openness</i>	0.8469 / 0.0004	0.6496 / 0.0005	0.8146 / 0.0025	0.4871 / 0.0005
<i>gdpgrowth + realinrate</i>	0.6352 / 0.4026	0.5920 / 0.0000	0.6009 / 0.3925	0.9735 / 0.0002
<i>gdpgrowth + tazrevenue</i>	0.1710 / 0.0025	0.7055 / 0.0018	0.6060 / 0.0061	0.8346 / 0.0000
<i>gdpgrowth + unemployment</i>	0.0491 / 0.1304	0.0019 / 0.0133	0.0786 / 0.0000	0.0418 / 0.0000
<i>grocapform + openness</i>	0.0000 / 0.0001	0.0000 / 0.0001	0.0000 / 0.0444	0.0000 / 0.2911
<i>grocapform + pcgdpgrowth</i>	0.0000 / 0.0000	0.0000 / 0.0008	0.0000 / 0.0000	0.0000 / 0.0001
<i>grocapform + realinrate</i>	0.0002 / 0.2174	0.0000 / 0.1359	0.0000 / 0.0001	0.0000 / 0.3773
<i>grocapform + tazrevenue</i>	0.0000 / 0.0041	0.0000 / 0.0115	0.0000 / 0.5314	0.0000 / 0.6577
<i>grocapform + unemployment</i>	0.0294 / 0.8705	0.0001 / 0.7528	0.0000 / 0.2250	0.0000 / 0.0000
<i>openness + pcgdpgrowth</i>	0.0057 / 0.0036	0.0006 / 0.3757	0.0405 / 0.0110	0.0007 / 0.3526
<i>openness + realinrate</i>	0.0390 / 0.4074	0.0104 / 0.0017	0.5779 / 0.0160	0.3894 / 0.0467
<i>openness + tazrevenue</i>	0.0761 / 0.4215	0.1179 / 0.2388	0.0191 / 0.0593	0.0871 / 0.0002
<i>openness + unemployment</i>	0.0305 / 0.2686	0.0321 / 0.1019	0.3013 / 0.0000	0.4340 / 0.0000
<i>pcgdpgrowth + realinrate</i>	0.0018 / 0.2888	0.1266 / 0.0019	0.0033 / 0.0175	0.0755 / 0.0504
<i>pcgdpgrowth + tazrevenue</i>	0.0748 / 0.0020	0.4732 / 0.0004	0.1944 / 0.0069	0.3777 / 0.0000
<i>pcgdpgrowth + unemployment</i>	0.0065 / 0.1278	0.0002 / 0.0160	0.0282 / 0.0000	0.0055 / 0.0000
<i>realinrate + tazrevenue</i>	0.4510 / 0.0741	0.0001 / 0.0979	0.6625 / 0.1007	0.1100 / 0.0057
<i>realinrate + unemployment</i>	0.1464 / 0.3629	0.1127 / 0.1533	0.0018 / 0.0000	0.4903 / 0.0000
<i>tazrevenue + unemployment</i>	0.0841 / 0.3604	0.0660 / 0.1865	0.5852 / 0.0000	0.0805 / 0.0000
<i>fordirinflow + gdpgrowth</i>	0.1392 / 0.0023	0.0794 / 0.5348	0.1309 / 0.0048	0.0805 / 0.7317
<i>fordirinflow + grocapform</i>	0.1258 / 0.0010	0.0312 / 0.0000	0.0261 / 0.0000	0.0028 / 0.0000
<i>fordirinflow + openness</i>	0.2572 / 0.0113	0.1957 / 0.0075	0.1295 / 0.2205	0.1192 / 0.0080
<i>fordirinflow + pcgdpgrowth</i>	0.0701 / 0.0004	0.0053 / 0.0281	0.0737 / 0.0063	0.0206 / 0.1047
<i>fordirinflow + realinrate</i>	0.3121 / 0.1842	0.5933 / 0.0178	0.7797 / 0.0028	0.9730 / 0.2217

Table 16 - Malmquist Index Economic Multi-Variable Estimations

FINANCIAL SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>lisdcomp + marketcap</i>	0.2875 / 0.3496	0.0265 / 0.0023	0.4415 / 0.9855	0.0000 / 0.7831
<i>lisdcomp + turnover</i>	0.2989 / 0.4081	0.0000 / 0.1650	0.6294 / 0.9652	0.0000 / 0.8737
<i>lisdcomp + valuetraded</i>	0.2813 / 0.4132	0.0235 / 0.0050	0.4377 / 0.6987	0.0000 / 0.0000
<i>lisdcomp + portinvbonds</i>	0.4345 / 0.6573	0.0084 / 0.3904	0.5896 / 0.3904	0.0000 / 0.0173
<i>lisdcomp + portinvequity</i>	0.4835 / 0.6650	0.0052 / 0.0055	0.6070 / 0.9536	0.0000 / 0.4817
<i>marketcap + portinvbonds</i>	0.5222 / 0.4928	0.0294 / 0.3767	0.9104 / 0.3077	0.0000 / 0.0000
<i>marketcap + portinvequity</i>	0.7394 / 0.7440	0.2174 / 0.5957	0.4083 / 0.4339	0.0000 / 0.0001
<i>marketcap + turnover</i>	0.7421 / 0.7591	0.1565 / 0.8104	0.8721 / 0.7645	0.7923 / 0.2774
<i>marketcap + valuetraded</i>	0.8075 / 0.9913	0.4668 / 0.1904	0.9175 / 0.6806	0.0001 / 0.0000
<i>portinvbonds + turnover</i>	0.9037 / 0.0124	0.7782 / 0.0514	0.6613 / 0.3190	0.3355 / 0.4234
<i>portinvbonds + valuetraded</i>	0.7631 / 0.8479	0.9622 / 0.4633	0.4049 / 0.8586	0.0071 / 0.0226
<i>turnover + valuetraded</i>	0.6031 / 0.7656	0.2881 / 0.0367	0.8362 / 0.8586	0.5574 / 0.3115

Table 17 - Malmquist Index Financial Sector Multi-Variable Estimations

6.5 Efficiency Change Multi-Variable Estimation

BANKING SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>dcredbybank + dcredgrurate</i>	0.0855 / 0.0643	0.1038 / 0.1614	0.9003 / 0.1132	0.9345 / 0.5612
<i>dcredbybank + grprcapflow</i>	0.1686 / 0.1063	0.6012 / 0.6690	0.1484 / 0.8204	0.9906 / 0.9564
<i>dcredbybank + liquid</i>	0.3141 / 0.5906	0.0774 / 0.1561	0.2463 / 0.0763	0.7270 / 0.6823
<i>dcredbybank + totaldomfin</i>	0.0124 / 0.3898	0.0461 / 0.6983	0.8293 / 0.4129	0.8987 / 0.8682
<i>dcredgrurate + grprcapflow</i>	0.5009 / 0.0395	0.3075 / 0.4906	0.8488 / 0.8532	0.9302 / 0.9667
<i>dcredgrurate + liquid</i>	0.0525 / 0.1675	0.1364 / 0.5195	0.1449 / 0.2861	0.4932 / 0.8077
<i>dcredgrurate + totaldomfin</i>	0.1084 / 0.7375	0.1771 / 0.6835	0.1628 / 0.6532	0.3996 / 0.9023
<i>grprcapflow + liquid</i>	0.0509 / 0.3554	0.4237 / 0.9212	0.9745 / 0.2182	0.9778 / 0.8567
<i>grprcapflow + totaldomfin</i>	0.0049 / 0.9282	0.1379 / 0.6026	0.2656 / 0.9867	0.6665 / 0.6991
<i>liquid + totaldomfin</i>	0.0365 / 0.1968	0.0615 / 0.2385	0.3984 / 0.6735	0.9323 / 0.9742

Table 18 - Efficiency Change Banking Sector Multi-Variable Estimations

ECONOMIC VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>gdpgrowth + grocapform</i>	0.0132 / 0.0070	0.3754 / 0.273	0.1673 / 0.0312	0.7182 / 0.1966
<i>gdpgrowth + infconsprice</i>	0.0228 / 0.8942	0.4131 / 0.7783	0.1651 / 0.6472	0.8422 / 0.4966
<i>gdpgrowth + openness</i>	0.0325 / 0.1915	0.4359 / 0.0069	0.2142 / 0.0143	0.7736 / 0.4626
<i>grocapform + infconsprice</i>	0.0218 / 0.5284	0.4525 / 0.9249	0.0995 / 0.9708	0.4815 / 0.4974
<i>grocapform + openness</i>	0.0178 / 0.1224	0.2131 / 0.0092	0.0964 / 0.0347	0.2512 / 0.3851
<i>grocapform + pcgdpgrowth</i>	0.0053 / 0.0033	0.3007 / 0.1492	0.0546 / 0.0245	0.2017 / 0.5035
<i>infconsprice + openness</i>	0.8133 / 0.3172	0.8155 / 0.0197	0.8816 / 0.06664	0.4964 / 0.8032
<i>infconsprice + pcgdpgrowth</i>	0.7669 / 0.0127	0.7363 / 0.2122	0.4853 / 0.0242	0.4902 / 0.5444
<i>openness + pcgdpgrowth</i>	0.2579 / 0.0283	0.0092 / 0.2639	0.0183 / 0.0513	0.4168 / 0.5416

Table 19 - Efficiency Change Economic Multi-Variable Estimations

FINANCIAL SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>lisdomcomp + portinvbonds</i>	0.5613 / 0.6886	0.1225 / 0.5315	0.9676 / 0.2442	0.1899 / 0.0029
<i>lisdomcomp + portinvequity</i>	0.6126 / 0.7488	0.0105 / 0.3152	0.9729 / 0.8983	0.2926 / 0.3179
<i>lisdomcomp + turnover</i>	0.4094 / 0.4142	0.0066 / 0.0032	0.9799 / 0.9539	0.8016 / 0.6085
<i>lisdomcomp + valuetraded</i>	0.2559 / 0.7532	0.0017 / 0.4258	0.9205 / 0.5801	0.6563 / 0.7609
<i>portinvbonds + portinvequity</i>	0.9617 / 0.2937	0.6831 / 0.1989	0.9604 / 0.3801	0.9963 / 0.4015
<i>portinvbonds + turnover</i>	0.9556 / 0.0145	0.8549 / 0.0008	0.5941 / 0.3579	0.6003 / 0.7851
<i>portinvbonds + valuetraded</i>	0.7589 / 0.7075	0.4593 / 0.4174	0.2452 / 0.9645	0.2816 / 0.3657
<i>portinvequity + turnover</i>	0.5663 / 0.0208	0.4792 / 0.0021	0.7325 / 0.3271	0.6571 / 0.7616
<i>portinvequity + valuetraded</i>	0.8069 / 0.7735	0.1895 / 0.2128	0.3602 / 0.3629	0.0000 / 0.0000
<i>turnover + valuetraded</i>	0.6998 / 0.9654	0.1394 / 0.2634	0.9312 / 0.9153	0.3475 / 0.6703

Table 20 - Efficiency Change Financial Sector Multi-Variable Estimations

6.6 Technical Change Multi-Variable Estimation

BANKING SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>dcredbybank + dcredgrwrate</i>	0.0674 / 0.5179	0.0337 / 0.2676	0.1974 / 0.6482	0.0001 / 0.9031
<i>dcredbybank + grprcapflow</i>	0.0412 / 0.0264	0.0577 / 0.2006	0.1908 / 0.1648	0.0228 / 0.0165
<i>dcredbybank + liquid</i>	0.3751 / 0.8476	0.0941 / 0.3485	0.2286 / 0.4006	0.0302 / 0.8204
<i>dcredbybank + privcred</i>	0.5339 / 0.1664	0.7032 / 0.6625	0.2563 / 0.6457	0.0004 / 0.1021
<i>dcredbybank + totaldomfin</i>	0.0406 / 0.8931	0.0648 / 0.1181	0.2469 / 0.1298	0.1105 / 0.0087
<i>dcredgrwrate + grprcapflow</i>	0.2026 / 0.0075	0.1142 / 0.1031	0.4428 / 0.2598	0.4548 / 0.0566
<i>dcredgrwrate + liquid</i>	0.5773 / 0.1627	0.2467 / 0.2101	0.6771 / 0.8498	0.8124 / 0.0077
<i>dcredgrwrate + privcred</i>	0.5778 / 0.0324	0.2589 / 0.0497	0.5612 / 0.2834	0.7149 / 0.0097
<i>dcredgrwrate + totaldomfin</i>	0.3075 / 0.5247	0.2045 / 0.1824	0.9887 / 0.1316	0.6012 / 0.0032
<i>grprcapflow + liquid</i>	0.0076 / 0.0646	0.0864 / 0.1253	0.1948 / 0.1878	0.0238 / 0.0243
<i>grprcapflow + privcred</i>	0.1015 / 0.0101	0.4272 / 0.0137	0.1813 / 0.4073	0.0253 / 0.2283
<i>grprcapflow + totaldomfin</i>	0.0008 / 0.6457	0.0067 / 0.6889	0.2551 / 0.7102	0.1424 / 0.2367
<i>liquid + privcred</i>	0.3228 / 0.0487	0.3114 / 0.0418	0.7516 / 0.4978	0.1158 / 0.5572
<i>liquid + totaldomfin</i>	0.0313 / 0.3292	0.0808 / 0.8892	0.5677 / 0.6827	0.2976 / 0.4283
<i>privcred + totaldomfin</i>	0.0092 / 0.4555	0.0105 / 0.0292	0.2269 / 0.0799	0.0964 / 0.0017

Table 21 - Technical Change Banking Sector Multi-Variable Estimations

ECONOMIC VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>centgovdebt + gdpgrowth</i>	0.1904 / 0.1074	0.0101 / 0.2842	0.0045 / 0.4223	0.0000 / 0.7503
<i>centgovdebt + realinrate</i>	0.5442 / 0.6662	0.3678 / 0.3689	0.0251 / 0.7798	0.0000 / 0.2306
<i>centgovdebt + tazrevenue</i>	0.9223 / 0.0004	0.4716 / 0.0115	0.0327 / 0.3156	0.0014 / 0.0452
<i>gdpgrowth + procapform</i>	0.1491 / 0.0176	0.9258 / 0.0001	0.0007 / 0.0000	0.0725 / 0.0000
<i>gdpgrowth + realinrate</i>	0.2771 / 0.1705	0.1341 / 0.2055	0.0193 / 0.0636	0.8934 / 0.1684
<i>gdpgrowth + tazrevenue</i>	0.3799 / 0.0000	0.2062 / 0.0000	0.5626 / 0.0003	0.4432 / 0.0000
<i>gdpgrowth + unemployment</i>	0.5368 / 0.1037	0.3986 / 0.0291	0.0356 / 0.0000	0.0887 / 0.0000
<i>grocapform + realinrate</i>	0.0316 / 0.0886	0.0001 / 0.6619	0.0000 / 0.0042	0.0000 / 0.3164
<i>grocapform + tazrevenue</i>	0.0371 / 0.0000	0.0010 / 0.0000	0.0000 / 0.0345	0.0000 / 0.0117
<i>grocapform + unemployment</i>	0.3137 / 0.5656	0.0311 / 0.6224	0.2018 / 0.0091	0.0429 / 0.0009
<i>realinrate + tazrevenue</i>	0.9970 / 0.0000	0.2619 / 0.0002	0.9545 / 0.0068	0.7555 / 0.0000
<i>realinrate + unemployment</i>	0.8323 / 0.2083	0.5862 / 0.1074	0.5495 / 0.0004	0.5125 / 0.0000
<i>tazrevenue + unemployment</i>	0.0000 / 0.4288	0.0000 / 0.2047	0.6977 / 0.0001	0.8254 / 0.0000

Table 22 - Technical Change Economic Multi-Variable Estimations

FINANCIAL SECTOR VARIABLES	COMMON-NO	COMMON-CROSS	FIXED-NO	FIXED-CROSS
<i>lisdomcomp + marketcap</i>	0.7423 / 0.2223	0.6551 / 0.0191	0.2469 / 0.4377	0.0000 / 0.0000
<i>lisdomcomp + portinvbonds</i>	0.6125 / 0.8457	0.2899 / 0.5025	0.4444 / 0.9587	0.0000 / 0.3816
<i>lisdomcomp + portinvequity</i>	0.6366 / 0.7888	0.2859 / 0.4376	0.4497 / 0.9567	0.0000 / 0.0015
<i>lisdomcomp + valuetraded</i>	0.8866 / 0.4573	0.5266 / 0.0377	0.2452 / 0.9334	0.0000 / 0.9823
<i>marketcap + portinvbonds</i>	0.8124 / 0.8843	0.5266 / 0.2446	0.7243 / 0.7942	0.0000 / 0.0000
<i>marketcap + portinvequity</i>	0.9269 / 0.8325	0.5648 / 0.1579	0.5398 / 0.5905	0.4148 / 0.4908
<i>marketcap + valuetraded</i>	0.5695 / 0.9403	0.2453 / 0.7094	0.4416 / 0.8492	0.0000 / 0.0696
<i>portinvbonds + valuetraded</i>	0.9271 / 0.8546	0.7063 / 0.0181	0.9478 / 0.8531	0.4314 / 0.4295
<i>portinvequity + valuetraded</i>	0.7353 / 0.7881	0.0065 / 0.0000	0.8492 / 0.8179	0.0143 / 0.0098

Table 23 - Technical Change Financial Sector Multi-Variable Estimations

7 CONCLUSION

This paper first examined the Malmquist index and its two components-efficiency change and technological change. Overall mean Malmquist productivity index with a value slightly greater than one (1.001706) indicates that for all countries in the sample there has been productivity gain on the average. Between the two groups of countries, there is a productivity gain in developed countries (0.06482% per year); there is a productivity loss in developing countries (0.03752% per year).

Developing countries have on average a higher efficiency change index, which indicates that this set of countries approach the "best practice" frontier at a faster rate than high-income countries, and hence the catch-up process works in the low-income countries. However, this set of countries are suffering from loss of productivity due to the other source of productivity growth-technical change (innovation)- which is in fact the main source of productivity growth for high-income countries (0.2877% technical change gain for developed countries and 1.2785% technical change loss for developing countries).

In the second part of the study, we investigated how banking sector, economic, financial development and institutional variables enter the regression equations when the dependent variable is one of these indexes. First we examined the single variable estimations and determined the significant variables. Then the double variable estimations are performed and finally estimations which employ all kinds of variables are carried out. Results suggest that, domestic credit by banks, liquid liabilities, real interest rate, foreign direct inflow, openness, market capitalization and value of the traded stocks are factors for Malmquist index, since these variables give significant results for single variable, double variable and all variable estimations. For the efficiency change domestic credit by banks, gross capital formation, inflation, listed domestic companies and the value of the traded stocks are significant variables according to the results of single variable, double variable and all variable estimations. Finally for the technological change, although all variable estimations do not give significant results, liquid liabilities, private credit, openness, tax revenue, unemployment, number of listed companies and market capitalization seem to be related according to the single variable and double variable estimations.

As the final part of the study, we tried to find the complete equations that explain each of the indexes. For the Malmquist index we found two most significant equations given below:

$$1. \text{ "MALM. INDEX} = -0.0006dcredbybank + 0.0001openness - 0.0010realinrate + 0.0008valuetraded"$$

where domestic credit by bank and real interest rate have the negative coefficients and openness and the value traded have the positive coefficients.

$$2. \text{ "MALM. INDEX} = 0.0005liquid + 0.0002openness - 0.0008realinrate + 0.0006valuetraded"$$

where liquid liabilities, openness and value traded have positive coefficients but real interest rate has a negative coefficient.

For the efficiency component, we found the following most significant equation:

$$\text{"EFF.} = 0.0003dcredbybank - 0.0005liquid - 0.0008infconspice - 0.0001grocapform + 0.0002lisdomcomp + 0.0004valuetraded"$$

In this equation, domestic credit by banking sector, number of listed domestic companies and value traded have positive coefficients; liquid liabilities inflation (consumer prices) and gross capital formation have negative coefficients. So, this regression equation explains that domestic credit by banking sector, number of listed domestic companies and total value of stocks traded are positively correlated with the efficiency component but liquid liabilities, inflation (consumer prices) and gross capital formation are negatively correlated with the efficiency component.

Finally, when we examine the regression equations for technology component of the Malmquist index, we are unable to find as good equations as we did for Malmquist index and the efficiency component. Among the regression equations we tried for technology component, domestic credit by banking sector, liquid liabilities, unemployment, gross capital formation and number of listed domestic companies are the significant ones. Equations given below are the significant ones:

$$1. \text{ TECHNOLOGY} = -0.0007liquid + 0.0010grocapform - 0.0005lisdomcomp$$

where liquid liabilities and number of listed domestic companies are negatively, gross capital formation is positively correlated with the technology component.

$$2. \text{ TECHNOLOGY} = 0.0005dcredbybank - 0.0003realinrate - 0.0008lisdomcomp$$

where real interest rate and number of listed domestic companies are negatively, domestic credit by banking sector is positively correlated with technology component.

$$3. \text{ TECHNOLOGY} = 0.0003dcredbybank + 0.0004unemployment + 0.0010turnover$$

where all the components are positively correlated with the technology component.

SELECT BIBLIOGRAPHY

- Adams, J. 1819, quoted from Hammond, 1991: 36.
- Bagehot, W. 1873, *Lombard Street*. Homewood, IL: Richard D. Irwin.
- Bekaert, G. and Harvey, C. Winter/Spring 1998, "Capital markets: an engine for Economic Growth." *The Brown Journal of World Affairs*, pp. 33-53.
- Bencivenga, V. R. and Smith, B. D. 1991, "Financial Intermediation and Endogenous Growth." *Review of Economics Studies*, 58: 195-209.
- Bhide, A. August 1993, "The Hidden Costs of Stock Market Liquidity." *Journal of Financial Economics*, 34(2): 31-51.
- Demirguc-Kunt, A. and Levine, R. May 1996, "Stock Market Development and Financial Intermediaries: Stylized Facts." *World Bank Economic Review*, 19(2): 291-322.
- Devereux, Michael B. and Smith, Gregor W. August 1994, "International Risk Sharing and Economic Growth." *International Economic Review*, 35(4): 535-50.
- Fare, R., Grosskopf, S., Norris, M., Zhang, Z. 1994, "Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries." *The American Economic Review*, 84: 66-83.
- GAMS 2002, "<http://www.gams.com>".
- Goldsmith, R. W. 1969, *Financial Structure and Development*. New Haven, CT: Yale University Press.
- Hamilton, A. 1781, quoted from Hammond, 1991: 36.
- Hammond, B. 1991, *Banks and Politics in America: From the Revolution to the Civil War*. Princeton, NJ: Princeton University Press.
- Hicks, J. A. 1969, *A Theory of Economic History*. Oxford: Clarendon Press.
- International Monetary Fund 2002, *International Financial Statistics*. "<http://ifs.apdi.net/imf>".
- King, R., Levine R. 1993, "Finance and Growth: Schumpeter Might be Right." *The Quarterly Journal of Economics*, 88: 717-737.
- La Porta, R., Lopez-de-Silanes F., Shleifer A., and Vishny, R.W. 1997, "Legal Finance." *Determinants of External Journal of Finance*, 52: 1131-1150.
- Levine, R. 1991, "Stock Markets, Growth and Tax Policy." *The Journal of Finance*, 46: 1445-1465.
- Levine, R., Renelt, D. 1982, "A Sensitivity Analysis of Cross-Country Growth Regressions." *The American Economic Review*, 82: 942-963.
- Levine, R., Zervos, S. 1993, "What We Have Learned About Policy and Growth from Cross-Country Regressions?" *The American Economic Review*, 83: 426-430.

- Levine, R. 1997, "Financial Development and Economic Growth: Views and Agenda." *Journal of Economic Literature*, 35: 688-726.
- Levine, R., Zervos S. 1998, "Stock Markets, Banks and Economic Growth." *The American Economic Review*, 88: 537-558.
- Levine, R., Loayza N., Beck T. 2000, "Financial Intermediation and Growth: Causality and Causes." *Journal of Monetary Economics*, 46: 31-77.
- Lucas, R. E. Jr. 1998, "On the Mechanics of Economic Development." *Journal of Monetary Economics*, 22: 3-42.
- McKinnon, R. I. 1973, *Money and Capital in Economic Development*. Washington, D.C.: Brookings Institution.
- Obstfeld, M. December 1994, "Risk-Taking, Global Diversification, and Growth." *American Aconomic Review*, 84(5): 1310-29.
- Penn World Tables 2002, "<http://pwt.econ.upenn.edu>".
- Schumpeter, J. A. 1912, *Theorie der wirtschaftlichen entwicklung*. Leipzig, Germany: Dunker & Humblot.
- Shleifer, A. and Vishy, R. W. June 1986, "Large Shareholders and Corporate Control." *Journal of Political Economy*, 96(3): 461-88.
- Taskin, F., Zaim, O. 1997, "Catching-up and Innovation in High- and Low-income Countries." *Economics Letters*, 54: 93-100.
- World Bank 2000, *World Development Indicators*. Washington, DC: World Bank.