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THE GROWTH EXPERIENCE OF INDIA AND SOUTH KOREA:

AN EMPIRICAL STUDY

BY

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DISSERTATION

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MENTOR

READER

READER

Acknowledgments

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Preface

The first contact between communities at the dawn of civilization was via the transfer of goods and services. This transformed over the millennia into trade between regions and eventually between nations. The "New World" so to speak was discovered in the process of trying to find a better trade route between Europe and South East Asia. The founding and development of the "New World" was mainly due to the human urge to seek better opportunities. Adam Smith summarized this age-old activity in his "Wealth of Nations" and the science of Economics was born.

Economic development is the focus of any individual, community and government. Constraints are a reality of life and success is measured in how one efficiently minimizes these constraints. There are incentives for prioritizing economic spending and subsequent growth. Stable economies produce the ultimate reward that all public policy experts seek as the Holy Grail – Growth.

Growth is the end game of all economic activity. This is what we all seek in the study of Economics. There is a, probably never ending, search to find just the right combination of economic policy that would provide the perfect formula for growth and development. I perceive growth to be an onion of multiple layers. The more layers you peel the more you learn. Thus, by definition there is simultaneity in the economic variables that result in the growth of an economy.

In this thesis, I will attempt to compare the economic policies of India and South Korea from 1962 to 2001. The exclusivity of this dissertation does not lie in the effort of studying, analyzing and understanding the Korean development experience, but is in the fact that it is being contrasted with another developing economy that shared the same initial economic profile.

1. Introduction

Economic development is demanded and sought by all societies and people of the world; there is an inherent urge and need to progress and better oneself in every person. This "betterment" most often than not means to improve one's earning power, one's income, and one's economic ability. The same concept when applied to nations is called "Economic Development." Individuals can be segmented according to their earning capacities. In the context of an economy this segmentation yields terms such as Developed, Developing and Under-Developed.

The focus of this dissertation would be to understand how countries make this transition from one level of development to the next. The aim is to research and understand the transition of the South Korean economy and contrast this with the development experience of India. The rapid rate at which the Korean economy developed makes it unique and warrants a close study of the socio-economic models that were used. The World Bank (1993) study of East Asian Economies attributed the Korean success to the existence of the right macroeconomic fundamentals and emphasized the importance of macroeconomic variables in generating the right economic environment for growth.

Comparison: India vs. Korea

There are intuitive reasons for the comparison of the two economies – South Korea and India have many characteristics in common such as large government presence, import substitution industrialization strategy, a financial sector where government owned banks have dominated and a large unorganized financial market exists. Both countries had more or less the same GDP growth rate in 1962 (2.7% for India and 2.1% for South Korea). However, over the years while Korea's rate of growth started increasing rapidly at around 9%, India's growth

rate remained stagnant at 3.5% till 1984[1]. Both had predominantly agrarian economies at the beginning of their journey as independent republic's in the late 40's, widespread malnutrition, low levels of education, almost nonexistent foreign trade, low per capita incomes and material impoverishment. However, in the late 60's South Korea's economy went through a metamorphosis of sorts relative to India's economy that progressed at a much slower pace.

[1] Studies have examined openness in trade to explain growth rates. Korea's high growth rate, it is suggested, is due to its early transition to a more export-oriented economy, while India's low growth rate is attributed to its reluctance to abandon its closed economy policies that existed until the early 1990's.

2. The Meaning Of Growth

Economic growth depends ultimately on the input of productive resources and the efficiency with which they are used. Resource input and efficiency depend on private forces in the economy and by government policies[2]. Historically, economists have considered land, labor and capital as the factors of production.

Land

However, the environment is so man-made that variations in natural resources are more effective at explaining historical differences in levels of income rather than in explaining current growth rates. This is supported by Denison's work, which establishes that natural resources play no explanatory role on developed country growth[3]. In developing countries, where man-made capital is scarcer, natural resource endowment looms larger as an explanatory variable, especially in countries with mineral wealth.

Labor

In developed countries, on the other hand, where productivity is high and labor scarce, one can never think about explaining growth without analyzing the labor supply. Developing countries are often assumed to have a surplus labor and this needs to be factored as a driver of growth. There is an enormous difference in the productivity of agricultural and non-agricultural labor; the differential impact can also explain economic growth.

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[2] Madison, A., *Explaining the Economic Performance of Nations: Essays in Time and Space*, Edward Elgar Publishing Company, 1995.
[3] See E.F. Denison, *Why Growth Rates Differ*, Brookings Institution, Washington, 1967, and Allen & Unwin, London 1968.

Capital

The next resource input that economists have studied and considered important is capital. Investment has evidenced to be the most important engine of growth in the post-war developing world. In most developing countries, it is only since World War II that investment has risen significantly above the level of Europe in the eighteenth century. This increase has been considered the single largest driver of accelerated economic growth. In the 1950's economists stressed the importance of high investment in achieving a 'take-off', transforming a stagnant economy into a developing one. Earlier research has suggested that the critical effort involved in the development process was to increase net investment from 5 to 10 percent of national income[4]. The argument for a 10 percent net investment rate implies a target for gross investment including allowance for replacement, of about 13 to 14 percent of GDP.

One criticism of comparing investment rates is that price of Capital goods varies significantly when compared among the developed and developing economies. Construction is generally cheaper in the developing world when compared to the developed world. However, equipment is more expensive. But the coverage of developing country estimates are often less complete leading to these two factors being offsetting. To measure the effect of investment on output it is more relevant to see the rate of growth of capital stock. Two countries might devote the same share of GDP to investment, but if the GDP is growing at a greater rate in one than in the other its capital stock will rise more quickly.

There are drivers that affect the efficient use of factors of production so as to maximize growth and subsequently development that impact the economic growth of nations. The drivers can be broadly classified as:

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[4] *The Theory of Economic Growth*, Allen & Unwin, London, 1959
The Stages of Economic Growth, Rostow W.W., Cambridge, 1960

(i) **Trade:** Trade theory is based on the principle of comparative advantage. It is most efficient for a country to export those goods that it is relatively best at producing and to import others. This source of comparative advantage has evolved over three models. The earliest Ricardian version attributed this to a country's natural resource endowments or special talents. The Heckscher-Ohlin theory bases comparative advantage on the given endowments of factors such as capital and labor. Thus it would be most efficient for least developed countries to produce and export labor-intensive goods. The third theory is the modern trade theory. This suggests that comparative advantages are not given or rigid. It argues that comparative advantage can be changed by learning-by-doing gained by competing in international markets; the success of the East-Asian "tigers" is attributed to the fact that they prospered by producing and exporting goods that were based on production efficiencies rather than cheap labor.

England's experience over the period 1700-1815 provides the classic example of dynamic growth spurred by trade[5]. Being the first exporter of manufactured goods boosted England's industrial revolution. These exports declined after 1815 as other European countries started to industrialize. Among the least developed countries also there are many examples of economic growth. These are primarily credited to exports that derived from the countries natural resources. The climate and soil made it possible to grow rubber in Malaysia; coffee in Brazil and Columbia; tea in India and Sri Lanka; beef and wheat in the United States, Argentina and Canada; butter and wool in New Zealand; cocoa in Ghana and Nigeria; and mine copper ore in Chile and Zaire. By contrast the current examples of successes are of least developed countries with extremely rapid growth of manufactured exports. Among these countries their comparative advantage initially came from their abundant labor. Some notable examples are Taiwan, Hong Kong, Singapore and Korea. More recently

[5] Kasliwal, P., *Development Economics*, South-Western College Publishing, 1995

as the wage rates grew in these countries they turned to exports that are intensive in human capital skills, thus exporting cars and electronics rather than just textiles and steel. Other diversified exporters are Brazil, Mexico, India, Pakistan, Egypt, and Thailand. Their exports and growth performance is somewhat less dramatic, while they continue to have a substantial share of primary commodities in their export bundle. Literature and empirical evidence suggests that the structure of a country's exports appears closely related to its growth performance. It can be observed from table-2 that the share of the top three exports has dropped from 55% in 1960 to 32% in 1978 suggesting diversification in exports. On the other hand, the trade composition of Africa has hardly changed over time.

Most African nations rely on a few primary exports, while the share of manufactured goods has barely grown. The African exporters group includes most of the non-oil producing Africa. This group seems to be unique among least developed countries, in the sense that it is stuck in the old pattern. Another observation is that countries well endowed with natural riches often perform worse than those with few resources. The analogy to better explain this is that individuals who are born rich generally are perceived to have a lesser incentive to work or study hard when compared to those who are not born with a silver spoon. Taiwan and Korea can be cited as countries that were "blessed" with few natural resources. The role of trade in their economic development is evidence of how a robust and efficient trade can impact economic growth.

Table 1 – Export Performance

	Diversified Exporters		Africa Exporters	
	1960	1978	1960	1978
Primary Goods	30%	29%	28%	31%
Manufactured Goods	15%	39%	4%	7%
Three Largest Exports Combined	55%	32%	69%	62%

Source: Kasliwal, P., *Development Economics*, South-Western College Publishing, 1995

Countries that concentrated largely on Ricardian type exports have shown the worst growth performance. The import substitution industrialization strategy, once considered a promising alternative, has not performed too well either. The best performance has been for those countries that achieved the fastest technical progress by pursuing manufactured exports in competitive world markets.

(ii) **Government:** Governments adopt a menu of policies and take a strong initiative in promoting industrialization. There are, however, two important differences: some governments tend to intervene indirectly with the decisions of the private sector; others more direct and more forceful.

The difference in the form of government intervention partly reflects the development stages of countries. Initially, developing countries tend to lack entrepreneurs experienced in international trade and a well-developed financial system and thus can benefit from greater participation by government in industrial and trade activities. As the private sector develops, the government usually relinquishes its role to private

entrepreneurs, intervening indirectly with taxes and subsidies to correct externalities.

In the case of Korea, this transition in the role of government occurred in the 1980's. Immediately after the Korean War a priority production approach was adopted in Korea as a result of a strong governmental initiative. In the 1980's, government intervention became indirect and the government began to assume a supporting role for the private sector. Nevertheless, the influence of the government on industries in Korea is greater when compared with the other "tigers".

In India this transition occurred only in the early 1990's. There was a severe balance of payments (bop) crisis in India that evolved over the prior 30 years due to a combination of an in-efficient public sector and populist economic policies initiated by a succession of governments throughout the 60's, 70's and 80's. The BOP crisis prompted the administration to implement an aggressive reform program under which all industries with the exception of Pharmaceuticals, Steel and Defense sectors of the economy were either liberalized or slated for later opening up to the private sector.

(iii) **Imported Technology:** Technology is an important ingredient in economic growth. Technology differs from other factors of production in the sense that it does not require denying consumption like capital accumulation; is not a long and arduous process like building human capital; it is not limited like natural resources; and finally it is unlike labor, which grows exogenously.

> .....The direct contribution of man-hours and capital accumulation would hardly account for more than a tenth of the growth in per-capita product.... The

> large remainder must be assigned to an increase in the efficiency of the productive resources. (Kuznets 1981)[6]

The transfer of foreign technology is indispensable in establishing new industries in developing countries. In the case of Korea, foreign technology was introduced in the 1960's mainly through imports of machinery and equipment was required. In the early 1970's technology transfer through direct foreign investment and licensing became important as Korea started building its heavy and chemical industries.

The government intervened in technology transfer to control the content of technology, restrictive, marketing clauses, the possible impact on the development of new industries, and royalty payment arrangements.

India on the other hand was persistent in continuing in a closed economy format in spite of the failings of such a system became evident. Joint ventures or foreign-controlled firms generally were discouraged, even though capital inflow was desired! The import of capital goods was restricted in order to promote the domestic capital goods industry. This kind of protectionism was also based on the theory of infant industry idea of creating technical progress by learning-by-doing. As a result, India now has excess capacity for producing machine tools, heavy electrical equipment, as well as machinery for sugar and paper mills. The hindrance of foreign technology transfer was in addition to the fact that productivity advances domestically were poor. Technology transfer in India for the most part was handled through a process called collaborative agreements. This would loosely involve the government conducting a review process of foreign technology and then would allow a domestic firm to then purchase this foreign technology. Negotiations were conducted on a tripartite basis with the government negotiating with the domestic and foreign firms. The

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[6] Kasliwal, P., *Development Economics*, South-Western College Publishing, 1995

government in this context was viewed as the harbinger of national interest. Inadvertently, the restrictions of royalty payments led to the often purchase of low-cost, low-tech packages.

(iv) **Financial systems and Policies:** Money plays the role of a conduit between savings and investment in the process of economic development, but in many developing countries government intervention or regulation in financial market tends to suppress this role of money and thus retard economic development. In most developing countries the financial sector is dualistic in nature; i.e., there is a highly regulated formal sector and a large unorganized sector known as the "black market." The formal sector provides loans primarily to the priority sectors of the economy at concessional rates. The "black market", on the other hand, serves the informal sectors of the economy and the lending rates are far higher than the government rates. Financial repression is generally used to describe the situation where interest rates are at negative real levels or where the government holds interest rates below market clearing levels. This implies that financial liberalization becomes an important aspect of macroeconomic stabilization.

The neoclassical approach to capital accumulation places the emphasis on a policy of streamlining domestic financial markets. Market forces can then operate so that market-determined interest rates can serve to improve efficiency in the market for funds, and thereby to improve its responsiveness in resource allocation.

Despite financial repression in Korea and India; Korea seems to have achieved a relatively rapid economic growth when compared to India. In Korea the financial repression was real and apparent. Real interest rates decreased to zero or to negative values with low artificial interest rates and a high rate of inflation. The government also intervened extensively in

the allocation of investment funds. An effect of this financial repression was Korea's heavy dependence on external savings to finance its rapid economic growth. Since the government controlled the allocation of funds, both internal and external, it is still unclear as to how the Korean economy achieved rapid economic growth.

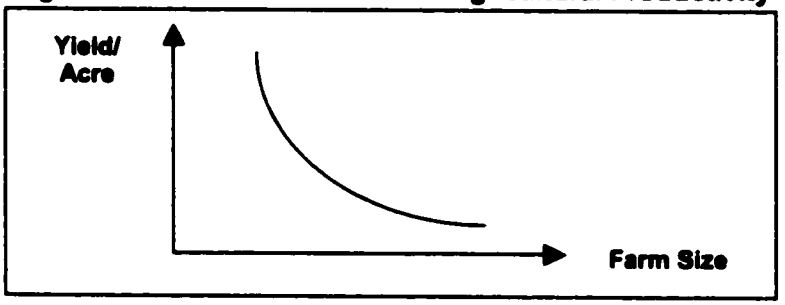
(v) **Agriculture:** There is a basic similarity in the agricultural development of India and Korea. First they both achieved self-reliance in food grains fairly early in spite of limited arable land in the case of Korea and limited capital and technology resource allocation in the case of India. In both countries the agricultural sector predominantly supplied the industrial sector with labor. Both countries have policies in place that protect the agricultural sector. The biggest dissimilarity between Korea and India is the relatively far more successful land reform implementation in Korea when compared to India. This lead to the creation of many small-scale family firms in Korea. In India, on the other hand in most instances the land holdings are so small that there are inefficient returns to scale that lead to low to negative returns on agricultural investment that for the most part mainly supports subsistence.

There is a striking empirical relation between farm size and yield per acre. Recent history suggests that reforms that prompted China's burst of economic growth started with the breakup of the large collective farms. Similarly, agricultural productivity in the erstwhile Soviet Union improved after the breakup of the massive state and collective farms and distributing these lands to the peasants.

The observation of farm size and yield was verified in a different context by a Japanese researcher. He conducted a study of farm output in various parts of Asia. He considered regions in which all other factors were fairly

similar except farm size, then measured the yield versus farm size, plotting the so called *Ishikawa Curve*.

Figure 1 – The Ishikawa Curve of Agricultural Productivity



It must be noted that the above curve merely notes an empirical regularity and not a causal relationship. The potential for agricultural advance can also be illuminated by a cross-section from a sample of developing and developed economies. The table below (table 2) illustrates the extremely wide range of production conditions that exist in farm sectors across the world. These include the differences in labor productivity, the intensity of land use, as well as policy-determined biases (positive or negative) as reflected in the price of agricultural versus other goods.

Table 2 – Agricultural Productivity in 1975

	Bilateral Comparisons with the United States (index value of 100)			
	Value Added Per farmer	**Value Added Per Capita**	**Value Added per Hectare**	**Relative Price of Agricultural Goods**
India	1.9	31	211	89
Korea	3.5	33	1013	141
China	2.3	48	217	N/A
United States	100	100	100	100

(vi) **Education and Social Basis for Education:** The human capital ingredient is recognized as a major input that generates growth. The skills enhanced by education are complimentary to the technological input to advance productivity. The basis to education can be studied in two parts. The first part is the demand side where the decision is viewed as an individual choice to invest in human capital based on cost-benefit evaluations. Quantifications of these costs and benefits allows a country to determine the appropriate kind of education measured in terms of it social rate of return. The second part is the study of the supply side that involves the evaluation of the institutional framework for providing education.

Lacking natural resources, Korea had to make full use of its abundant labor forces in order to achieve economic development. The development of an educational system and the upgrading of their labor forces were given high priority in the development strategy.

3. Research Objectives and Formulation of Hypotheses

The purpose of this research is to understand what ultimately drives growth. The hypothesis is that as a nation is young and has limited resources there is greater need to manage the resource allocation. Subsequently as nations develop their economic power, the transition needs to take place from a command to a free market economy. In an attempt to understand what drives growth one needs to have a very clear understanding of how the various macro-economic policy instruments can be used to spur development.

However, first the development of a nation and its people should be pre-cursed with a clear focus on diagnosing the problem. The percent of population under the poverty line; its correlation to education levels, Industrial growth, policy decisions, and health care expenditures. Infrastructure growth and investment in the transportation, power and communication sectors need closer scrutiny. The level of metropolitan orientation is very important in order to understand growth and development. The imbalance of urban and rural access to infrastructure; how these are influenced by policy decisions. Reduce producer and consumer go-betweens in the agricultural marketplace. The migration from rural to urban areas predominantly led by rural poverty. The acreage of agricultural land that depends on natural resources and that has access to irrigation facilities.

4. Methodology

The predictive implications of the model developed by Victor Murinde will be used to empirically test relationships between macroeconomic variables and economic growth for India and South Korea. The model is based on the standard aggregate IS-LM aggregate supply model for an open economy. It incorporates extensions that are appropriate for a developing economy.

The starting point to developing the macro-economic model is to construct a simple accounting framework for a small, open economy (table 3). In the first part of the table, the rows represent income-expenditure flow variables; Taxes (T), Consumption (C), Investment (I); while in the second part of the same table, the rows represent the stocks of assets and liabilities; Capital (K), Loans (L), Domestic Money (M) and Foreign Money (F). The columns represent the major broad sectors of the economy; Private Sector (P), Banking Sector (BA), Government Sector (G) and the Foreign Sector (FO). This means that a single row distributes the stock or flow of a variable or asset over the supply and demand sectors; while a single column represents the sector's sources and uses of funds (flows) or a sector's balance-sheet (stocks).

Table 3 – Simplified Accounting Structure of a Macro Model for a Small Open Economy

	Private Sector (P)	Banks Sector (BA)	Government Sector (G)	Foreign Sector (FO)
1. Income-Expenditure				
Taxes (T)	T^P	-	T^G	-
Consumption (C)	C^P	-	C^G	C^{FO}
Investment (I)	I^P	-	I^G	I^{FO}
Net Acquisitions (S)	S^P	-	S^G	S^{FO}

Source: Murinde, V., *Macroeconomic Policy Modeling for Developing Economies*, Ashgate Publishing Ltd., 1993.

	Private Sector (P)	Banks Sector (BA)	Government Sector (G)	Foreign Sector (FO)
2. Assets & Liabilities: Balance-Sheet Accounts		...		
Capital (K)	K^P	-	K^G	-
Loans (L)	L^P	L^{BA}	L^G	-
Domestic Money (M)	M^P	M^{BA}	M^G	-
Foreign Money (F)	-	-	F^G	F^{FO}
Net Worth (W)	W^P	W^{BA}	W^G	W^{FO}

Source: Murinde, V., *Macroeconomic Policy Modeling for Developing Economies*, Ashgate Publishing Ltd., 1993.

Flows (Horizontal Sums):

$$Taxes(T): T^P = T^G \qquad (4.1)$$

Tax-flows from Private Sector to Govt. Sector

Consumption (C) in terms of Income (Y), Import (Z) and Exports (X):

$C^P = Y^P{}_C + Z^P{}_C - X^P{}_C$ - Private Sector Consumption

$C^G = Y^G{}_C + Z^G{}_C - X^G{}_C$ - Govt. Sector Consumption

$C^{FO} = X_C{}^{FO} - Z_C{}^{FO}$ - Foreign Sector Consumption

$C^P + C^G = Y^P{}_C + Y^G{}_C - C^{FO}$ - Total Pvt. & Govt. Sector Consumption

. . .

$$C = C^P + C^G = (Y^P{}_C + Y^G{}_C) + Z_C - X_C \qquad (4.2)$$

Investment:

$I^P = Y^P{}_I + Z^P{}_I$ - Private Sector Investment

$I^G = Y^G{}_I + Z^G{}_I$ - Govt. Sector Investment

$$I^P + I^G = Y^P{}_I + Y^G{}_I - I^{FO} \qquad (4.3)$$

Total Pvt. & Govt. Sector Investment

Flows (Vertical Sums):

Private Sector:

$C^P + I^P = Y^P{}_C + Y^P{}_I + Z_I + Z^P{}_C - T^P$

$C^P + I^P = Y^P + Z^P - X^P - T^P$

$$S^P = Y^P - T^P - C^P - I \qquad (4.4)$$

Net acquisition of assets by the Private sector (S^P)

Savings - Investments

Government Sector (G):

$S^G = Y^G + T^G - C^G - I^G$ - Net acquisition of assets by the govt. sector

Foreign Sector (FO):

$C^{FO} = X_C{}^{FO} - Z_C{}^{FO}$ - Foreign Sector Consumption

$I^{FO} = Z_I{}^{FO}$ - Foreign Sector Investment

$S^{FO} = X_C{}^{FO} - Z_C{}^{FO} - Z_I{}^{FO}$

$$S^{FO} = X_C{}^{FO} - Z^{FO} \quad (4.5)$$

S^{FO} is the net acquisition by the foreign sector. S^{FO} is the also the current account of the balance of payments.

Stocks (Horizontal Sums):

$$Capital(K) : K = K^P \quad (4.6)$$

Capital appears on the assets side of the private sector according to this model. Capital on the balance sheet of the banks and the foreign sector is ignored.

$$Loans(L) : L^{BA} = L^G + L^P \quad (4.7)$$

Banks extend loans to the government and the private sector.

$$L^P = (L^{BA} - L^G) + L^{umm} \quad (4.8)$$

"Black Market" L^{umm} loans are included in loans extended to the private sector.

$$M^G = M^{BA} + M^P \quad (4.9)$$

M is Domestic Money. Money issued by the government goes to the banks (BA) and private sector (P).

$$F^{FO} = F^G \quad (4.10)$$

F is Foreign Money. Foreign currency claims on government is equal to the foreign money holdings by FO.

Stocks (Vertical Sums):

$$\text{Private Sector}: V = K^P + M^P + L^P \quad (4.11)$$

V is Net Wealth held by private sector.

$$\text{Government Sector}: D = L^G + M^G + F^G \quad (4.12)$$

D is Net Debt held by private sector.

$$\text{Foreign Sector}: F^{FO} = F^G \quad (4.13)$$

This is the net claim of the foreign sector on the government.

Stock Flow Positions

(i) Private Sector

$$\Delta W^P = W^P{}_t - W^P{}_{t-1} = Y^P - T^P - C - I = \Delta L^P + \Delta M^P$$

Where, Δ denotes change

$$\Delta W^P = Y^P - T^P - C = I + \Delta L^P + \Delta M^P$$

Therefore;

$$\Delta W^P = Y^P - T^P - C = K_t - (1-\delta)K_{t-1} + \Delta L^P + \Delta M^P \qquad (4.14)$$

Where ΔW^P denotes net worth of the private sector

(ii) Government Sector

$$\Delta W^G = W^G{}_t - W^G{}_{t-1} = Y^G - T^G - C - I = \Delta L^G + \Delta M^G + \Delta F^G$$

Where, Δ denotes change

$$\Delta W^G = Savings - Investment$$

$$\Delta W^G = Y^G + T^G - C = K^G{}_t - (1-\delta)K^G{}_{t-1} + \Delta L^G + \Delta M^G + \Delta F^G \qquad (4.15)$$

Where ΔW^G denotes net worth of the government sector. This demonstrates the government budget constraint.

(iii) Foreign Sector

$$\Delta W^{FO} = W_t^{FO} - W_{t-1}^{FO} = X_C^{FO} - Z_C^{FO} - Z_I^{FO} = \Delta F^{FO} \quad (4.16)$$

Where, Δ denotes change. This expresses the BOP.

Table 3 is simplified by consolidating the private sector and the banking sector into one private and banks sector (PB); thus obtaining table 4 below.

Table 4 – The Accounting Structure, With The Private Sector and Banking Sector Consolidated

	Private Banks Sector (P)	**Government Sector (G)**	**Foreign Sector (FO)**
1. Income-Expenditure	...		
Taxes (T)	T^{PB}	T^G	-
Consumption (C)	C^{PB}	C^G	C^{FO}
Investment (I)	I^{PB}	I^G	I^{FO}
Net Acquisitions (S)	S^{PB}	S^G	S^{FO}

Source: Murinde, V., *Macroeconomic Policy Modeling for Developing Economies*, Ashgate Publishing Ltd., 1993.

	Private Banks Sector (P)	Government Sector (G)	Foreign Sector (FO)
2. Assets & Liabilities: Balance-Sheet Accounts			
Capital (K)	K^{PB}	K^{G}	-
Loans (L)	L^{PB}	L^{G}	-
Domestic Money (M)	M^{PB}	M^{G}	-
Foreign Money (F)	-	F^{G}	F^{FO}
Net Worth (W)	W^{PB}	W^{G}	W^{FO}

Source: Murinde, V., *Macroeconomic Policy Modeling for Developing Economies*, Ashgate Publishing Ltd., 1993.

Flows (Horizontal Sums):

$$Taxes(T): T^{PB} = T^{G} \qquad (4.17)$$

Tax-flows from Private/Banks Sector to Govt. Sector

Consumption (C) in terms of Income (Y), Import (Z) and Exports (X):

$C^{PB} = Y_C{}^{PB} + Z_C{}^{PB} - X_C{}^{PB}$ - Private & Banks Sector Consumption

$C + G = Y^{G}{}_C + Z^{G}{}_C - X^{G}{}_C$ - Govt. Sector Consumption

$C^{FO} = X_C^{FO} - Z_C^{FO}$ - Foreign Sector Consumption

$C^{PB} + C^G = Y_C^{PB} + Y_C^G - C^{FO}$ - Total Pvt./Banks & Govt. Sector Consumption

$$C = C^{PB} + C^G = (Y_C^{PB} + Y_C^G) + Z_C^{FO} - X_C^{FO} \quad (4.18)$$

Income generation from Private/Banks and Govt. sectors

Investment:

$I^{PB} = Y_I^{PB} + Z_I^{PB}$ - Private/Banks Sector Investment

$I^G = Y_I^G + Z_I^G$ - Govt. Sector Investment

$$I^{PB} + I^G = (Y_I^{PB} + Y_I^G) - I^{FO} \quad (4.19)$$

Total Pvt. & Govt. Sector Investment

Flows (Vertical Sums):

Private & Banks Sector:

$$C^{PB} + I^{PB} = Y_C^{PB} + Y_I^{PB} + Z_I^{PB} + Z_C^{PB} - X_C^{PB}$$

$$C^{PB} + I^{PB} = Y^{PB} + X^{PB} - X_C^{PB}$$

$$Y^{PB} + Z - X = C + I$$

$$Y^{PB} + Z - X - C = I = S \qquad (4.20)$$

Net acquisition of assets by the private/banks sector.

Government Sector (G):

$$T^G = T^{PB}$$

$$S^G = Y^G + T^G - C^G - I^G \qquad (4.21)$$

Net debt by the govt. sector

Foreign Sector (FO):

$$S^{FO} = X_C{}^{FO} - Z_C{}^{FO} - Z_I{}^{FO} \qquad (4.22)$$

Foreign Sector Investment

S^{FO} is the net acquisition by the foreign sector. S^{FO} is the also the current account of the balance of payments.

Stocks (Horizontal Sums):

$$Capital(K): K_t{}^{PB} = K^{PB}{}_{t-1}(1-\delta)K^P + I_t{}^{PB}$$

Capital and investment by Private/Banks.

$$Capital(K): K_t^G = K^G{}_{t-1}(1-\delta)K^P + I_t^G \quad (4.23)$$

Capital and investment by Government.

$$Loans(L): L^{PB} = L^G \quad (4.24)$$

Loans from Private/Banks to Government.

$$M^{PB} = M^G \quad (4.25)$$

Money issued by G to Private/Banks.

$$F^{FO} = F = G \quad (4.26)$$

Foreign currency claims on government is equal to money holdings by FO.

Stocks (Vertical Sums):

$$PrivateSector: V = K^{PB} + M^{PB} + L^{PB} \quad (4.27)$$

V is Net Wealth held by Private/Bank sector.

$$GovernmentSector: D = L^G + M^G + F^G \quad (4.28)$$

D is Net Debt held by Government sector.

$$ForeignSector: F^{FO} = F^G \quad (4.29)$$

This is the net claim of the Foreign sector on the Government.

Stock Flow Positions

(i) Private and Banks Sector

$$\Delta W = W_t - W_{t-1} = Y^{PB} - T - C - I = \Delta L + \Delta M$$

Where, ΔW = savings - Investment

$$\Delta W = Y = T - C = S = \Delta K + \Delta L + \Delta M$$

Therefore;

$$\Delta W = Y - T - C = S = K_t - (1-\delta)K_{t-1} + \Delta L + \Delta M \qquad (4.30)$$

...

(ii) Government Sector

$$\Delta W = W_t - W_{t-1} = Y^G + T - C - I = \Delta L^G + \Delta M^G + \Delta F^G$$

Therefore,

$$\Delta W = Y^G + T - C = S = K_t - (1-\delta)K_{t-1} + \Delta L^G + \Delta M^G + \Delta F^G \qquad (4.31)$$

Where ΔW denotes net worth of the government sector. This demonstrates the government budget constraint.

(iii) Foreign Sector

$$W^{FO} = W_t^{FO} - W_{t-1}^{FO} = X_C^{FO} - Z_C^{FO} = F^{FO} \qquad (4.32)$$

This expresses the BOP equation, ignoring the capital account.

The stock flow accounting structure generates a number of identities from which conventional macroeconomic results can be derived within the IS-LM framework. For example;

1. The IS equation can be traced in the national income identity. In this identity we take consumption (C) and investment (I) identities of the Private/Banks sector, the Government sector (G) and Foreign sector (FO).

   $C^{PB+G} + I^{PB+G} = Y_I^{PB+G} + Y_C^{PB+G} + Z - X_C^{FO}$ - National Income Identity

   ...

2. The money demand function can be traced in the demand supply position of assets and liabilities in the economy; specifically from loan (L) and domestic money (M).

   Demand = Supply

   $L^G = L^{PB}$

   $M^{PB} = M^G$

Therefore,

$$L^G + M^{PB} = L^{PB} + M^G$$

3. The government budget constraint (GBC) cuts across the stocks and flows in the accounting structure, linking the income-expenditure side with the assets-liabilities side of the government sector versus other sectors:

GBC = $Y^G + T = G - C^G - I^G = S - I = \Delta L^G + \Delta M^G + \Delta F^G$

It should be noted that the GBC clearly underlies the money supply function. It links the budget deficit (G-T) with the BOP (ΔF).

4. The BOP can be traced in the foreign sector identity assuming no exports of investment goods, and abstracting from the capital account of the BOP in general.

$$F^{FO} = C^{FO} + I^{FO} \quad \cdots$$

$$F^{FO} = X_C{}^{FO} - Z_C{}^{FO} - Z_I{}^{FO}$$

The analysis has been organized in the form of a stock flow account. This framework will allow the functional specification of major relationships in the economic system of a developing country.

5. Model Specification

The identities derived from the stock flow accounting framework of a developing economy are used as building blocks for specifying the model. The expenditures sector is modeled to generate the conventional IS schedule. The money supply function is specified in terms of a government budget constraint. The money demand and supply functions are solved simultaneously to generate the LM equation. The external sector identities generate the BOP function. To obtain an aggregate supply function, a labor market is added to reflect the structural rigidities in developing country labor markets; a production function spells out the special role of import inputs and black-market working finance in a developing country.

The Expenditure Sector:

Drawing from the identities of the accounting structure, outlined in the previous section, derives the equilibrium output in the expenditure sector. This enables the derivation of an IS equation of the model. The reduced form is described below.

$$Y = a_1 Q^* E - a_2 Q + a_3 K_{-1} + a_4 M + a_5 L - a_6 R + a_7 G - a_8 CR + a_9 Q^e \qquad (5.1)$$

Where $Q^* E$ is the foreign producer price in domestic currency; Q is the domestic price level; K_{-1} is lagged real capital stock; M is money supply; L is commercial banks claims on government (loans); R central bank's controls (interest rate); G is government expenditure; CR is the black-market interest rate; and Q^e is the expected change in the domestic price level.

The signs associated with Q^*E (+) and Q (-) are unambiguous. In alignment with conventional economic theory, the IS equation above is represented in the income (Y) and black-market (CR) space; it shows the Y and CR combinations which keep the goods market in equilibrium, given prices. The negative (-) coefficient associated with the black-market interest rate shows that the IS curve is downward sloping in the income (Y)/Black-market (CR) space.

The Money Market:

The demand and supply positions of the private/banks sector vs. the government are noted from the accounting structure. Further examination of the accounting structure yields that the supply of money is derived from the government budget constraint. The argument is essentially that, given a level of government expenditure (G), not all fiscal and monetary policy instruments can be used independently. Instead, one policy instrument variable must accommodate to the financing of the expenditure, given the level of the other instruments. Thus, if government expenditure (G) outstrips taxes (T), stocks of assets cannot be constant, as the deficits need to be financed by borrowing money (M) from the commercial banks, or by drawing upon foreign reserves (F). This also illustrates the link between government budget deficits (G-T) and the BOP under fixed exchange rates.

The money supply function can be written in its reduced form as $M = b_1G - b_2Y - b_3Q^*E + b_4Q - b_5L - b_6F + b_7(M_{-1} + L_{-1} + F_{-1})$, Where Q^*E is the foreign producer price in domestic currency; Q is the domestic price level; M_{-1}, L_{-1}, F_{-1} are lagged money, loans and foreign reserves; M is money supply; L is commercial banks claims on government (loans); G is government expenditure.

On the demand side, the model postulates that the demand for real money (M^d) is a function of real income (Y), real wealth (V) and the rate of return to money

(M) and loans (L). Due to the low level of financial development in least developed economies, the Keynesian transaction and precautionary motives behind income are far stronger than speculative ones. In these economies money is traded off with real assets due to the high inflation rates. Thus the expected change in price level becomes a good proxy for the opportunity cost of holding money. Black-market interest rates (CR), whether observed or not, reflect the cost of credit as loans for working capital in the unorganized money markets earn black-market interest rates. In an inflationary economy, it is more realistic to use the real rate of interest (i.e., R-Q^e). Finally, real wealth (V) is included in the spirit of the portfolio theory of the demand for money.

Based on the above postulates, the reduced form of the LM function is given by:

$$CR = w_1 Y + w_2 Q^* E + w_3 Q + w_4 Q^e + w_5 L + w_6 K_{-1} - w_7 R - w_8 G + w_9 F - w_{10}(M_{-1} + L_{-1} + F_{-1}) \quad (5.2)$$

The above equation illustrates the orthodox LM curve. Given domestic prices (Q), the LM curve determines combinations of income (Y) and black-market interest rates (CR) that keep the money market in equilibrium. Taking the Y and CR space the relevant sign is given by the fact that $w_1 > 0$ implying that the LM curve is upward sloping.

The Aggregate Supply Function:

A production function and a labor market are added to the model to allow the price level to be determined endogenously. The motivation is to derive an aggregate supply function that will be useful in specifying an inflation target.

- Production Function: The model bases the production function on the observation of fixed capital, availability of labor, the importance of the

black-market as a source of finance for working capital purposes, and the special role of imported inputs. It is postulated that in small open economies, production in the short run is a function of labor inputs, the availability of black-market loans for working capital needs, imported materials used as input, and a random productivity or supply stock. Thus, the production function is: $y = x_1 l + x_2 n + x_3 k + u : x_1, x_2, x_3 > 0$. Where y = is the natural log of output, l = the natural log of labor inputs, k is the natural log of black market finance for working capital needs, n = is the natural log of imported inputs, and u is supply stock. Further the expected production function can be written as: $y^e = x_1 l^e + x_2 n^e + x_3 k^e$.

- Labor Market: The bargaining parameters influencing labor supply and demand are considered as part of the labor market. It is assumed that the wage package is set at the beginning of each period and is expected to clear the labor market. The wage package includes the money wage as well as other benefits that are bargained as part of the labor contract. Since neither the workers nor the managers know what the future prices would be, the prices are set simultaneously with other prices and the level of output. These are the parameters that will determine the amount of labor, imported inputs and black-market utilized.

Wage bargaining mostly occurs in the private sector; it is assumed that since the wage rates and structures are predetermined and imposed as policy, labor only decides if the wage rates are worth their while. If labor is not happy with the wage rates then they seek better opportunities in the private sector. It is also assumed that workers evaluate their wage package in relation to domestic prices, especially in an inflationary environment. This is why it is postulated that the supply of labor is a linear function of wage package and domestic prices at bargaining time.

On the demand side, the demand for labor results from firms employing just the right amount of labor that would equalize the real wage package and the marginal productivity of labor derived from the production function. The marginal products of labor, black-market finance, and imported materials at wage bargaining time are derived and equated to the price of labor, black-market finance and the price of imported materials. The aggregate supply function can be written in its reduced form as:

$$Q = \theta_1 Y + \theta_2 Q^* E + \theta_3 CR - \theta_5 Q^e + \theta_6 P^e + \theta_7 Q^{*e} E^e + \theta_8 CR^e + cons\tan t \qquad (5.3)$$

The External Sector: stocks and flows relating to the foreign sector according to the accounting framework described earlier describe the BOP. The BOP is considered in terms of both the current account (CA) and the capital account (KA). The BOP is simplified to specify the difference between export (X) earnings and payments for imports (Z). In treating capital, in the model, there is a parting of ways from the interest parity theorem, which suggests that capital flows are influenced by changes in the foreign interest rates versus the domestic interest rates. This parting of ways is due to the fact that on studying the capital accounts of least developed economies, it is observed that typically capital inflows take the form of foreign aid and grants, and are thus not influenced by interest rate differentials.

The exchange rate regimes are defined as the fixed and flexible exchange rate regimes. The fixed exchange rate can be written in its reduced form as follows:

$$F = e_1 Q^* E - e_2 Y - e_3 Q - e_4 M - e_5 L + e_6 R + e_7 CR - e_8 K_{-1} - e_9 Q^e + e_{10} K_0 \qquad (5.4)$$

Under the flexible exchange rates, the exchange rate adjusts endogenously so that the BOP remains in equilibrium as opposed to the fixed exchange rate regime where the exchange rate adjusts endogenously. Using this definition of a flexible exchange rate definition, the reduced written form of the flexible exchange rate is written as:

$$0 = e_1 Q^* E - e_2 Y - e_3 Q - e_4 M - e_5 L + e_6 R + e_7 CR - e_8 K_{-1} - e_9 Q^e + e_{10} K_0 \qquad (5.5)$$

Summing up the basic specifications of the model:

From the first principles the "Murinde" model generates some equations that shed light on how the economic system of a standard developing country works. However, the variables are identified as endogenous and exogenous and are also identified as the ones that are most effective policy instruments. The model specifications are written out in their functional forms to distinguish between the endogenous and exogenous variables under fixed exchange rates as follows:

Demand Side (IS)

$$Y = Y(Q^* E, Q, K_{t-1}, M, L, CR, R, Q^e, G; t_1, t_x)$$

Aggregate Supply

$$Q = Q(Y, Q^* E, CR, Q^e, P, Q^e * E, CR^e)$$

Money Supply

$$M = M^s(G, Y, Q^* E, Q, L, F, (M_{-1} + L_{-1} + F_{-1}); t_1, t_x)$$

Money Demand

$$CR = CR(Y_t R_t Q^* E, Q, K_{t-1}, Q^e M, L)$$

Balance of Payments

$$\Delta F = F(Q^* E, Q, Y, Q, K_{t-1}, M, L, R, CR, K_0; t_t, t_x)$$

There are thus five equations and 5 endogenous variables, namely the black-market interest rate (CR), Y for real income, Q for domestic prices, ΔF for foreign reserves, E for exchange rate, and M for a monetary aggregate. There are also main policy instruments that are captured as the following:

1.	G	Government spending, budgetary policy instrument
2.	$(M_{-1} + L_{-1} + F_{-1})$	Lagged money, loans and foreign reserves; financial policy instruments
3.	t_y, t_x	Tax rates for income and exports, respectively, budgetary policy instruments
4.	E or ΔF	Exchange rates or foreign reserves policy; financial policy instrument
5.	L	Commercial banks claims on government; financial policy instrument

6. R — Central banks controls; financial policy instruments

7. K_0 — External aid policy; financial policy instrument

Murinde solves the framework described above to yield a system of equations under the fixed as well as flexible exchange rate regimes. The equations are described below:

Fixed Exchange Rates:

$$Y_t = f_1 Q^* E_t - f_2 Q_t \pm f_3 K_{t-1} - f_4 L_t \pm f_5 R_t + f_6 G_t - f_7 F_t + f_8 \ln Q^e + f_9 (M_{t-1} + L_{t-1} + F_{t-1}) - f_{10} TY_t - f_{11} XT \quad - \quad 5.6$$

$$Q_t = g_1 Y_t + g_2 Q^* E_t - g_3 Q^e + g_4 Q^* E_{t-1} + g_5 L_t + g_6 K_{t-1} - g_7 R_t - g_8 G_t + g_9 F_t - g_{10} (M_{t-1} - L_{t-1} - F_{t-1}) + g_{11} TY_t - g_{12} XT_t \quad - \quad 5.7$$

$$F_t = h_1 Y_t \pm h_2 Q^* E_t - h_3 Q_t + h_4 L_t \pm h_5 R_t + h_6 K_{t-1} - h_7 G_t + h_8 Ko_t + h_9 Q_{t-1} - h_{10} (M_{t-1} - L_{t-1} - F_{t-1}) + h_{11} TY_t - h_{12} XT_t \quad - \quad 5.8$$

Flexible Exchange Rates:

$$Y_t = j_1 Q^*_t + j_2 E_t - j_3 Q_t \pm j_4 K_{t-1} - j_5 L_t \pm j_6 R_t + j_7 G_t - j_8 F_t + j_9 Q_{t-1} + j_{10} (M_{t-1} + L_{t-1} + F_{t-1}) - j_{11} TY_t - j_{12} XT_t \quad - \quad 5.9$$

$$Q_t = k_1 Y_t + k_2 Q^*_t + k_3 E_t - k_4 Q_{t-1} + k_5 Q^*_{t-1} + k_6 E_{t-1} + k_7 L_t + k_8 K_{t-1} - k_9 R_t - k_{10} G_t + k_{11} F_t - k_{12}(M_{t-1} - L_{t-1} - F_{t-1}) + k_{13} TY_t - k_{14} XT_t \quad - \quad 5.10$$

$$E_t = p_1 Y_t - p_2 Q^*_t + p_3 Q_t \pm p_4 K_{t-1} - p_5 L_t \pm p_6 R_t + p_7 Q_{t-1} - p_8 Ko_t + p_9 G_t - p_{10} F_t + p_{11}(M_{t-1} + L_{t-1} + F_{t-1}) - p2TY_t - p_{13} XT_t \quad - \quad 5.11$$

The model in its reduced form consists of a system of three equations each for the fixed exchange rate and flexible exchange rate variant. The first is an aggregate demand schedule that has a left hand side variable as the real growth rate. The second is an aggregate supply schedule that has the left hand side variable as the inflation rate. The third is the foreign balance schedule which depending on the regime, either has foreign reserves as the left hand side variable with the exchange rate "fixed", or has the exchange rate as the left hand side variable treating foreign reserves as "fixed".

The policy instruments in the model consist of budgetary and financial instruments. The budgetary instruments are real government spending, income tax rate and export tax rate; while the financial policy instruments are the official interest rate, loans from commercial banks, foreign reserves or the exchange rate, and foreign direct investment inflows, which are determined by contributing countries. Specifically the relevant policy issues that the model focuses on can be summarized as follows:

1. Increases in the official interest rate have two effects on the demand side. The first is the orthodox effect where the demand for money reduces investment demand and is contractionary on real income. The second is the McKinnon-Shaw effect where the rise in interest rates diverts funds from the cash and black-market finance into the banking system and this tends to reduce the black-market rate. Loanable funds increase as a result to boost investment demand and real income expands. Thus there is

theoretical ambiguity with regards to the short run effects on aggregate demand due to a rise in interest rates in both the fixed as well as flexible exchange rate regimes. The model predicts that a rise in official interest rates tend to reduce inflation in the short run.

2. Increases in government borrowing from commercial banks (L), which when manipulated as a policy instrument, is similar to monetary ceiling/targets in the monetarist model applications, is predicted as being stagflationary in the short run, irrespective of exchange rate regime in force. The model predicts that in the short run

3. The model further predicts that in the short run under both fixed and flexible exchange rate, a rise in government spending is expansionary but may generate lower inflation. This might be due to the rise in government spending on money and black-market rate vs. official interest rate. The transmission mechanism is such that if the black-market rate decreases, lower inflation will be the result.

4. The effect of devaluation on aggregate demand could be expansionary. Devaluation raises the domestic currency price of foreign goods. This induces a rise in home consumption expenditure, investment expenditure and foreign demand for exports. The offsetting contractionary effect is that the real money supply (M) falls especially as export tax revenue increases and the budgetary position improves. The net effect of devaluation depends on whether it increases or lowers black-market interest rates, the former being expansionary and the later contractionary. In isolation, devaluation tends to increase the black-market interest rate through the rise in spending and fall in money.

5. Rising foreign aid inflows improves the Balance Of Payments (BOP) under fixed exchange rates and appreciates the exchange rate under flexible

exchange rates. However, it is inflationary and its effect on the real growth rate target is indeterminate theoretically.

Table 5 – Taxonomy of Short Run Single Equation Predictions of the Model[7]

	Fixed Exchange Rates			Flexible Exchange Rates		
	Real Growth Rate	Inflation Rate	BOP	Real Growth Rate	Inflation Rate	Exchange Rate
Variable						
Y		+	-		+	+
Q^*E	+/-	+	+/-			
Q^*E_{t-1}		+				
Q^*				+	+	-
Q^*_{t-1}					+	
E					+	
Q	-		-	-		+
K_{t-1}	+/-	+	+/-	+/-	+	+/-
L	-	+	+	-	+	-

[7] The predicted sign regarding the effect of a Right Hand Side variable on the Left Hand Side target variable is given in each case as positive (+), negative (-) or indeterminate (+/-).

Taxonomy of Short Run Single Equation Predictions of the Model (Contd.)

	Fixed Exchange Rates			Flexible Exchange Rates		
	Real Growth Rate	Inflation Rate	BOP	Real Growth Rate	Inflation Rate	Exchange Rate
R	+/-	-	+/-	+/-	-	+/-
G	+	-	-	+	-	+
F	-	+	-	-	+	-
Q_{t-1}	+	-	-	+	-	+
$M_{t-1} + L_{t-1} + F_{t-1}$	+	-	+	+	-	+
TY	-	+	-	-	+	-
XT	-	+	+	-	+	+
K_0			+			-

Source: Murinde, V., *Macroeconomic Policy Modeling for Developing Economies*, Ashgate Publishing Ltd., 1993.

6. Model Estimation

Macro-Economic Model and Dataset

The model being fit is a macroeconomic model based on the stock and flow accounting structure described in the methodology section above. The model has a fixed and flexible exchange rate variant. The model is presented below in its empirically testable form. The natural log transformation is used for variables other than tax rates (TY) and interest rates (R) to reduce ordinary heteroskedasticity and to simplify interpreting the exchange rate and inflation equations.

Fixed Exchange Rates:

$$(\ln Y_t - \ln Y_{t-1}) = f_0 + f_1 \ln Q^* E_t - f_2 \ln Q_t \pm f_3 \ln I_{t-1} \pm f_4 \ln I_{t-2} - f_5 \ln L_t \pm f_6 \ln R_t + f_7 \ln G_t - f_8 \ln F_t + f_9 \ln Q_{t-1} + f_{10} \ln M_{t-1} \pm f_{11} \ln L_{t-1} + f_{12} \ln F_{t-1} - f_{13} TY_t \pm f_{14} \ln d\_lib_t \pm f_{15} \ln cg\_\exp_t + \epsilon_{1t} \quad - \quad \textbf{6.1}$$

$$(\ln Q_t - \ln Q_{t-1}) = g_0 + g_1 \ln Y_t + g_2 \ln Q^* E_t - g_3 \ln Q_{t-1} + g_4 \ln Q^* E_{t-1} + g_5 \ln L_t + g_6 \ln I_{t-1} - g_7 R_t - g_8 \ln G_t + g_9 \ln F_t - g_{10} \ln M_{t-1} - g_{11} \ln L_{t-1} - g_{12} \ln F_{t-1} + g_{13} TY_t \pm g_{14} \ln d\_lib_t \pm g_{15} \ln cg\_\exp_t + \epsilon_{2t} \quad - \quad \textbf{6.2}$$

$$(\ln F_t - \ln F_{t-1}) = h_0 - h_1 \ln Y_t + h_2 \ln Q^* E_t - h_3 \ln Q_t + h_4 \ln L_t + h_5 R_t + h_6 \ln I_{t-1} - h_7 \ln G_t + h_8 \ln Ko_t + h_9 \ln Q_{t-1} - h_{10} \ln M_{t-1} - h_{11} \ln L_{t-1} - h_{12} \ln F_{t-1} + h_{13} TY_t \pm h_{14} \ln d\_lib_t \pm h_{15} \ln cg\_\exp_t + \epsilon_{3t} \quad - \quad \textbf{6.3}$$

Flexible Exchange Rates:

$$(\ln Y_t - \ln Y_{t-1}) = j_0 + j_1 \ln Q^*_t + j_2 \ln E_t - j_3 \ln Q_t \pm j_4 \ln I_{t-1} \pm j_5 \ln I_{t-2} - j_6 \ln L_t \pm j_7 R_t + j_8 \ln G_t - j_9 \ln F_t + j_{10} \ln Q_{t-1} + j_{11} \ln M_{t-1} \pm j_{12} \ln L_{t-1} + j_{13} \ln F_{t-1} - j_{14} TY_t \pm j_{14} \ln d\_lib_t \pm j_{15} \ln cg\_\exp_t + \in_{4t} \quad - \quad \textbf{6.4}$$

$$(\ln Q_t - \ln Q_{t-1}) = k_0 + k_1 \ln Y_t + k_2 \ln Q^*_t + k_3 \ln E_t - k_4 \ln Q_{t-1} + k_5 \ln Q^*_{t-1} + k_6 \ln E_{t-1} + k_7 \ln L_t + k_8 \ln I_{t-1} - k_9 R_t - k_{10} \ln G_t + k_{11} \ln F_t - k_{12} \ln M_{t-1} - k_{13} \ln L_{t-1} - k_{14} \ln F_{t-1} + k_{15} TY_t \pm k_{14} \ln d\_lib_t \pm k_{15} \ln cg\_\exp_t + \in_{5t} \quad - \quad \textbf{6.5}$$

$$(\ln E_t - \ln E_{t-1}) = p_0 + p_1 \ln Y_t - p_2 \ln Q^*_t + p_3 \ln Q_t - p_4 \ln I_{t-1} - p_5 \ln L_t \pm p_6 R_t + p_7 \ln Q_{t-1} - p_8 \ln Ko_t + p_9 \ln G_t - p_{10} \ln F_t + p_{11} \ln M_{t-1} + p_{12} \ln L_{t-1} + p_{13} \ln F_{t-1} - p_{14} TY_t pf_{14} \ln d\_lib_t \pm p_{15} \ln cg\_\exp_t + \in_{6t} \quad - \quad \textbf{6.6}$$

The data used in the estimation is with respect to India and South Korea based on annual observations for the period 1950 to 2001. The main source of data is the International Financial Statistics (IFS, IMF) yearbooks. Detailed presentation of the data sources is described in the appendix.

The variables used in the above equations are defined in current period (t) as follows:

1. Y_t = Real Gross Domestic Product (GDP) at market prices.

2. Q_t = GDP Deflator.

3. F_t = Total foreign exchange reserves (excluding gold) in US dollars. E_t is used for conversion.

4. E_t = Annual average exchange rate.

5. Q^*_t = The world export price index.

6. G_t = Real government purchases of goods and services including recurrent and development expenditure.

7. TY_t = The income tax rate, calculated as total income tax revenue in percent of GDP in the monetary economy.

8. I_t = Real gross domestic investment.

9. Ko_t = Real capital and aid flows, (excluding reserves) in US Dollars. This is interpreted as the foreign aid policy instrument.

10. R_t = Official (regulated) interest rate.

11. L_t = Real loan obligations of the government sector estimated as IFS commercial bank claims on government.

12. d_lib_t = Dummy variable to capture periods of financial reform (1991 – 2001 for India & 1965-1971 and 1982-1989 for Korea.)

13. $cg\_\exp_t$ = Central government expenditure.

14. $\varepsilon_{it} : i = 1.....6$ = Unobservable stochastic terms, which in the usual fashion are assumed serially uncorrelated and normally distributed with zero mean and unit variance.

The dummy variable D_Lib captures financial liberalization in India since 1991. The interest rates were gradually de-regulated and the tax structure rationalized[89].

Attempts at financial reform began in Korea in 1965, with an increase in interest rates to encourage savings and financial deepening as well as a more efficient use of capital. This policy was reversed in 1972 when the government lowered interest rates and tightened control on the banking sector[10]. Korea undertook liberalization of the financial sector again in 1982, when commercial banks were denationalized. The share of "policy loans" in domestic credit was reduced and commercial banks were required to extend at least 35 percent of the loans to small and medium sized firms. However, progress in liberalization was slow in the first half of the 1980s as the Korean economy was faced with serious imbalances. In the second half of the 1980s more liberalization measures were introduced and various interest rates were freed[11].

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[8] The financial liberalization in India was taken up as part of the overall structural reform initiated in 1991. Reduction in statutory licquidity ratio in stages, nationalized banks were given the freedom to acquire equity funds from the capital market, private commercial banks and government borrowing at market-related interest rates entered the market. The government also introduced a number of measures of tax reform particularly in the area of personal direct taxes.

[9] See Dua, P., Rashid, A.I., Salvatore, D., "The Impact of Financial and Fiscal Variables on Economic Growth: The Case of India and South Korea".

[10] Credit was directed to priority industries that were most heavy industries and corporate taxes were reduced from 50 percent to 20 percent (Yoo, 1994). This heavy reliance on Central Bank credit and its drive to develop the heavy and chemical industry drove Korea's inflation rate in the 1970s. However, this lapse in macroeconomic control was soon corrected with the government's decision to cut the fiscal deficit.

[11] See Dua, P., Rashid, A.I., Salvatore, D., "The Impact of Financial and Fiscal Variables on Economic Growth: The Case of India and South Korea".

Estimation & Testing Procedures

The testing procedure included a battery of specification tests. The first test was for first order auto-correlation. It was decided to decisively rely on the Lagrange Multiplier (LM) test as the Durbin-Watson test statistic is questionable when the model equation includes lagged endogenous variables among the regressors[12]. Historically the LM test relies on large sample arguments. However, it has been shown that these arguments do not preclude the use of large sample tests when the sample size is small[13]. Thus the LM test was constructed by rewriting equations 6.1 to 6.6 with a one period lagged endogenous variables among the independent RHS variables. Then a 2SLS regression was run on each equation to obtain the regression residuals. These residuals were then regressed on all independent RHS variables in the regression plus one time lagged residuals. The LM test statistic was constructed as follows:

$$LM = TR^2$$

$$TR^2 \approx \chi^2(df, 0.95)$$

Where: T is the number of observations; R^2 is the for the restricted equation based on residuals; $\chi^2(df, 0.95)$ is the Chi-Square distribution obtained from the Chi-Square distribution tables, according to the degrees of freedom and at 0.95 percentage points. The number of degrees of freedom is equal to the number of RHS variables including a constant. The test results are as follows:

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[12] Dezhbaksh (1990)
[13] Harvey, 1981, p. 154

Table 6 – LM Test Results for Fixed and Flexible Exchange Rate Equations

	Real Growth Rate	Inflation	BOP	Exchange Rates
Fixed Exchange Rates	$TR^2 = 7.37$ $\chi^2(df,0.95) = 18.5$	$TR^2 = 14.64$ $\chi^2(df,0.95) = 18.5$	$TR^2 = 6.15$ $\chi^2(df,0.95) = 18.5$	-
Flexible Exchange Rates	$TR^2 = 5.41$ $\chi^2(df,0.95) = 18.5$	$TR^2 = 14.61$ $\chi^2(df,0.95) = 18.5$	-	$TR^2 = 5.94$ $\chi^2(df,0.95) = 18.5$

The LM test results for first order autocorrelation yield that there was ***no*** serial auto-correlation in the Real Growth Rate, Inflation and BOP/Exchange Rate equations in both the fixed and flexible exchange rate versions....

Since the number of independent regressors is large (16) in all six equations and relatively few observations for India and Korea (approximately 25 each) a novel approach is employed to increase the degrees of freedom in order to obtain readable results. The data streams for India and Korea were stacked and dummy interaction terms were introduced into the empirically testable equations listed in 6.1 to 6.6. Multiplying the dummy variable that was zero (0) in India and one (1) in Korea provided the dummy interaction terms. However, before proceeding with the model estimation, tests for heteroskedasticity were conducted, i.e. to test whether the assumption, that the variances of the stochastic disturbance terms were finite and constant (homoskedastic) over the India and Korea sample. The

Breusch-Pagan-Godfrey[14] test was applied. This is regarded as a reasonably powerful test[15] to accept or reject the null hypothesis of homoskedasticity. The test is constructed by carrying out an initial regression to obtain the residuals and variance. Where variance is calculated as the sum of the square residuals divided by the number of observations. Then each individual residual is squared and divided by the variance. This statistic thus obtained is then further regressed on all the independent variables in the original equation. The regression sum of squares (RSS = Θ) is divided by 2 and compared to the Chi-Square distribution with degrees of freedom equal to the number of independent variables excluding a constant at the 5% level of significance. The Breusch-Pagan-Godfrey test results are described below (Table-7):

Table 7 – Breusch-Pagan-Godfrey Test Results for Fixed and Flexible Exchange Rate Equations

	Real Growth Rate	Inflation	BOP	Exchange Rates
Fixed Exchange Rates	$\Theta/2 = 5.46$ $\chi^2(df, 0.95) = 18.5$	$\Theta/2 = 5.73$ $\chi^2(df, 0.95) = 18.5$	$\Theta/2 = 19.72$ $\chi^2(df, 0.95) = 18.5$	
Flexible Exchange Rates	$\Theta/2 = 5.62$ $\chi^2(df, 0.95) = 18.5$	$\Theta/2 = 4.97$ $\chi^2(df, 0.95) = 18.5$		$\Theta/2 = 21.16$ $\chi^2(df, 0.95) = 18.5$

[14] See Gujarati, *Basic Econometrics – 4th Edition*, 2003, pg 411
[15] See Kmenta, 1986, P.295

The Breusch-Pagan-Godfrey test results suggest that the BOP/Exchange Rate equations are plagued with heteroskedasticity in both the fixed as well as flexible exchange rate versions of the model. This is primarily driven by the variable that describes the net foreign direct investment inflows into the economy. The omission of this variable gives $\Theta/2$ values of 4.68 and 3.75 respectively as described in the table below (table-8).

Table 8 - Breusch-Pagan-Godfrey Test Results for BOP/Exchange Rate Equations After Omitting Variable Describing Net FDI Inflows

	BOP	Exchange Rates
Fixed Exchange Rates	$\Theta/2 = 4.68$ $\chi^2(df, 0.95) =$ 18.5	-
Flexible Exchange Rates	-	$\Theta/2 = 3.75$ $\chi^2(df, 0.95) =$ 18.5

The results in table-8 above suggest that the net FDI inflows into Korea and India were very different for the time period studied. However, as the omission of this variable is not recommended since it is a policy instrument variable the weighted least squares approach is adopted for estimating the initial BOP/Exchange rate equations under both the fixed and flexible exchange rate versions. However, this would make intuitive sense as the FDI inflow to India and Korea was markedly different with Korea accounting for far greater net FDI inflows than India for the period studied.

The Real Growth Rate and Inflation equations are free from heteroskedasticity[16] under the fixed as well as flexible exchange rate versions.

Initial Estimates

Initial Estimation results for the initial equations 6.1 to 6.6 are reported in table 9 to table 14 below:

Table 9 – Real Growth Rate Equation (Fixed Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model GROWTH
Dependent Variable Y

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	32	1.000761	0.031274	16.42	<.0001
Error	13	0.024754	0.001904		
Corrected Total	45	1.012656			

Root MSE	0.04364	R-Square	0.97586
Dependent Mean	0.06265	Adj R-Sq	0.91644
Coeff Var	69.64639		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.206502	0.079227	2.61	0.0217
Y1	1	-0.13821	0.252301	-0.55	0.5931
Q*E	1	-0.39293	0.195861	-2.01	0.0661
Q	1	-0.58871	0.735301	-0.80	0.4377
Q1	1	0.159199	0.437230	0.36	0.7216
I1	1	0.071065	0.433411	0.16	0.8723
I2	1	-0.04193	0.225163	-0.19	0.8551
L	1	0.019536	0.072322	0.27	0.7913
R	1	0.283785	1.825185	0.16	0.8788
G	1	-0.29924	0.337709	-0.89	0.3917
F	1	-0.05584	0.061037	-0.91	0.3769
F1	1	-0.00768	0.030450	-0.25	0.8048
M1	1	0.127526	0.213359	0.60	0.5603
L1	1	0.057252	0.137983	0.41	0.6850
TY	1	-5.37196	4.048446	-1.33	0.2074
D_LIB	1	0.040383	0.047405	0.85	0.4097
CG_EXP	1	0.115958	0.306788	0.38	0.7115
DY1	1	-0.67916	0.587191	-1.16	0.2682
DQWE_E	1	0.182419	0.260038	0.70	0.4954
DQ	1	-0.96719	0.540014	-1.79	0.0966

[16] See table-7

DQ1	1	-1.44343	0.885079	-1.63	0.1269
DI1	1	0.126120	0.458299	0.28	0.7875
DI2	1	0.170364	0.421807	0.40	0.6929
DL	1	0.192080	0.152760	1.26	0.2307
DR	1	1.766796	1.443775	1.22	0.2428
DG	1	0.724131	0.537949	1.35	0.2013
DF	1	-0.01452	0.051201	-0.28	0.7811
DF1	1	-0.02798	0.032312	-0.87	0.4023
DM1	1	-0.06064	0.263809	-0.23	0.8218
DL1	1	0.123966	0.184676	0.67	0.5138
DTY	1	5.012168	3.292836	1.52	0.1519
DD_LIB	1	-0.11847	0.048980	-2.42	0.0310
DCG_EXP	1	-0.26586	0.533761	-0.50	0.6267

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
16	13	3.99	0.0079	F_Test

Table 10 – Inflation Equation (Fixed Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	INFLATE
Dependent Variable	Q

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	32	0.096148	0.003005	11.52	<.0001
Error	13	0.003391	0.000261		
Corrected Total	45	0.099168			

Root MSE	0.01615	R-Square	0.96593
Dependent Mean	0.08786	Adj R-Sq	0.88207
Coeff Var	18.38260		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.048626	0.153036	0.32	0.7557
Y	1	0.218416	0.408007	0.54	0.6015
Y1	1	-0.09074	0.241926	-0.38	0.7136
QWE_E	1	0.470112	0.256836	1.83	0.0902
QWE_E1	1	-0.18512	0.147440	-1.26	0.2314
Q1	1	-0.62558	0.436524	-1.43	0.1754
I1	1	-0.79436	0.384001	-2.07	0.0591
L	1	-0.21530	0.073358	-2.93	0.0116
R	1	2.683124	1.893480	1.42	0.1800
G	1	-0.50685	0.118452	-4.28	0.0009
F	1	-0.04747	0.040550	-1.17	0.2628
F1	1	0.008284	0.018720	0.44	0.6654
M1	1	-0.43187	0.364519	-1.18	0.2573
L1	1	-0.28803	0.134351	-2.14	0.0515
TY	1	4.237386	4.690991	0.90	0.3828
D_LIB	1	-0.05658	0.043485	-1.30	0.2158
CG_EXP	1	-0.65867	0.405986	-1.62	0.1287
DY	1	-0.69770	0.347206	-2.01	0.0657

DY1	1	-0.39179	0.510185	-0.77	0.4563
DQWE_E	1	-0.61771	0.267365	-2.31	0.0379
DQWE_E1	1	0.160655	0.160073	1.00	0.3339
DQ1	1	-0.01334	0.849424	-0.02	0.9877
DI1	1	0.888741	0.324790	2.74	0.0170
DL	1	0.333168	0.093557	3.56	0.0035
DR	1	-0.91142	1.673022	-0.54	0.5951
DG	1	0.710959	0.254277	2.80	0.0151
DF	1	0.006653	0.033806	0.20	0.8470
DF1	1	-0.02582	0.029490	-0.88	0.3971
DM1	1	0.443639	0.393671	1.13	0.2801
DL1	1	0.358866	0.128556	2.79	0.0153
DTY	1	-3.47623	3.491698	-1.00	0.3376
DD_LIB	1	0.021895	0.075567	0.29	0.7766
DCG_EXP	1	0.549524	0.484837	1.13	0.2775

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
16	13	3.76	0.0102	F_TEST

Table 11 – BOP Equation (Fixed Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	BOP
Dependent Variable	F

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	32	4.856948	0.151780	1.34	0.2953
Error	13	1.475629	0.113510		
Corrected Total	45	5.935794			

Root MSE	0.33691	R-Square	0.76698
Dependent Mean	0.12627	Adj R-Sq	0.19339
Coeff Var	266.82734		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-1.06920	4.610725	-0.23	0.8202
Y	1	-8.55008	18.43376	-0.46	0.6504
Y1	1	-2.33967	4.187601	-0.56	0.5859
QWE_E	1	1.532192	3.588608	0.43	0.6764
Q	1	-3.00336	20.68073	-0.15	0.8868
Q1	1	-2.38167	10.22001	-0.23	0.8194
I1	1	-4.86808	6.752981	-0.72	0.4837
L	1	-0.02636	4.300911	-0.01	0.9952
R	1	30.11082	22.04239	1.37	0.1951
G	1	-0.63795	8.250566	-0.08	0.9395
K_FDI	1	-0.17661	0.289556	-0.61	0.5524
F1	1	0.340784	0.482985	0.71	0.4929
M1	1	-4.38244	2.927755	-1.50	0.1583

L1	1	-0.81269	2.548664	-0.32	0.7549
TY	1	30.37499	92.10011	0.33	0.7468
D_LIB	1	-0.27474	0.739971	-0.37	0.7164
CG_EXP	1	-3.28496	4.336829	-0.76	0.4623
DY	1	7.318453	10.16786	0.72	0.4844
DY1	1	26.04325	32.14289	0.81	0.4324
DQWE_E	1	-0.38698	5.548896	-0.07	0.9455
DQ	1	9.777298	12.86636	0.76	0.4609
DQ1	1	23.21256	43.67294	0.53	0.6040
DI1	1	-0.41310	11.72890	-0.04	0.9724
DL	1	-0.04815	6.875628	-0.01	0.9945
DR	1	-54.7826	56.84935	-0.96	0.3528
DG	1	-1.20968	16.42503	-0.07	0.9424
DK_FDI	1	0.779709	0.487930	1.60	0.1341
DF1	1	-0.88516	0.822957	-1.08	0.3017
DM1	1	9.295732	6.301996	1.48	0.1640
DL1	1	-2.82148	6.977646	-0.40	0.6925
DTY	1	-57.2441	94.26835	-0.61	0.5541
DD_LIB	1	0.631493	2.054695	0.31	0.7635
DCG_EXP	1	11.23825	10.74207	1.05	0.3145

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
16	13	1.28	0.3324	F_TEST

Table 12 – Real Growth Rate Equation (Flexible Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	GROWTH
Dependent Variable	Y

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	23.04356	0.658387	170.72	<.0001
Error	10	0.038566	0.003857		
Corrected Total	45	23.07588			

Root MSE	0.06210	R-Square	0.99833
Dependent Mean	0.10402	Adj R-Sq	0.99248
Coeff Var	59.70111		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.054825	0.240198	0.23	0.8241
Y1	1	-0.34392	0.576824	-0.60	0.5643
Q_W	1	-0.08765	0.158888	-0.55	0.5933
E	1	0.184846	0.472597	0.39	0.7039
E1	1	-0.06572	0.187893	-0.35	0.7338
Q	1	-0.60869	0.616748	-0.99	0.3470
Q1	1	0.255794	0.263311	0.97	0.3542
I1	1	0.217136	0.396489	0.55	0.5959
I2	1	0.111065	0.307334	0.36	0.7253

L	1	0.047285	0.140336	0.34	0.7431
R	1	-0.70083	1.429331	-0.49	0.6345
G	1	-0.12945	0.357304	-0.36	0.7247
F1	1	0.006166	0.035043	0.18	0.8638
M1	1	0.380107	0.341312	1.11	0.2915
L1	1	0.090083	0.122801	0.73	0.4801
TY	1	-0.36308	5.336080	-0.07	0.9471
D_LIB	1	0.023205	0.047182	0.49	0.6335
CG_EXP	1	-0.02818	0.313751	-0.09	0.9302
DY1	1	-1.13491	1.924817	-0.59	0.5685
DQ_W	1	-0.08753	0.367437	-0.24	0.8165
DE	1	-0.12663	0.344587	-0.37	0.7209
DE1	1	0.057445	0.405405	0.14	0.8901
DQ	1	-0.96674	1.624932	-0.59	0.5651
DQ1	1	-1.86137	1.902813	-0.98	0.3510
DI1	1	0.213563	0.658190	0.32	0.7523
DI2	1	-0.06410	0.467716	-0.14	0.8937
DL	1	0.097733	0.371486	0.26	0.7978
DR	1	3.310351	3.455002	0.96	0.3606
DG	1	0.680953	0.587841	1.16	0.2736
DF	1	0.026685	0.102238	0.26	0.7994
DF1	1	-0.03305	0.061048	-0.54	0.6001
DM1	1	-0.46631	0.459466	-1.01	0.3341
DL1	1	0.250734	0.327734	0.77	0.4619
DTY	1	2.967624	4.356310	0.68	0.5112
DD_LIB	1	-0.06506	0.096016	-0.68	0.5134
DCG_EXP	1	-0.42572	0.905591	-0.47	0.6484

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
18	10	0.80	0.6758	F_TEST

Table 13 – Inflation Equation (Flexible Exchange Rates)

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The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	INFLATE
Dependent Variable	Q

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	1.379950	0.039427	95.40	<.0001
Error	10	0.004133	0.000413		
Corrected Total	45	1.383408			

Root MSE	0.02033	R-Square	0.99701
Dependent Mean	0.06785	Adj R-Sq	0.98656
Coeff Var	29.96120		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.248412	0.078546	3.16	0.0101

Y	1	0.205404	0.243138	0.84	0.4180
Y1	1	0.166866	0.127554	1.31	0.2201
Q_W	1	0.531994	0.130173	4.09	0.0022
Q_W1	1	-0.37929	0.111942	-3.39	0.0069
E	1	0.037473	0.106609	0.35	0.7325
E1	1	-0.28523	0.084896	-3.36	0.0072
Q1	1	-0.29701	0.162031	-1.83	0.0967
I1	1	-0.78109	0.167048	-4.68	0.0009
L	1	-0.28218	0.059970	-4.71	0.0008
R	1	2.827941	0.580211	4.87	0.0006
G	1	-0.57916	0.112333	-5.16	0.0004
F	1	-0.02410	0.007875	-3.06	0.0120
F1	1	-0.01112	0.012032	-0.92	0.3773
M1	1	-0.85578	0.196867	-4.35	0.0015
L1	1	-0.31723	0.084553	-3.75	0.0038
TY	1	-2.04241	1.766702	-1.16	0.2745
D_LIB	1	-0.02359	0.014785	-1.60	0.1417
CG_EXP	1	-0.71755	0.241144	-2.98	0.0139
DY	1	-0.97873	0.340215	-2.88	0.0165
DY1	1	-0.87770	0.283303	-3.10	0.0113
DQ_W	1	-0.58422	0.152632	-3.83	0.0033
DQ_W1	1	0.426392	0.141177	3.02	0.0129
DE	1	-0.18785	0.103956	-1.81	0.1009
DE1	1	0.250761	0.202734	1.24	0.2444
DQ1	1	-0.73509	0.513774	-1.43	0.1830
DI1	1	1.017615	0.215393	4.72	0.0008
DL	1	0.410730	0.087306	4.70	0.0008
DR	1	-1.58437	1.096037	-1.45	0.1789
DG	1	0.820486	0.221453	3.71	0.0041
DF1	1	0.001174	0.026005	0.05	0.9649
DM1	1	0.815006	0.226555	3.60	0.0049
DL1	1	0.448022	0.103128	4.34	0.0015
DTY	1	0.781873	1.314977	0.59	0.5653
DD_LIB	1	-0.04886	0.029289	-1.67	0.1263
DCG_EXP	1	0.498864	0.350760	1.42	0.1854

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
17	10	2.54	0.0678	F_TEST

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Table 14 – Exchange Rate Equation (Flexible Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model BOP
Dependent Variable E

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	0.610172	0.017946	6.29	0.0013
Error	11	0.031374	0.002852		
Corrected Total	45	0.623777			

Root MSE	0.05341	R-Square	0.95110
Dependent Mean	0.06687	Adj R-Sq	0.79994
Coeff Var	79.86278		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.998499	0.383596	2.60	0.0246
Y	1	-1.94881	2.471673	-0.79	0.4471
Y1	1	0.568445	0.669047	0.85	0.4136
Q_W	1	-0.38935	0.546115	-0.71	0.4907
Q	1	-0.90693	1.821628	-0.50	0.6284
Q1	1	1.242055	1.317758	0.94	0.3662
I1	1	0.461465	1.191379	0.39	0.7059
L	1	-0.30017	0.434405	-0.69	0.5039
R	1	-3.38604	4.495337	-0.75	0.4671
G	1	-0.24839	0.813663	-0.31	0.7659
K_FDI	1	-0.02384	0.041892	-0.57	0.5808
F	1	0.028150	0.069096	0.41	0.6915
F1	1	0.035158	0.091685	0.38	0.7087
M1	1	-0.32276	0.760132	-0.42	0.6793
L1	1	0.033990	0.407061	0.08	0.9350
TY	1	-24.8728	7.713547	-3.22	0.0081
D_LIB	1	0.185832	0.083649	2.22	0.0482
CG_EXP	1	0.172957	0.713461	0.24	0.8129
DY	1	-2.68659	1.661505	-1.62	0.1342
DY1	1	-5.74314	2.772296	-2.07	0.0626
DQ_W	1	-0.24052	0.694900	-0.35	0.7358
DQ	1	-4.23507	1.376140	-3.08	0.0105
DQ1	1	-8.85101	2.238376	-3.95	0.0023
DI1	1	0.951372	1.557043	0.61	0.5536
DL	1	0.972423	0.619498	1.57	0.1448
DR	1	13.00798	4.632983	2.81	0.0170
DG	1	2.296530	1.185193	1.94	0.0788
DK_FDI	1	-0.04769	0.092651	-0.51	0.6169
DF	1	-0.08339	0.142687	-0.58	0.5707
DF1	1	-0.07421	0.160233	-0.46	0.6523
DM1	1	-0.42271	0.865738	-0.49	0.6350
DL1	1	1.181923	0.589793	2.00	0.0703
DTY	1	27.03991	6.257869	4.32	0.0012
DD_LIB	1	-0.55048	0.153508	-3.59	0.0043
DCG_EXP	1	-1.58600	1.269730	-1.25	0.2376

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
17	11	5.59	0.0030	F_TEST

The initial estimates of the models do not yield satisfactory results. It should be noted however, that the growth rate equation in both the fixed and flexible exchange rate versions displays a negatively sloped aggregate demand schedule in the (Y, Q) space as suggested by the theoretical specifications of the Murinde IS-LM framework. This is true for both the India specific parameters and the Korea specific dummy interaction terms. Further there was a F-Test designed to capture the differentiation of the variables for India and Korea. The F-Test gives us an efficient parameter to establish differences between various policy

instruments for India and Korea from within the same 2SLS estimation thus making the interpretations consistent.

Observing the results in table-9 (Real Growth Rate – Fixed Exchange Rates) we note that the equation exhibits a negatively sloped aggregate demand schedule in the (Y, Q) space. However, many of the variables are not statistically significant and some of the policy variables have sign reversals (Loans (L), Foreign Reserves (F))[17]. The F-Test yielded that at-least one dummy interaction term was different when compared to India. The results suggest that the interaction term for the dummy variable flagging financial liberalization was significant in Korea. This was not the case in India. Inflation was significant for Korea and not for India. This suggests that both a rise in domestic prices and financial liberalization had a negative impact in explaining real growth rate in Korea. However, the foreign producer prices in domestic currency were significant in explaining real growth rate in India under the fixed exchange rate regime.

On close scrutiny of table 12 we observe that the equation does not do well for both India and Korea. The F-Test verified that none of the dummy interaction terms were different when compared to the India specific parameters.

The inflation equation does well among both the fixed and flexible exchange rate regimes for both India and Korea (table-10 and table-13). The F-Test results suggest that some variables for Korea were significantly different from India in explaining inflation. Govt. Spending, Loans in current and lagged periods, Investment in lagged period, foreign producer prices in domestic currency and output were all significant in explaining inflation in Korea. Foreign producer prices in domestic currency, lagged investments, current and lagged period loans, and government spending and central government expenditure were all significant in

[17] See table-5

explaining inflation in India. All were contractionary with relation to Inflation with the exception of foreign producer prices in domestic currency.

Under the flexible exchange rate regime the model estimates are efficient for India and Korea. With the exception of current period output, current period exchange rates, lagged period foreign reserves, income tax rates and the dummy variable for financial liberalization – all other variables were significant for India. The trend was very similar for Korea. With the exception of lagged exchange rates, lagged inflation, official interest rates, lagged foreign reserves and income tax rates – all other variables were significant in explaining inflation in Korea. The F-Test yielded that the dummy interaction terms were different for Korea.

The balance of payments (BOP) equation does not yield satisfactory results under the fixed exchange rate regime (table 11). The F-Test also does not yield significantly different results suggesting that the difference in BOP between India and Korea could be due to other variables that existed outside the scope of the current model.

The exchange rate equation under the flexible exchange rate regime (table 14), on the other hand, yields results that suggest that lagged input, current and lagged period inflation, official interest rates, government spending, lagged real loans, income tax rate and domestic liberalization were different and significant in impacting exchange rates in Korea. The income tax rate and the dummy variable for domestic liberalization were significant for India. The F-Test yields results that suggest the dummy interaction terms were significantly different when compared to the India specific parameters.

Preferred Equations – Fixed Exchange Rates: Growth, Inflation and BOP

It should be noted that the initial estimates of the growth, inflation and BOP equations were not completely satisfactory with few variables being significant and additionally some variables displaying sign reversals when compared to the theoretical predictions of the Murinde model. Thus these results were treated as tentative and a series of preferred equations were run.

Using the empiricist approach in determining variables to be included in the model; a series of preferred equations were estimated. The preferred equations here are interpreted as having more information on the target variables than the initial equations. The general framework followed sequentially dropping the variables that were insignificant from the initial equations till a good fit was achieved. This parsimonious estimation for the Real Growth Rate Equation is given in table-15 below. The Inflation Rate equation is described in table-16 and the BOP equation is detailed in table-17

Table 15 – Real Growth Rate Equation (Fixed Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	GROWTH
Dependent Variable	Y

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	2.288065	0.127115	212.48	<.0001
Error	32	0.019143	0.000598		
Corrected Total	50	2.309615			

Root MSE	0.02446	R-Square	0.99170
Dependent Mean	0.06308	Adj R-Sq	0.98704
Coeff Var	38.77265		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|

Intercept	1	0.134795	0.047908	2.81	0.0083
QWE_E	1	-0.20537	0.026840	-7.65	<.0001
Q	1	-0.10648	0.039661	-2.68	0.0114
Q1	1	0.403334	0.041256	9.78	<.0001
I1	1	0.274557	0.034497	7.96	<.0001
R	1	-0.59221	0.306093	-1.93	0.0619
F1	1	0.025784	0.004556	5.66	<.0001
TY	1	-3.64612	1.020515	-3.57	0.0011
D_LIB	1	0.021812	0.009673	2.25	0.0311
CG_EXP	1	0.156095	0.048635	3.21	0.0030
DQWE_E	1	0.219997	0.032630	6.74	<.0001
DQ	1	-0.30875	0.115984	-2.66	0.0120
DQ1	1	-0.33163	0.122738	-2.70	0.0109
DI1	1	-0.17508	0.062879	-2.78	0.0089
DR	1	0.632490	0.333579	1.90	0.0670
DF1	1	-0.00430	0.009603	-0.45	0.6572
DTY	1	2.506661	0.428071	5.86	<.0001
DD_LIB	1	-0.02865	0.021119	-1.36	0.1843
DCG_EXP	1	0.042810	0.125157	0.34	0.7346

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
9	32	13.09	0.0001	F_TEST

The preferred equation for Real Growth Rates follows the theoretical predictions of the Murinde model. The aggregate demand schedule is negatively sloped in the Y, Q space for both India and Korea. The model predicts that for every one percent increase in domestic prices (Q), there is a decline of 0.10% in the real growth rate for India. In the case of Korea this decline, in Real growth rate, is in the magnitude of 0.3%. However, in the long run the increase in prices is expansionary in the case of India but has a contractionary impact on growth rates in Korea.

Looking at the main policy instruments in the equation i.e., the financial policy instrument of lagged foreign reserves (F1) and the budgetary policy instrument of income tax revenue (TY), it is observed that in the case of India a devaluation has a small expansionary effect and an increase in income tax rates has a large and significant contractionary impact on real growth rates. In the case of Korea, however, the effect of a devaluation on growth rate is indeterminate, but an educated guess would suggest that in a small open economy there would be an expansionary effect at the least. Income tax revenue on the other hand has a significant and large expansionary impact on real growth rates.

Table 16 – Inflation Equation (Fixed Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model INFLATE
Dependent Variable Q

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	8.104135	0.578867	320.53	<.0001
Error	60	0.108358	0.001806		
Corrected Total	74	8.217177			

Root MSE	0.04250	R-Square	0.98681
Dependent Mean	0.07566	Adj R-Sq	0.98373
Coeff Var	56.16866		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.044573	0.005928	7.52	<.0001
Y	1	0.032837	0.096242	7.34	0.0041
QWE_E	1	0.208003	0.022837	9.11	<.0001
I1	1	-0.25172	0.023529	-10.70	<.0001
R	1	0.812554	0.103947	7.82	<.0001
G	1	-0.29471	0.016758	-17.59	<.0001
F1	1	-0.03417	0.003403	-10.04	<.0001
D_LIB	1	-0.01281	0.003054	-4.19	<.0001
DY	1	0.007706	0.079521	7.10	0.0031
DQWE_E	1	-0.15125	0.025507	-5.93	<.0001
DI1	1	0.525074	0.045860	11.45	<.0001
DR	1	-0.46179	0.127023	-3.64	0.0006
DG	1	0.144469	0.024389	5.92	<.0001
DF1	1	0.028737	0.007518	3.82	0.0003
DD_LIB	1	-0.03774	0.006591	-5.73	<.0001

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
7	60	44.28	0.0001	F_TEST

The inflation equation yields a positively sloped aggregate demand schedule in the Y,Q space. This is in line with the theoretical predictions of the Murinde model. Close examination of the financial and budgetary policy instruments yield that in the case of India, government spending has a contractionary effect on inflation. Devaluation has a negative impact on inflation in India. In the case of

Korea, government spending and devaluation have an expansionary effect on inflation. With regards to the official interest rate, an increase in interest rates of 1% yields an increase of 0.8% in the rate of inflation in India and this same action yields a decline of 0.5% in the inflation rate in Korea. The lagged investment variable is contractionary in India and has an expansionary impact in Korea.

Table 17 – Balance of Payments Equation (Fixed Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	BOP
Dependent Variable	F

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	28	212.2382	7.579934	42.94	<.0001
Error	21	3.706926	0.176520		
Corrected Total	49	214.8176			

Root MSE	0.42014	R-Square	0.98283
Dependent Mean	-0.23297	Adj R-Sq	0.95995
Coeff Var	-180.34483		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1.296387	1.211284	1.07	0.2967
Y	1	-4.65054	2.695241	-1.73	0.0991
Y1	1	-2.94252	1.486345	-1.98	0.0610
QWE_E	1	4.289945	1.251285	3.43	0.0025
Q	1	-15.5166	3.900841	-3.98	0.0007
Q1	1	-7.43861	1.893765	-3.93	0.0008
I1	1	-8.03573	1.515669	-5.30	<.0001
R	1	34.64071	8.857382	3.91	0.0008
G	1	-7.71997	2.110651	-3.66	0.0015
F1	1	-0.02069	0.237833	-0.09	0.9315
M1	1	-4.44429	1.368369	-3.25	0.0039
L1	1	-2.06158	0.889593	-2.32	0.0307
TY	1	4.672543	27.49092	0.17	0.8667
D_LIB	1	-0.34945	0.271832	-1.29	0.2126
CG_EXP	1	-4.74787	1.466856	-3.24	0.0040
DY	1	-0.22688	3.234371	-0.07	0.9447
DY1	1	-0.02070	4.326458	-0.00	0.9962
DQWE_E	1	-4.88114	1.442612	-3.38	0.0028
DQ	1	-4.87414	5.738586	-0.85	0.4053
DQ1	1	10.86075	4.171387	2.60	0.0166
DI1	1	7.716340	2.174960	3.55	0.0019
DR	1	-16.5899	11.76973	-1.41	0.1733
DG	1	8.877613	2.555545	3.47	0.0023
DF1	1	-0.66336	0.301560	-2.20	0.0392
DM1	1	7.191090	1.637420	4.39	0.0003
DL1	1	2.819539	0.999150	2.82	0.0102
DTY	1	-16.9618	18.77867	-0.90	0.3766

DD_LIB	1	-0.05215	0.450447	-0.12	0.9089
DCG_EXP	1	5.465465	3.539504	1.54	0.1375

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
14	21	3.73	0.0033	F_TEST

The balance of payments schedule is downward sloping as predicted by the Murinde model. The close scrutiny of the main macroeconomic policy instruments yields that; lagged investments have a contractionary impact on balance of payments in India and a expansionary impact on balance of payments in Korea. An increase in the official interest rate improves the BOP situation in India but is indeterminate in Korea for the model estimated. Government spending also has opposite effects in India and Korea with an increase in government spending having a negative impact in India and a positive impact in Korea. The effect of devaluation on BOP is indeterminate in India but has a negative impact on Korea's BOP. Financial policy instruments of lagged money and loans have a contractionary effect on BOP in India. These variables have the opposite effect in Korea. The effect of income tax revenue on BOP is indeterminate in both India and Korea.

Preferred Equations – Flexible Exchange Rates: Growth, Inflation and Exchange Rates

The initial estimates of the growth, inflation and Exchange Rate equations were not completely satisfactory with variables being insignificant and some variables displaying sign reversals when compared to the theoretical predictions of the Murinde model. Thus these results were treated as tentative and a series of preferred equations were run for the flexible exchange rate variant of the Murinde model.

Similar to the preferred equations under the fixed exchange rate regime, the empiricist approach was used in determining variables to be included in the model; a series of preferred equations were estimated. The preferred equations here are interpreted as those that had more information on the target variables than the initial equations. The general framework followed sequentially dropping the variables that were insignificant from the initial equations till a good fit was achieved. This parsimonious estimation for the Real Growth Rate Equation is given in table-18 below. The Inflation Rate equation is described in table-19 and the Exchange Rate equation is detailed in table-20.

Table 18 – Growth Rate Equation (Flexible Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	GROWTH
Dependent Variable	Y

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	11.05738	0.614299	682.40	<.0001
Error	32	0.028806	0.000900		
Corrected Total	50	11.09427			

Root MSE	0.03000	R-Square	0.99740
Dependent Mean	0.05804	Adj R-Sq	0.99594
Coeff Var	51.69785		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.199214	0.055584	3.58	0.0011
Q_W	1	-0.10876	0.034343	-3.17	0.0034
Q	1	-0.31575	0.116687	-2.71	0.0108
Q1	1	0.296110	0.059847	4.95	<.0001
I1	1	0.115815	0.041886	2.76	0.0094
R	1	-0.69523	0.366057	-1.90	0.0666
E1	1	-0.05998	0.033883	-1.77	0.0862
TY	1	-4.06143	1.367092	-2.97	0.0056
D_LIB	1	0.031921	0.012386	2.58	0.0148
CG_EXP	1	-0.03743	0.056452	-0.66	0.5120
DQ_W	1	0.323028	0.062523	5.17	<.0001
DQ	1	-0.54718	0.129554	-4.22	0.0002
DQ1	1	-0.20162	0.109266	-1.85	0.0743
DI1	1	-0.01490	0.065728	-0.23	0.8222
DR	1	0.952392	0.376376	2.53	0.0165
DE1	1	0.023765	0.048440	0.49	0.6270
DTY	1	2.122091	0.697075	3.04	0.0046
DD_LIB	1	-0.05800	0.024378	-2.38	0.0235
DCG_EXP	1	0.243702	0.089637	2.72	0.0105

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
9	32	5.93	0.0001	F_TEST

The growth rate equation is a negatively sloped demand schedule in the Y,Q space as predicted by theory postulated in earlier sections of this document. Additionally a one period lag of increase in prices provides an expansionary effect on growth rates in India and a contractionary effect in Korea. Lagged investments had a significant and expansionary impact on growth rates in India and their effect was undetermined in Korea. The official interest rates had a negative impact on growth rates in India, but had an expansionary effect in Korea. The lagged exchange rate had a negative impact in India but a positive impact on growth rates in Korea. Income tax revenue had a contractionary effect on real growth rates of India and a positive impact in Korea.

Table 19 – Inflation Equation (Flexible Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model INFLATE
Dependent Variable Q

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	8.104135	0.578867	320.53	<.0001
Error	60	0.108358	0.001806		
Corrected Total	74	8.217177			

Root MSE	0.04250	R-Square	0.98681
Dependent Mean	0.07566	Adj R-Sq	0.98373
Coeff Var	56.16866		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.044573	0.005928	7.52	<.0001
Y	1	0.032837	0.096242	0.34	0.7341
QWE_E	1	0.208003	0.022837	9.11	<.0001
I1	1	-0.25172	0.023529	-10.70	<.0001
R	1	0.812554	0.103947	7.82	<.0001
G	1	-0.29471	0.016758	-17.59	<.0001
F1	1	-0.03417	0.003403	-10.04	<.0001
D_LIB	1	-0.01281	0.003054	-4.19	<.0001
DY	1	0.007706	0.079521	0.10	0.9231
DQWE_E	1	-0.15125	0.025507	-5.93	<.0001
DI1	1	0.525074	0.045860	11.45	<.0001
DR	1	-0.46179	0.127023	-3.64	0.0006
DG	1	0.144469	0.024389	5.92	<.0001
DF1	1	0.028737	0.007518	3.82	0.0003
DD_LIB	1	-0.03774	0.006591	-5.73	<.0001

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
7	60	44.28	0.0001	F_TEST

The inflation equation under the flexible exchange rate regime does not yield satisfactory results in the Y,Q space. However, the model predictions as far as the signs are concerned are "directionally" in line with the theoretical predictions of the Murinde model. Lagged investments had opposite effects in India (contractionary) and Korea (expansionary). This trend was true for the impact of real interest rates on inflation in India (expansionary) and Korea (contractionary). Government spending and devaluation had a contractionary effect in India

whereas they had a expansionary effect in Korea. The dummy variable that captures financial liberalization was significant and exhibited a contractionary influence in both India and Korea, with the effect being slightly more with respect to Korea.

Table 20 – Exchange Rate Equation (Flexible Exchange Rates)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model BOP
Dependent Variable E

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	24	14.10079	0.587533	12.99	<.0001
Error	51	2.306456	0.045225		
Corrected Total	75	16.52173			

Root MSE	0.21266	R-Square	0.85942
Dependent Mean	0.06579	Adj R-Sq	0.79327
Coeff Var	323.26311		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-0.30384	0.077891	-3.90	0.0003
Y1	1	1.554089	0.452605	3.43	0.0012
Q_W	1	0.175245	0.179094	0.98	0.3324
Y	1	2.800589	1.078537	2.60	0.0123
I1	1	-0.81244	0.222557	-3.65	0.0006
Q	1	1.575265	0.958031	1.64	0.1063
R	1	2.976638	0.806145	3.69	0.0005
E1	1	0.346033	0.181093	1.91	0.0617
F1	1	-0.02875	0.057069	-0.50	0.6166
M1	1	-1.13682	0.323821	-3.51	0.0009
L1	1	-0.05111	0.134411	-0.38	0.7054
D_LIB	1	-0.04135	0.028181	-1.47	0.1484
CG_EXP	1	0.150329	0.239746	0.63	0.5334
DY1	1	-1.96118	1.210360	-1.62	0.1113
DQ_W	1	-0.33168	0.314420	-1.05	0.2964
DY	1	1.452214	0.751981	1.93	0.0590
DI1	1	0.138143	0.440442	0.31	0.7551
DQ	1	1.787978	0.458057	3.90	0.0003
DR	1	-2.97805	0.854726	-3.48	0.0010
DE1	1	-0.14002	0.283432	-0.49	0.6234
DF1	1	0.238715	0.063861	3.74	0.0005
DM1	1	0.475887	0.337496	1.41	0.1646
DL1	1	-0.03500	0.139510	-0.25	0.8029
DD_LIB	1	0.072883	0.065306	1.12	0.2696
DCG_EXP	1	-1.15320	0.524766	-2.20	0.0325

Test Results for Variable F_TEST

Num DF	Den DF	F Value	Pr > F	Label
12	51	12.36	0.0001	F_TEST

The exchange rate schedule is positively sloped in the Y, Q space in line with the theoretical predictions. Domestic prices had an expansionary effect and lagged investments had a contractionary effect in India and Korea. Official interest rates and lagged exchange rates have a expansionary effect in India and a contractionary impact on exchange rates in Korea. Lagged foreign reserves, lagged money and financial liberalization had a contractionary effect on exchange rates in India and an expansionary effect in Korea. The impact of central government expenditure was insignificant in India, but had a significant negative impact on exchange rates in Korea.

7. Summary & Conclusions

The differing exchange rate regimes in India and Korea prompted the decision to compare the fixed exchange rate model that estimates growth rates in India to the flexible exchange rate model that estimates growth rates for Korea. It is evident from table-21 below that for the most part India had a fixed exchange rate regime for the time period that is used in the analysis.

Table 21 – Exchange Rate Regimes[18]

	INDIA	KOREA
1950-1971	Pegged to Pound Sterling	Fluctuating
1971-1973	Pegged to US Dollar Aug-Dec 1971: Back to Pound Sterling in Dec 1971	Fluctuating
April 1973 – Present	Basket Pegging Within Margins After 1975: Managed Floating After 1978.	Pegged to US dollar after 1974. Managed floating after 1980.

In summary table-22 below gives a head-to-head comparison of the growth rate equation for India and Korea. In line with the logic outlined above, the flexible exchange rate variant of the growth rate model for India is compared to the fixed exchange rate version of the model estimating growth rates for Korea.

There are two versions of the growth rate equation that are depicted in the table below for both India and Korea. The first is the complete model as described by Murinde and the second is the parsimonious estimation of the growth rate equation that is referred to as the preferred version of the model. The preferred versions were run due to the poor performance of the total equation.

Table 22 – Growth Rate Comparisons: India vs. Korea

	Fixed Exchange Rate Model		Flexible Exchange Rate Model	
	INDIA		KOREA	
	Initial Equation for Growth Rate	Preferred Equation for Growth Rate	Initial Equation for Growth Rate	Preferred Equation for Growth Rate
Lagged Growth Rate (Y_t)	**-0.138** **(-0.55)**	-	**-1.13** **(-0.59)**	-
Exchange Rates at Foreign Producer Prices (QWE_E_t)	**-0.392** **(-2.01)**	**-0.205** **(-7.65)**	-	-
Foreign Producer Prices (Q_W_t)	-	-	**-0.087** **(-0.24)**	**0.323** **(5.17)**
Lagged Investments (I_{t-1})	**-0.041** **(-0.19)**	-	**-0.064** **(-0.14)**	-
Loans (L_t)	**0.019** **(0.27)**	-	**0.097** **(0.26)**	-
Govt. Spending (G_t)	**-0.299** **(-0.89)**	-	**0.680** **(1.16)**	-
Foreign Reserves (F_t)	**-0.055** **(-0.91)**	-	**0.026** **(0.26)**	-
Lagged Foreign Reserves (F_{t-1})	**-0.007** **(-0.25)**	**0.025** **(5.66)**	**-0.033** **(-0.54)**	-
Exchange Rates (E_t)	-	-	**-0.126** **(-0.37)**	

[18] Source: Economic and Social Survey of Asia and the Pacific, 1985.

Growth Rate Comparisons: India vs. Korea (Contd.)

Lagged Exchange Rates (E_{t-1})	-	-	0.057 (0.14)	0.023 (0.49)
Lagged Money (M_{t-1})	0.127 (0.60)		-0.466 (-1.01)	
Lagged Loans (L_{t-1})	0.057 (0.41)	-	0.250 (0.77)	-

The values given in parenthesis are t values for each variable.

There were seven variables (coded in green in table-22) in the preferred versions of the growth rate model for India and Korea that offers us the opportunity to provide direct comparisons. These variables were current and one period lagged domestic prices, one period lagged investments, official interest rates, Income tax revenue, central government expenditure and the dummy variable for financial liberalization.

1. ***Current and One Period Lagged Domestic Prices:***

   Domestic prices were significant in explaining growth rates in India and Korea. When current period domestic prices rose by 1% they had a contractionary effect of 0.11% on growth rates in India and 0.55% on growth rates in Korea. The direction of the impact follows the theoretical model predictions. However, it must be noted that domestic prices had a significantly larger impact on the overall growth rate in Korea than they did in India. Part of the explanation for this could be attributed to the fact that a large portion of the Indian economy was and is agrarian and by

definition out of the purview of recorded consumer prices and GDP measures. The rate of transformation of Korea from an agrarian economy to a manufacturing one was far more rapid in the time period studied when compared to India. There is a system of procurement that India practices, however these prices do not cover the entire marketplace. In other words it is entirely possible to underestimate the true impact of domestic prices on the Indian growth rate. However, the point needs to be noted that the Korean growth rate exhibited far more sensitivity to changes in domestic prices when compared to the Indian growth rate.

One period lagged domestic prices follow the theoretical model predictions for India but not for Korea where they exhibit a sign reversal. The Indian growth rate exhibits a positive relationship to lagged domestic prices while the Korean growth rate is impacted negatively by lagged domestic prices. However, it needs to be pointed out that the negative impact of the lagged period domestic prices on the Korean growth rate is lower when compared to the sensitivity exhibited by the current period domestic prices. The movement can be said to be "directionally" consistent with the Murinde model.

2. ***One Period Lagged Investment:***

In India lagged investments had a significant expansionary effect on the growth rate. The sensitivity derived from the model suggests that for every 1% rise in lagged investments, the real growth rate rose by 0.27%. The impact of this variable was undetermined with respect to Korea. The theoretical model postulated by Murinde predicts the sign to be ambiguous with relation to investments.

3. ***Current Period Official Interest Rates:***

The theoretical model is ambiguous with relation to the sign associated with official interest rates. Part of the reasoning is that there are two effects of a rise in the official interest rate. The first is the orthodox effect where the demand for money reduces investment demand and is contractionary on real income. The second is the McKinnon-Shaw effect where the rise in interest rates diverts funds from the cash and black-market finance into the banking system and this tends to reduce the black-market rate. Loanable funds increase as a result to boost investment demand and real income expands. Thus there is theoretical ambiguity with regards to the short run effects on aggregate demand due to a rise in interest rates in both the fixed as well as flexible exchange rate regimes.

The official interest rate had a contractionary effect on real growth rates in India but they exhibited an expansionary impact on the real growth rate of Korea. This might suggest that the first or orthodox effect was more predominant in India, where the rising interest rates reduced the demand for money reducing the investment demand and thus had a contractionary effect on real growth. The official interest rates and their impact on Korea's growth rate seem to suggest that the McKinnon-Shaw effect was more predominant and thus had a expansionary effect on Korea's real growth rate.

4. ***Current Period Income Tax Revenue:***

The theoretical model predicts that income taxes will have a contractionary impact on growth rates under both the fixed as well as the flexible exchange rate regimes. However, the scrutiny of table-22 above yields that the prediction of the impact of increasing income taxes holds

true for the model estimating India's growth rates. Rising taxes have an expansionary effect on the Korean growth rate. There is opportunity to further explore the reasons for such a sign reversal. However, for purposes of this thesis we will suffice with determining the impact of different macroeconomic policy variables and how they explained growth rates in the Indian and Korean economies.

5. ***Central Government Expenditure:***

In addition to the macroeconomic policy instruments laid out by Murinde in his model, I added two more variables that could explain the differing growth rates in India and Korea. The first is the level of central government expenditure. This was done to capture the level of bureaucracy in both economies. It should be noted at the outset that the level of bureaucratic control is assumed to be lesser in the Korean economy when compared to the Indian economy. As such one would expect that the negative impact of central government expenditure on growth rates should be far lesser in the Korean economy vs. the Indian economy.

The model predicts that for every 1% rise in the level of central government expenditure; the Korean growth rate was impacted positively in the magnitude of 0.24% vs. an expansionary impact of 0.16% on India's growth rate. This seems to be in line with expectations that more bureaucratic expenditure would mean lesser investment that makes it to the "real" economy thus having a lesser impact on real growth rates.

6. ***Dummy for Domestic Liberalization:***

The second extra variable that was added to the original model was a dummy variable that captures the periods of financial reform that were undertaken in India and Korea. The Indian economy went through a period of financial reform beginning in 1991 and this had a positive impact on real growth rates. The Korean economy on the other hand displayed a contractionary impact on its growth rate due to financial liberalization. This seems to be counter-intuitive to popular wisdom and expectations of the impact due to financial liberalization. The possible reason for the "perverse" sign associated with the dummy variable for Korea could be the fact that the Korean economy in general went through a period of contraction due to the global financial meltdown in the middle to late nineties and there could have been a spill-over of this impact that is being captured by the dummy variable. The reason that this would not impact the significance and positive impact associated with the dummy variable for India is due to the fact that the Indian economy was not as affected by the global financial crisis as did the Korean economy.

CONCLUSIONS

The results obtained in the models described above show that there were differences in how the macroeconomic variables have impacted growth rates in Korea and India. In India lagged domestic prices and lagged investments had the largest positive impact, whereas in Korea the official interest rate and income tax revenue were what had the largest and positive impact on real growth rate.

The policy instruments that led the charge in exhibiting the largest and negative impact on the Indian growth rates were the official interest rate and income tax revenues. The variables associated with current and lagged period domestic

prices were what displayed the largest and most negative impact on the Korean real growth rate.

It is important to note that this model by definition only looks at a limited set of various policy instruments that could have explained the growth rates in India and Korea. However, it is also important to note that among the variables that were analyzed there is ample opportunity to identify the differences in what could be considered the drivers of growth. A natural next step of this model could be the extension of the model to include variables like differences in education, agriculture, healthcare etc. That is left for deeper analysis in another thesis.

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Appendix

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Data Definitions and Sources

Variable	Source
Y = Real GDP	IFS Year Book; Line 99bp
Q = GDP Deflator (1995=100)	IFS Year Book; Line 99bip
F = Foreign Reserves	IFS Year Book; Line 11d
E = Actual Exchange Rates	IFS Year Book; Line rf
Q^* = Export Price Index of the World	IFS Year Books
G = Real Government Spending	
• Nominal	IFS Year Book; Line 82
• GDP Deflator	IFS Year Book; Line 99bip
XT = Export Tax rate	
• Total Tax Revenue	Govt. Finance Statistics Yearbooks
• Total Export Receipts	Govt. Finance Statistics Yearbooks
TY = Income Tax rate	
• Total Income Tax Revenue	Govt. Finance Statistics Yearbooks
• GDP Deflator	IFS Year Book; Line 99bip
L = Real Loans	
• Nominal Loans	IFS Year Book; Line 22a
• GDP Deflator	IFS Year Book; Line 99bip
I = Real Gross Domestic Investment	IFS Year Book; Line 93e

Variable	Source
K = Net Imports • Exports • Imports	 IFS Year Book; Line 98c IFS Year Book; Line 90c
R = Official (regulated) interest rate	IFS Year Book; Line 60
$Q^* E$ • Q* – Export Price Index of the World • E – Actual Exchange Rate	 IFS Year Books IFS Year Book; Line rf
M = Reserve Money	IFS Year Book; Line 14
CG_Exp = Central Govt. Expenditure	World Bank Data
D_Lib = Dummy for Domestic Liberalization	

Abstract

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The Growth Experience of India and South Korea: An Empirical Study

Dissertation directed by Dominick Salvatore, PhD

Economic development is demanded and sought by all societies and people of the world; there is an inherent urge and need to progress and better oneself in every person. This "betterment" most often than not means to improve one's earning power, one's income, and one's economic ability. The same concept when applied to nations is called "Economic Development."

The focus of this dissertation is to research and understand the transition of the South Korean economy and contrast this with the development experience of India. The rapid rate at which the Korean economy developed makes it unique and warrants a close study of the socio-economic models that were used. The World Bank (1993) study of East Asian Economies attributed the Korean success to the existence of the right macroeconomic fundamentals and emphasized the importance of macroeconomic variables in generating the right economic environment for growth.

There are intuitive reasons for the comparison of the two economies – South Korea and India have many characteristics in common such as large government presence, import substitution industrialization strategy, a financial sector where government owned banks have dominated and a large unorganized financial market exists. Both countries had more or less the same GDP growth rate in 1962 (2.7% for India and 2.1% for South Korea). However, over the years while Korea's rate of growth started increasing rapidly at around 9%, India's growth rate remained stagnant at 3.5% till 1984. Both had predominantly agrarian economies at the beginning of their journey as independent republic's in the late 40's, widespread malnutrition, low levels of education, almost nonexistent foreign trade, low per capita incomes and material impoverishment. However, in the late 60's South Korea's economy went through a metamorphosis of sorts relative to India's economy that progressed at a much slower pace.

VITA

Vidyotham Veera Reddi, son of Ramakrishna and Suguna Reddi, was born on April 22, 1969, in Hyderabad, India. After obtaining a bachelor of commerce degree in 1992 from Wesley Degree College in Hyderabad, India, he entered the University of Mumbai. In 1994, he received the Master of Arts degree in Economics from the University of Mumbai. He entered Fordham University in the fall of 1994 and earned his second Master of Arts degree in Economics.

During his time at Fordham he was awarded the presidential scholarship. He is currently a member of the Omicron Delta Epsilon International Honor Society in Economics. While working towards his doctoral degree in Economics, under the mentorship of Dr. Dominick Salvatore, he continued to work full time from 1995 to 2002 for AT&T in various capacities in AT&T's market research divisions. From 2002 until present time he is an analytics services manager at ACNielsen.