GROWTH MODELS WITH NON-CONVENTIONAL MEASURES OF GDP

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CERTIFICATE

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ABSTRACT

The report by Stiglitz et al., (2009) pointed out many weaknesses of GDP as a measure of economic welfare and social progress. There are a lot of indicators whom should be incorporated in the calculation of GDP. All the factors may not be added in the calculation due to data problems but, those indicators which can be calculated, should be added or deducted from the GDP. As many studies in the current literature emphasised on the fact that that GDP is not a good indicator of growth of an economy because it has many confines in it. GDP should be modified for the number of factors which are important and make a great contribution in GDP. In our study, we have calculated three modified versions of GDP as MGDP1, MGDP2 and MGDP3 in which we have added Home Production by women at home, subtracted Natural Resource Depletion and Debt Stock from the GDP. Home Production is the major part of the economy and still it is not included in the calculation of GDP. Home production is 25 to 40% of the GDP for different countries. Then we use four different growth models in which we re-estimate the growth of three South Asian Countries i.e. Pakistan, India and Sri Lanka over the period of 1980-2015. At first instance we use conventional GDP in a model then we use Modified versions of GDP instead of conventional GDP and then compare the results of both the estimations. The results of the study suggest that modified measures of GDP exhibit quiet different set of determinants. Therefor the growth literature with the objective to improve welfare needs a re-calculation with the better measures of GDP. Home

Production, Resource depletion and debt stock are important factors of the GDP and these should be incorporated in the current GDP to get the clearer picture of the economic growth.

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Chapter 1

1 Introduction

Growth of an economy is traditionally measured as the percentage increase in real GDP. Many economists have said that GDP has many shortcomings. GDP is a deceptive measure in many ways to measure the economic well-being of any country (Stiglitz et al., 2009). Jones and Klenow (2010) show that the traditional measure of gross domestic product neglects many important indicators of economic well-being such as Home Production, Debt Stock, Natural Resource depletion, Imbalance, Recreation and Leisure, Morbidity, Infant mortality, Virgin environments and Illegality. To overcome these shortcomings, economists in the past researches have introduced many other measures of economic wellbeing. These modifications in measuring GDP carried out two torrents like GDP and non GDP or welfare approach (Jones and Klenow, 2010). In fact, it is very unmanageable to adjust the GDP of many of these missing factors because of the lack of data. However, there are some important factors which can be incorporated in the calculation of GDP.

Tariq (2015) adjusted GDP for three factors: Home production (HP), debt indebtedness, and depletion of natural resources. Home Production is the value of work perform by the house holds for their betterment. Mostly females participates at home production activities but their work is not included in the calculation of GDP. Debt is the burden on the economy which has to be paid by the future incomes of the country. Natural Resource Depletion is the loss of the natural resources which is actually the consumption of future income. So Home Production is added in the GDP as it is the production with in the economy but it was left un-added while calculating GDP. Debt Stock is differentiated from the GDP because it is the burden, a liability which has to

be repaid. Natural resource Depletion is also subtracted because it is the consumption of future income not the current income.

We have obtained three modified versions of GDP adjusted for the above three factors. As contrary to Tariq (2015), we have generated the whole series of modified GDPs and uses the latest available data. The adjusted GDP changes the country's classification of wealth and income. At this point, it becomes interesting to explore whether the growth economy as estimated by the traditional GDP is still intact after taking into account the changes. We use these adjusted GDPs and explore that either the new measure of GDP effect the growth of the country or not. The aim of this study is to re-estimate some growth models using traditional GDP and adjusted GDP and compare the results. The results of our study suggest that GDP should be adjusted for all the three factors to get the clearer picture of economic growth.

1.1 Objectives of the Study

- To calculate modified GDP adjusted for Debt, Home Production and Resource Depletion using latest data.
- To re-estimate growth models with modified GDP as measure of income.
- To compare the results with the models using conventional GDP .

1.2 Significance of the Study

GDP models aim to suggest measures for improved welfare. However the traditional GDP is not a good proxy of welfare as discussed earlier. After Second World War, GDP was adopted as a measure of economic performance. Home Production, Debt Stock and Resource Depletion are

three important factors which should be taken into account in measurement of economic performance, but in conventional GDP these factors are missing. Taking into account these might have a strong impact on the whole growth literature. This research shows how much growth models are effective when these factors are taking into account.

1.3 Motivation of the Study

GDP does not take into account the actual welfare of the economy in many ways. This considers only market activities and ignore non-market economic activities (Stiglitz et al., 2009). By viewing on the other side, there are different intentions of the statistical system, the choice of one scale may be insignificant for another, there are different prices that make up the GDP and different stages of preferences are problems related to GDP so the GDP cannot represent a unique tool of its kind for welfare for social and economic well-being and their standard of living (Jones and Klenow 2010).

GDP also includes many assumptions, for example, either it measures the well-being of individuals, society as a whole, or the sum of any part of an economy, or only the activities of the market, so the main question is what must be calculated and the primary objective must be transparent in all aspects. An important point is that the services given by family members at home specially from female members does not included in GDP, despite it is quite clear that Home Production and many non- market activities falls in the definition of a good economic activity. So the GDP is underestimated in relation to the actual level of economic activity.

In this study, we provide household work of women in the calculation of gross domestic product and check its responses on well-being. As mentioned above, domestic Home Production is the largest part that is not covered by GDP. This is due to the existence of many obstacles and constraints in measuring the exact value of Home Production. By excluding Home Production, we are actually not including women's services for their family members provided by them at their home to improve the well-being of their family leading to the well-being of the economy, which is a kind of discrimination and this would be unfair. In our study, we will calculate Home Production (HP). It is very important to adjust GDP with female participation from home to get a clear picture of actual state of welfare in an economy.

Chapter 2

2 Literature Review

2.1 GDP and problems with its usage

We have mentioned several limitations in the calculation of GDP in light of the current research. If traditional GDP would still be used to measure of the well-being of economies, many indicators such as household production, household participation, mortality, expenditure on personal defense, inequality, life expectancy, public goods and services, intermediate goods and other important social factors contributing to well-being remain outside the measure of well-being. In our study we will also include measurable missing factors such as Home Production, Natural Resource Depletion and Debt Stock in GDP. Because of the problem of data availability, an ideal scale of GDP cannot be made, but we can obtain and estimate data for a number of variables and adjust the GDP of these variables.

Gross Domestic Product was used as a tool to reflect the economic performance of the countries and the Governments in currently published literature. Economists start to check the performance of an economy using GDP as a tool after World War II and so far it is continued. However, it is condemned by many economists to use GDP as a tool to measure economic performance. Islam and Clarke (2002), and Bleys (2012) they emphasized on human development and said that this would be the better proxy for performance than GDP.

This study aims to compare the conventional GDP with the GDP modified[1] for the economic performance of Pakistan, India and Sri Lanka. Nordhaos and Tobin (1972), Islaam andClarke (2002), criticized the use of GDP as a measure of performance for not taking into account the difference in prices. Islam and Clarke (2000, 2002) argues that there must be a cost with a benefit so GDP must be adjusted for that cost. We are in a need to broad the definition of the word "economic" if we wish to incorporate non-market domestic household activities in production of the economy, i.e. the use of natural capital resources and human capital resources to satisfy human needs (Goldschmidt 1982, 1987, 1990, and 1993). Many researchers like Nordhaos and Tobin (1972), Gronau (1980), Solberg and Wong (1992) Pampel and Tanaka (1986), Sen (1976, 1999), Garibaldi and Wasmer (2004), Dunlop, et al. (1999) and Stiglitz et al (2009) emphasized that GDP is biased against home production

[1] Modified GDP is calculated by using the indicators mainly Home Production, Debt Stock and Natural Resource depletion for further detail see. (Rahila Tariq's thesis entitled "Beyond GDP; the Nation's Economic Performance Adjusted for Home Production, Foreign Debt and Resource Depletion")

Problems with Conventional GDP

Author	Year	Findings
Stiglitz	2009	GDP is a market phenomenon and it does not include non-market activities
Islam & Clarke	2002	There must be a cost with a benefit so GDP must be adjusted for that cost
Nordhaus & Tobin	1972	GDP is biased against home production (HP) as women have the main role and major producer of HP
Esteve-Volart	2004	Gender discrimination does not include the work of women at home in the National Accounting System

2.2 Adjustments in GDP

Development economics allow for well-being by considering freedom of speech, freedom to choose occupation and social skills, but the discussion of well-being is not clearly defined in GDP. Non-market activities in GDP should also be included in order to obtain a clearer picture of the economic well-being of each country. Researchers have done an excellent job on a social welfare approach to achieve the best results, Islam and Clark (2002) and Stiglitz et al (2009). Some new techniques to measure welfare were presented by different researchers.

Nordhaus and Tobin (1972) presented "Measure of Economic Welfare (MEW)", Gronau (1980), Solberg and Wong (1992) made **"**Utility Approach for Home Production" and HDI approach was developed by Mehboob-ul- Haq (2003). Islam and Clarke (2002) explored "Cost and Benefits approach". "Consumption based approach" was introduced by Jones and Klenow

(2010). “Mashup indices” was presented by Ravallion (2011). Economic welfare is a hot topic today, it get start from “MEW” (Measure of Economic Welfare) of Nordhaus and Tobin in (1972).

Welfare approach have incorporated many factors which were not included in the GDP. MEW represents another concept of the NNP (Net National Product), economist used both the measures of welfare but NNP was more effective and therefore NNP was used more than MEW. Index of Sustainable Economic Welfare (ISEW) was extracted from the work of MEW. It enhanced the thought of welfare by including costs and benefits and environmental impacts, which continues with Gronau’s model (1980). They all worked to measure welfare for an economy relating to GDP and have some benefits and limitation as well . MEW approach used GNP. Conceptually, GNP is a global measure and a sum of the real annual consumption of households. "It was proposed that all goods and services either they are marketed or non-marketed should be evaluated at current market prices or at market prices and similar opportunities either these are public goods or private goods. The actual consumption is estimated on the prices of goods and services prevailing in the market, these prices are basically fixed. The actual welfare (MEW-A) was distinguished by MEW sustainable welfare (MEW-S) from them, both can be expressed in aggregate or in per capita terms. Some methods of GDP calculation like welfarism (utilitarian), inter-temporal separation of utility, the optimal distribution of income, cardinal measurement, and consistency of taste and transaction was introduced by Islam and Clarke (2000, 2002). Gronau (1980) defined Market price approach and opportunity cost approach**,** and also give the solution to the situation at which household does not consume the market goods and opportunity.

Different Measurement indices was introduced by Marc (2009) and 23 alternative indices for policy making was proposed by Bleys (2012). Compared with GDP, a material-based classification system measured welfare and economic well-being and measuring sustainability as another problem. Well-being means studying the living situation of an individual or group, utility approach, and needs of humans and their abilities used to evaluate it. The measure of economic well-being is the general level of welfare which citizens may enjoy, and the economic definitions of well-being are classified into different income categories. Economic income approach, sustainable income approach and psychometric income approach were used to measure. Finally, sustainability of this well-being, measures by measuring sustainability.

Two main classifications of indices were described by Ravallion (2011) in his mash up indices. First, where principles and practices include only one indicator such as GDP, which meet the overall need of the economy, while indicators showing the different trends of the economy and manufacturing through a series of components are called the Mashup indices. With the expansion of MEW, Gronau (1980) constructs a utility-based model for measuring household production and single-family work and also uses a fixed elasticity of alternatives to measure the marginal production function. Domestic production is determined by two variables: 1. Home production using market goods 2. Domestic production using household goods. Solberg and Wong (1992) used the Gronau model to estimate household production, entertainment, marketing, travel, participation, and time allocation for both families when both spouses are workforce. It also compares two family runner models with a Gronau model of a person. While making policies, policy makers work on the assumption that it is a kind of exchange between home production and market production regarding women's participation in the workforce. Now a days, educated

women do not choose between home production and entertainment; either they choose between working in the market and entertainment, but that depends on market income, local production, wages and prices [(Leibowitz, 1974), (Pampel and Tanaka, 1986), Garibaldi and Wasmer (2004)].

In traditional societies, women have lived in gender discrimination, in-equality and deprivation. They had to work hard like slaves but they cannot avail the basic human rights and less access to basic necessities like health, food and education (Sen 1999).

Adjustments in GDP

Author	Year	Modifications in GDP
Nordhaus & Tobin	1972	Introduced "Measure of Economic Welfare" (MEW)
Gronau , Solberg & Wong	1980,1992	Developed Utility Approach for Home Production
Mehboobul Haq	2003	Developed HDI for health and education
Islam & Clarke	2002	Developed Cost and Benefits approach
Jones & Klenow	2010	Developed consumption based approach

2.3 GDP and Economic Welfare

Economic growth is a complex phenomenon to explain because so many factors are contributing in the process of growth of an economy. All the theories with the expectations that some specific factors or some specific market forces makes some economies richer than others become in-consistent while they empirically tested to confirm them. For example, there are many exceptions which can be raised against the theory which said that human capital is the only factor of growth:

if we have a glance on countries such as Poland, South Korea, Sri Lanka and Russia, they have very high educational levels like the richest economies but they are much poorer. There might be another problem in human capital which is the possibility of existence of an inverse causal relationship among the two, I.e. education and growth, and one should also careful in making causal relationship because it would be very important to understand which one causes the other.

Human capital is no doubt an important factor of economic growth, Barrow and Sala-Martin (1995) Barrow (1998), but one should kept in mind that human capital cannot explain more than fifth of the growth and living standard, Olson (1996). Technology and growth also have the same type of relationship. The countries with high levels of income can afford high R and D expenditures and avail benefit from positive returns and spin-off benefits. There is a positive relationship between technology and growth both in theoretical and empirical point of view, but the problem is how poor countries spend a lot of money on technology. The rich countries can invest heavy expenditure on technology and in advancement of technology so they can avail the benefit, Yeager (2004).

Natural resources are another factor which is very important for economic growth, Shaaban (1987), Walker and Ryan (1990). The rich countries like US, Germany, Japan, Singapore, Taiwan Hong Kong and Norway are poor in term of natural resources such as oil, gas, coal, land, etc. However, poor countries are much richer in natural resources such as Russia, Brazil, Nigeria, Venezuela, Saudi Arabia, etc. This trend of exceptions can be seen in trade and population density. If we consider trade, countries in the past like France, Germany, Taiwan even Asian countries, they focus mainly on export while demote imports by promoting “infant industry”. If we look at

the theory, the same type of differences can be observed in economists with the supporting idea that trade and growth have strong causal relationship.

If we talk about the population density, there was a theory which relate poverty with the population density, after the Malthusian predictions. Highly populated countries like Switzerland and Germany and some Asian countries like India and china have high growth rates and their population is not a hurdle in the way to their economic development. On the other hand, if we look at countries, such as Brazil and Mexico, they are having less density of population, but they are developed countries. If we have Comparative analysis this would reveal many problems and many controversies of development theories. Neither one factor can explain the economic differences in between the countries. In addition, In 1990s Washington's consensus failed to explain the growth of several countries like Mexico, Argentina, Russia, and so on. Stiglitz (1998) and Roderick (2004) emphasized on the fact that there cannot be a single recipe for all countries. Most of the Developing countries depend on a large agricultural sector, and this sector usually have adverse supply shocks which have negative impact on growth. The growth of agriculture sector leads to the growth of the industrial sector and services, and investment decisions largely depend on social infrastructure Krishna (2004).

Natural resources, insecurity, peace situation, climate and topography are the factors which are directly linked to economic growth, Current empirical researches confirm this, these factors also affects productivity of agriculture, economic structure, cost of transportation and commodity market competition, (Warner 1997), (Bloom and Sachs 1998), (Masters and McMillan 2001) and (Armstrong and Reid, (2004). While the other researchers like Roderick et al., (2002) and Easterly

and Levin, (2003) said that there would be no geographical impact on growth if there is institutional control. Shahjehan and Edwin (2001) said that by getting growth of the labor force as constant, other factors like investment in physical and human capital, low inflation and trade liberalization policies, are also important factors of economic growth. Their research also point the adoption of new technology is also an important factor. Barrow (1996) proves a negative relation between economic growth and high inflation. Many researches didn't find a strong positive correlation between trade openness and economic growth in the country. Milesi and Ferretli (1995) rejected the hypothesis positive relation between capital inflows and economic growth. Rodrick (1998) in his research did not find any significant correlation between growth and financial liberalization in small open economies. In the same way, Edison (2002) also did not find the presence of a strong relationship between trade liberalization and economic growth. His report said that financial integration alone cannot promote growth, it has to consider certain economic, financial, institutional and political characteristics. Along with the growth of the labor force, low inflation, tight trade policies, investment in technology and investment in skills of labor are also important factors for growth in the economy.

In addition, there is also a need to be able to get benefit from useful technological changes to enhance production effectiveness. There are a lot of studies in the literature showing income, real interest rates, foreign capital inflows, dependency ratios, changing terms of trade, foreign aid and trade openness of the Economy as determinants of economic growth in Pakistan. Stock market development and long-term economic growth have a strong, significant and positive relationship for 47 countries, Levine and zervos (1998). Their studies are based on cross-sections to known experimental boundaries. In theory, traditional literature on growth has not been sufficient to

explore the relationship between financial markets and economic growth because it focuses primarily on the level of capital per worker or productivity, but not on growth. That is, endorsed by external technical progress. The growing interest in modern literature stems from the connection between financial development and growth from the perspectives of self-growth models, where growth is self-sufficient and influenced by primary conditions. In this context, the stock market shows not only the level effects, but also the rate of effects. Much of the literature suggests that the evolution of the stock market is positively correlated with the level of economic development and capital accumulation. This conclusion is conclusively supported by the idea that stock markets are growing as economies develop in terms of number of listed companies by market value and by market value [Atje and Jovanovich, (1993); Korajczyk, (1996); Demirguc-Kunt and Maksimovic, (1996); Levine and Zervos, (1998) and Blackburn et, al (2005)] However, these results did not indicate a direct and orderly expansion of stock markets in the financial system.

The relationship between energy consumption and growth has been studied in detail in literature. The seminal experiment was conducted by Kraft and Kraft (1978) who found one reason for GNP for energy use using US annual data. In another study, Errol and Yu (1987) examined the relationship between GDP and energy consumption in England, France, Italy, Germany, Canada and Japan and found different empirical evidence on the relationship between energy consumption and economic growth. Stern (1993) used a multivariate framework including capital and labor in the energy consumption and GDP model. Asafo-Adjay (2000) estimated the causal relationship between energy consumption, income, India, Indonesia, the Philippines, and Thailand. Yoo (2006) discussed the relationship between electricity consumption and economic growth in ASEAN member countries, including Indonesia, Malaysia, Singapore and Thailand The study period

is from 1971 to 2002. Its empirical results indicate a causal link in one direction of economic growth to energy consumption (electricity consumption) only in Indonesia and Thailand. In Malaysia and Singapore, there is a twofold causal relationship between electricity consumption and economic growth. Similarly, Chen et al. (2007) causal relationship between electricity consumption and economic growth using the inter-group integration approach in 10 industrialized and low-income countries in the Asian region. The causal causal panel of these variables is shown, but causality ranges from GDP per capita to per capita consumption of electricity in a heterogeneous causation approach. By contrast, Narayan and Singh (2007), in Fiji, document the unbalanced causality of electricity consumption to the economic growth and joint integration of both variables. Narayan and Smith (2009) have demonstrated the causality of these variables in the case of the countries of the Middle East. Their empirical evidence shows that 0.04% of GDP can be increased due to a significant 1% increase in electricity consumption. Oztrak (2010) and Payne (2010) conducted a study on energy consumption (electricity consumption) and economic growth. Evidence based on the review shows that electricity consumption has a positive impact on economic growth through elegant realities.

On the contrary, Narayan and Prasad (2008) use the boootstrap tests to study the causal relationship between electricity consumption and economic growth in 30 OECD countries. They note that electricity consumption appears to be driving real GDP per capita in Australia, Iceland, Italy, the Slovak Republic, the Czech Republic, Korea, Portugal and the United Kingdom. Yo and Kwak (2010) explore the link between electricity consumption and GDP per capita in seven countries in South America, including Argentina, Brazil, Chile, Colombia, Ecuador, Peru and Venezuela. There is no causal link between electricity consumption and economic growth agents

of the real GDP of Argentina, Brazil, Chile, Colombia and Ecuador, but two-way causality of these variables in the case of Venezuela. Moreover, there is no causal link between electricity consumption and economic growth in the case of Peru. Literature studies have also provided multiple and multiple empirical data for these variables. For example, Squalli and Wilson (2006) discussed this issue in the GCC countries. They used the ARDL bound tests and the causal approach of Toda and Yamamoto (1995) to test the causal trend between electricity consumption and economic growth. Joint integration is observed for all countries included in the sample, but the evidence for causation is mixed. Squalli (2007) appears to be examining causation in the case of OPEC economies. The ARDL bound test approach was used to study the combined integration of variables, confirming the long-term relationship between electricity consumption and economic growth. Their empirical evidence of the causal relationship between electricity consumption and economic growth is varied. Similarly, Sinha (2009) explored this issue for 88 developing and developed economies. Experimental results indicate a two-way causal relationship between variables, not only long-term, but also for a short period of time. Ozturk and Acaravci (2010) conducted a study to explore the relationship between energy consumption and economic growth in the economies of South Africa, including Albania, Bulgaria, Hungary and Romania. The experimental results show a long-term correlation between two variables: per capita electricity consumption, GDP per capita or economic growth in Hungary and the two-way causality between these variables In addition, there is no combined integration of electricity consumption and GDP per capita in Albania, Bulgaria and Romania, which allows the short-term error correction model to be estimated.

Acaravci and Ozturk (2009) examined the causation between per capita electricity consumption and GDP by 15 countries in transition: Albania, Belarus, Bulgaria, Estonia, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Czech Republic, Czech Republic, Russian Federation, Serbia, Slovakia and Ukraine. The Padroni panel and the error correction method do not support the common integration of variables, and economic growth does not stimulate an increase in electricity consumption in these economies. Yu and Lee (2010) discussed the relationship between electricity consumption and economic growth. Their empirical evidence suggests an inverted U-shaped correlation between electricity consumption and per capita income in cross-country analysis. In the light of the above discussion we can say that Economic growth cannot be linked to any particular factor which lead to the path of development.

Chapter 3

3 Data and Methodology:

This chapter contains three sections, the first section deals with the method of calculation of MGDPs and study literature on different ways to choose the model. In the second section, availability of data and data sources are discussed. Section III deals with the graphical representation of the data. Finally, the chapter IV review the techniques we use in estimation. The main objective of this chapter is to understand the theoretical perspectives of different approaches and standards. The study will calculate three revised GDP measures for domestic production, debt stock and resource depletion for Pakistan, India and Sri Lanka for the period 1980-2015. After calculating MGDPs, we will estimate the three growth models using MGDPs as well as the traditional GDP. We will compare adjusted GDP growth to conventional GDP. This chapter contains a methodology for calculating the above variables, their source of data and methodology of estimation.

Modified Gross Domestic Product (MGDP)

In our study, we will calculates three modified series of GDP named as MGDP1, MGDP2 and MGDP3. Their calculation methods are described in detail below. MGDP1 will be calculated as follows:

$$MGDP1_{it} = GDP_{it} + HP_{it}$$

$$MGDP2_{it} = GDP_{it} + HP_{it} - RD_{it} - Debt_{it}$$

$$MGDP3_{it} = GDP_{it} - RD_{it} - Debt_{it}$$

The i is the ith country's observation and t is the time.

MGDP = Modified Gross Domestic Product

GDP = Gross Domestic Product

HP = Home Production

RD =Resource Depletion

$Debt$ = Foreign Debt

HP would have the positive impact in economic production so MGDP1 would enhance the value of GDP by the adding of the value of HP, on contrary Debt stock and Resource Depletion would have adverse effect on the production of the country so MGDP3 would be obtained by subtracting Debt stock and Resource Depletion from GDP and MGDP2 would in between i.e. we would add HP and less Debt stock and RD from GDP.

3.1.1 Home Production (HP)

Women's work at home in Home Production is a vital economic activity. Women take part in home work to benefit their families and of course benefit to society. Despite the difficulty of measurement, many researches have attempted to shown the value of Home Production in monetary terms, such as Nordhaus, Tobin (1972), Garibaldi and wasmar (2004), Bambil and Tanaka (1986) and Gronau (1980). We put an assumption in our study that women benefits for home in Home Production would be equal the benefits at market production. Simply we can say that, in our assumption, working at home would give equal benefits as working on market activities

for Women. These two are ideal alternatives. We have two other categories of unemployed women and women workers in the labor market and workers, and women who are unemployed are those who do not work in the market. This would be a strong assumption, and we will be using it throughout in our study for analytical simplicity because it means that women can do in many economic productive activity.

The calculation of Home production is as follows

$F1 =$ % portion of adult female in adult population

$F2 =$ % of female Participating in job markets

$$F3 = F1 - F2$$

$F3 =$% of female working at home and causing Home Production

$$F = F3 * Population$$

F Would be the total number of female giving Home Production

Here we introduce another assumption that the value of services of men at market would be equal to the value of services of women at home. Thus the value added per capita of male and female would be equal

Let

Vm = Total value added of the manufacturing (whole industry) sector

Nm = Total Number of Employees in the manufacturing (whole industry) sector

Then

$$\text{Per capita value added} = \frac{Vm}{Nm} = Vmpc$$

$$Fm = \frac{Nm}{N} * F$$

N represents the total number of employees in manufacturing, agriculture and service sectors. Fm represent the number of females working at home whose services is to be valued at the rate of manufacturing value added per capita. Similarly .

$$Fs = \frac{Ns}{N} * F \qquad and\ Vspc = \frac{Vs}{Ns}$$

$$Fa = \frac{Na}{N} * F \qquad and\ Vapc = \frac{Va}{Na}$$

Where s represents the service sector and a for the agriculture sector. And the total value added by the female working at home is thus .

$$HP_{it} = Fm * Vmpc + Fs * Vspc + Fa * Vapc$$

3.1.2 Debt Stock

External loan (debt) would be a burden of the management of economy in future days. We in this study only consider external debt and do not take into account domestic debt. Traditionally the External debt was thought to be an income and it was added as additional income in GDP, but it should be shown as a liability. By using external debt, countries consume the share of future generations or leave the burden on their generations. Do not confuse positive GDP growth if the balance of debt is there. It is necessary to exclude the external debt balance of traditional GDP in

order to obtain a clear picture of the economy. For simplicity, we use debt stock instead of external or external debt.

Here we estimated foreign Debt by the following equations.

$$Debt_{it} = total\ intake_{it} - total\ disbursment_{it}$$

$total\ intake$ = All intakes whether in the form of foreign loan (grants+ aid) or in the form of Debt service receiving.

$total\ disbursment$ = All disbursement is included whether disbursed in the form loan to other countries or in the form of Debt servicing .

3.1.3 Natural Resource Depletion (RD)

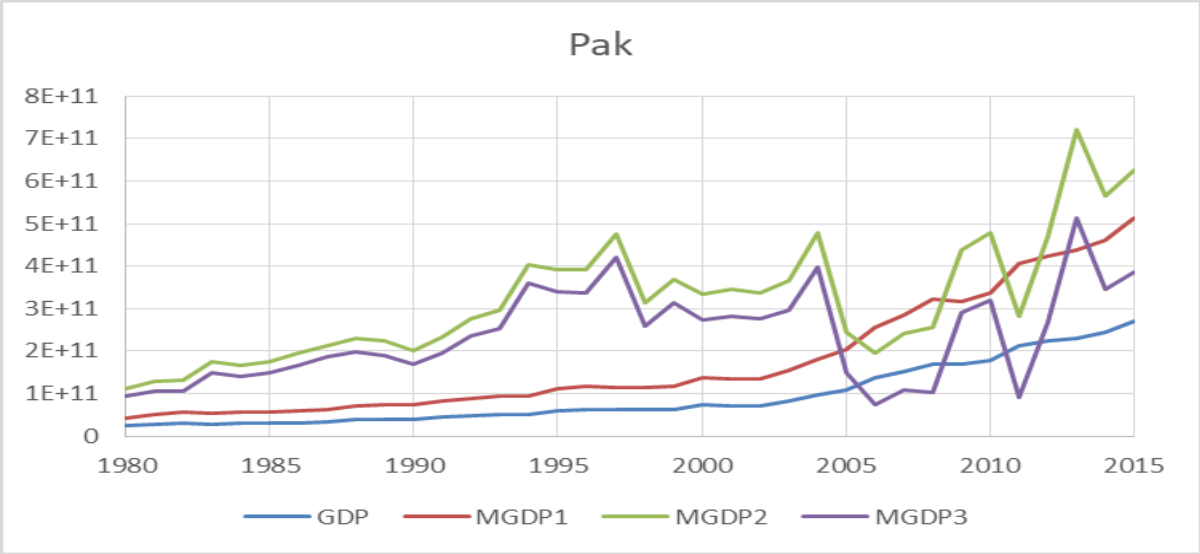
Natural resources are like the whole life cycle income for the country. The depletion of natural resources would be like the expenses incurred by the country, which includes losses of all the natural resource, their annual consumption, forests losses, agricultural land losses, loss of non-renewable resources, and damage to environment damage with pollution. These are fixed resources and cannot be renewed, so the depletion of these resources can lead to depletion of reserves and adversely affect the well-being of any economy in the upcoming times. Current consumption of these resources should be sacrificed for future consumption. The data of natural resource depletion is obtained by WDI data bank and is available on their website. We used that data for our calculations.

3.2 Data Sources

The data used in the study will be obtained from WDI (World Development Index)-2015 database sheet available on World Bank's website where we get the data on women force participation rate, Resource depletion (natural resource consumption) and Debt (foreign Debt) for Pakistan. We will get data of variable 15+ female in percentage to get employed female population. The data is available for Debt Stock in WDI as the total change in external Debt stock and in constant US $. The data for RD is available in the percentage of GNI so we will also use data of GNI .

3.3 Graphical Representation of GDP, MGDP1, MGDP2 and MGDP3

Figure 1: Graph of GDPs of Pakistan



This figure 1 is the graph of the values of different definitions of GDP of Pakistan, i.e. GDP, MGDP1, MGDP2 and MGDP3. The lowest line in the graph represent GDP, the second from the bottom represent MGDP1, the second last from the bottom represent MGDP3 while the upper most line in the graph represent MGDP2. We can see in the graph that GDP and MGDP1 have the same trend because we only adds home production in GDP to obtain MGDP1. While on the other hand

MGDP2 and MGDP3 have same trend because in MGDP2 we adds the value home production and subtracts natural resource depletion and debt stock to obtain its value while to obtain MGDP3 we only subtract natural resource depletion and debt stock. The fluctuations in MGDP2 and MGDP3 are due to fluctuations in the values of debt stock and natural resource depletion.

Figure 2: Graph of GDPs of India

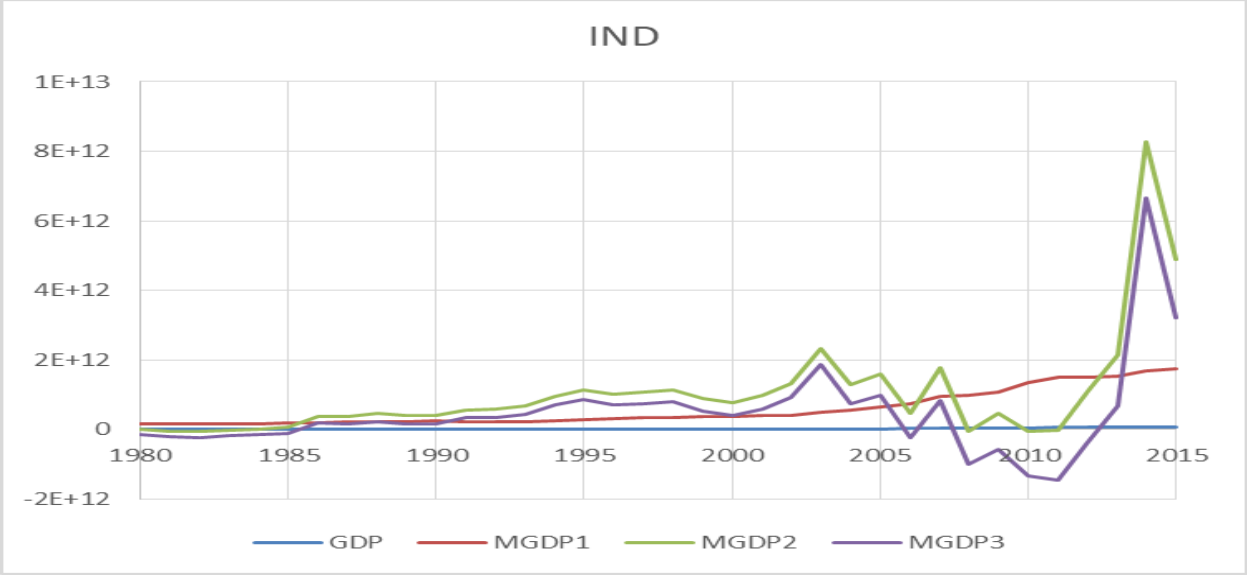


Figure 2 is representing the different definitions of GDPs of India. In the graph, the lower straight line represent the values of GDP and the upper straight line represent MGDP1. These lines are not straight in actual, they actually have a smooth trend over. We can see in the graph two fluctuating lines, the lower fluctuating line is of MGDP3 while the upper fluctuating line representing the values of MGDP2.

Figure 3: Graph of GDPs of Sri Lanka

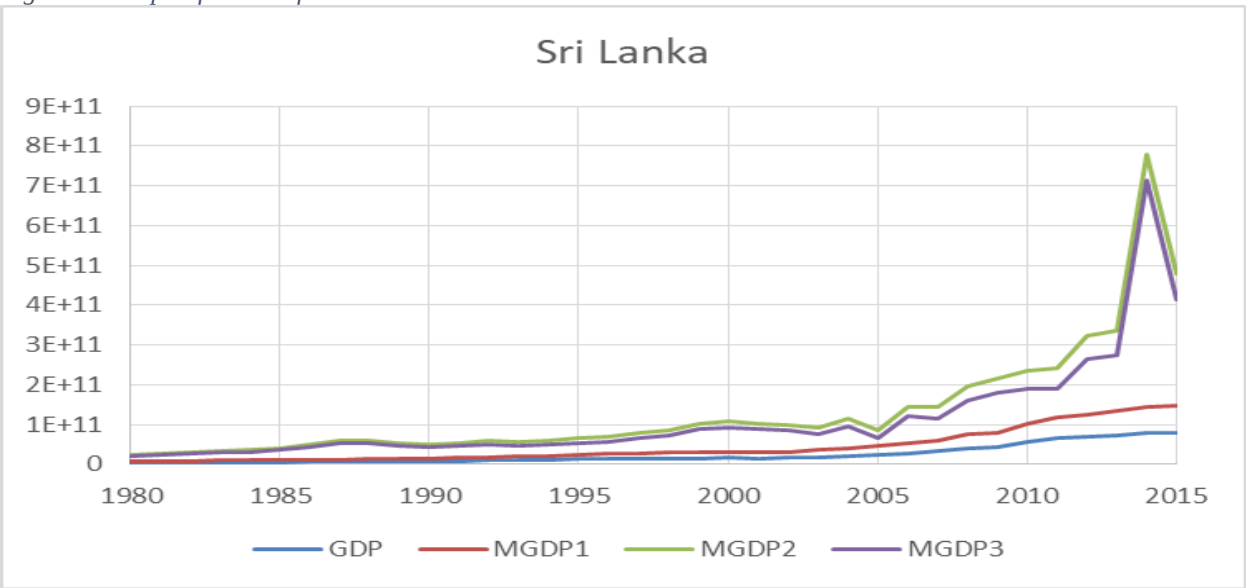


Figure 3 is representing the GDPs of Sri Lanka. The upper most line in the graph represent MGDP2. The lowest line in the graph represent GDP, the second from the bottom represent MGDP1, the second last from the bottom represent MGDP3. Sri Lanka also have the same ranking of GDPs like Pakistan and India.

3.4 The Unit Root Test

It is compulsory to check the stationarity of a time series in its analysis to avoid misleading results of regression, commonly referred to as spurious results of an econometric estimate. So, the first ever step in any time series estimation is to test for a unit root problem and eliminate it. A fixed time sequence has a constant average, trend and contrast.
"A time series is fixed if the distribution of probability does not change over time" (Stoke and Watson, 2004). As cited by Dolado, Jenkinson and Sosvilla-Rivero (1990), Engel and Granger (1987) determine the order of integration as follows: We say that YT variable is integrated in the order of [or y ~ i (d)] fixed, non-reversible, And self-regression gradient (Arma) representation after the differentiation of time. Thus, the time series is a constant level if it has a zero-order integration, while for a non-fixed time series in the first difference if it has integrated commands and generally if a time series must be separated from both, It contains the order of integration I (d) (Gujarati, 2004) .

To explain the unit root test, the simple random walk model is used:

$$Y_t = \rho Y_{t-1} + \mu_t \qquad 3\text{-}1$$

Which is an auto regressive of order one, AR(1) with μt as a stochastic error term and also known as the white noise error term

If ρ = 1, then the stochastic variable Yt has a unit root. The equation can be expressed in an alternative form as:

$$\Delta Y_t = \delta Y_{t-1} + \mu_t \qquad \textbf{3-2}$$

Where

$$\Delta Y_t = Y_t - Y_{t-1} \qquad 3\text{-}3$$

And $\Delta = \rho - 1$

If,

$\delta = 0$

Then, 3.2 becomes as:

$$\Delta Y_t = (Y_t - Y_{t-1}) = \rho - 1 \qquad 3\text{-}4$$

The equation 3.4 is stationary at first difference and has order of integration I(1).

3.4.1 DF Test for Unit Roots

Dicky and Fuller (1979, 1981) proposed two alternative regression equations: (1) the one is the regression with a constant and (2) the second is with a constant and non- stochastic time trend in the model .

These models are as fellow:

(1) The model with a constant :

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \mu_t \qquad 3\text{-}5$$

(2) The model included a constant and non-stochastic time trend:

$$\Delta Y_t = \alpha + \beta + \delta Y_{t-1} + \mu_t \qquad 3\text{-}6$$

The conventional student's t- distribution is not applicable for this test. Mackinnon (1991) tabulated critical values through Monte Carlo Simulation for DF-Test. If the FD- statistics is less than in absolute term than the critical values, then the null hypothesis of unit roots is rejected and concluded the Yt is a stationary series .

3.4.2 ADF Test of Unit Roots

The simple DF- test was further augmented by Dicky and Fuller (1979, 1981). In this augmentation they eliminate autocorrelation in autoregressive model. ADF also has three possible form test:

(i) With No trend and no intercept

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{n} \beta_i Y_{t-i} + \mu_t \qquad 3\text{-}7$$

(ii) With Intercept and no trend

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^{n} \beta_i Y_{t-i} + \mu_t \qquad 3\text{-}8$$

(iii) With Intercept and with trend

$$\Delta Y_t = \alpha + \beta + \delta Y_{t-1} + \sum_{i=1}^{n} \gamma_i Y_{t-i} + \mu_t \qquad 3\text{-}9$$

DF-Test and ADF test both have same hypothesis and the critical values.

3.5 Autoregressive Distributive Lag (ARDL) Model

In time series analysis, the concept of cointegration is very famous and is frequently used in the econometric analysis. Co-integration is an analytical method that tests same trends in different time series which we are observing at the same time and develops the dynamics for short and long terms for the model. Main purpose of co-integration is to extract the relationship of variables at I (1) level. The concept of cointegration was presented by the Granger concept (1981). Different methods are used in co-aggregation, such as: a residue test represented by Engel and Granger (1987), Johansen cointegration Test (1988), Johansen and Josilious test (1990) and bond test for ARDL presented by Pesaran and Shin (2001). Pesaran and Shin (2001) developed ARDL approach to integration. If the variables are of different order of integration then ARDL approach is used for analysis because it takes no account of the difference of the integration of variables. This can be

called the most flexible approach because it allows difference of integrated I (0), I (1) or combination. This cointegration approach is more important than other approaches because it is more suitable for small sized sample. But, we cannot apply ARDL to the variables if I (2) .

ARDL is in general form of the (p,q) model is:

$$Y_t = \alpha_0 + \alpha_1 T + \sum_{i=1}^{n} \beta_i Y_{t-1} + X_t + \sum_{j=1}^{n} \gamma_i X_{t-1} + V_t$$

Chapter 4

4 Methods of Model Selection and Encompassing Principle

4.1 Model Specification Methods

Encompassing

There are many explanatory variables that are associated with the dependent variable, you cannot include all the relevant variables in one model. Therefore you need to build a small alternative model and make an alternative choice. Economic theory cannot guide us in this case. The alternative model is a selection based on the statistical basis. In previous literature, the concept of inclusion was used to select alternative models. The universal principle is used to develop a test framework that unifies the literature on non-overlapping tests, allowing analysis of the relationship between alternative models. The test of non-overlapping hypotheses began with Cox's pioneering work (1961, 1962). A different test was proposed for linear nonlinear regression model, nonlinear regression models and multivariate regression models. These models are estimated using intrinsic variables Pesaran (1974), Pesaran and Dayton (1978), Ericsson (1983) and Godfery (1983). In addition, a number of Monte Carlo studies were carried out on the characteristics of small samples of alternative tests that were generally analyzed by the strength of relative tests of local alternatives (Ericsson, 1983) Davidson and McKinnon (198) and Bizarran (1982)). Davidson and McKinnon (1981) suggested alternative tests for those who were working directly test the probability ratio of Cox co-ordinated, which can be calculated using standard regression packages to reduce non-overlapping computational load tests. Therefore, the economic literature on the test of non-overlapping and broad hypotheses continues to grow (Sawyer (1982) and Dastoor and McCaller

(1978)). In fact, all of the above has been applied in econometrics (Davidson et al. (1978), Davidson and Hendry (1981), Davis (1982), Gregory and McAllier (1983)). The Role of the Encompassing Principle spread Beyond the Calculation of nested or non-nested Test Statistics Hendry and Richard (1982) discuss their critical role in evaluating an adequate data representation model. The encompassing principle emphasizes the choice of the best model and also illustrates the failure and success of competing models for the same data (Maizon and Richard, 1986).

A large number of variables have been used in the past research for the determination of GDP. If we ignore any of these variable, this may cause omitted variable bias, while incorporating and considering all the variables used in the past my lead to too big model which would have low precision and insignificant results. The encompassing technique is the best solution so far in this case. This approach is stated as follows;

1. Suppose x models have been proposed in the past by different researchers.
2. We would re estimate them and rank them according to the standard errors.
3. Suppose Mi model have smallest standard error, then the following hypothesis can be applied.

$$H_0(1): Mi\ encompasses\ M1$$

$$H_0(2): Mi\ encompasses\ M2$$

$$H_0(3): Mi\ encompasses\ M3$$

$$H_0(n): Mi\ encompasses\ Mn$$

The models which are encompass by Mi can b ignored because Mi already have their prediction power. The models which are not encompass by the Mi model, then we make a general model which would have the union of the variables of Mi model and the variables of the models which are not encompass by the Mi model (Bontemps et al., 2008). Then the general model is simplified using general to specific approach.

4.1.1 Encompassing Tests

The encompassing test can be done by using the various diagnostic tests as following.

- Cox Non-Nested Hypothesis Test.
- Ericsson Instrumental Variable Test.
- Sargan Restricted and Unrestricted Reduce form Test.
- Joint Model F-test (*J- test*).

4.1.2 General to Specific

The general to specific method is also known by different names such as London School of Economics (LSE) Methodology, Hendry Methodology and PcGets. London school of Economics proposed an empirical modelling methodology which is consistent with their econometric vision. At the theoretical level, the reduction theory explains how economic models are essentially a kind of empirical model, derived from DGP. The reduction theory provides the origin of the experimental model. The main aim of the reduction theory is to study the concept of probabilities used in simplifying the experimental model (Hendry, 1995). In general, the process of creating the data model (DGP) is replaced by the concept of local data generation (LDGP). The LDGP is a common distribution among subset of the analysed variables (Hendry, 2000) At the practical level, the overall approach, designed to simulate the reduction theory, in which researchers obtain the final econometric model from an unrestricted general model. Davidson et al. (1978) is the mainstay of general modelling to specific one. The general-to-specific approach is a practical example of

the reduction theory that is associated with the process of Generating Data Hendry (1983). In the beginning, the unrestricted general model is formulated based on the previous theoretical and empirical context. The unrestricted general model is then gradually simplified by testing the reasonable economic constraints of abnormal and identical representation. Each simplification step is verified through diagnostic tests. Various methods have been used to streamline the model in general to the specific approach as Hoover and Perez (1999) provide important evidence in the Monte Carlo simulation by revising the Lovell experiment (1983). It simplifies the automatic pattern selection algorithm for G2S (PcGets) and their algorithm simplifies the fact that the unrestricted general model is always compatible with the results. Examine different paths by testing the wrong specification tests. In addition, Hendry and Karolzig (1999) improved the algorithm in several ways, including pre-search and additional path limitation. In the pre-search method, variables are tested first, whether significant or not, with predefined selection criteria such as p and t values. The significant level is used and insignificant variables are permanently removed from the model. The automatic model selection algorithm consists of different diagnostic tests. For example: residuals Autoregressive test (AR 1-4), Autoregressive Conditional Heteroskedasticity (ARCH 1-5), normality test, Chi-square test on parameter stability and Chow test on the breaking points. In addition, Hendry and Richard (1982) suggested that the satisfactory econometric model contains the following criteria.

Data admissible: These are the logical criteria, both models, and the observed data must be interpretable.

Theory consistent: Economic literature contains enormous alternative economic theories, so the pathological model must be in the explicit theoretical framework and must be consistent with the

characteristics of observed data. The model should provide some additional explanations not included in the previous model.

Weakly exogenous: Technically, regressor of the satisfactory model at least weakly exogenous.

Suppose the following model

$y_t=a+\beta x_t+u_t$…….(a) $u_t \backsim NID(0,\sigma 2)$

$x_t=\delta+\gamma y_{t-1}+v_t$……..$(b)$ $v_t \backsim NID(0,\sigma 2)$

Where, $(u_t,)=0$, this implies that x_t is weakly exogenous with β

Parameter constancy: Parameters of the satisfactory model must be variable in relation to time. This requires that the value of the parameter applies to both inside and outside the sample at the end of the sampling period for the test to remain constant for the parameter. Hendry suggested Chi-square and Chow test to compare the performance of the model between the inside and outside of the sample. $Forescat\ Chi2=\Sigma eft2T*t=T+1\sigma 2$

Where, $\sigma 2$ is error variance, $\Sigma e2ft=MSEf.(T*-T)$ and shows the forecast error. The null hypothesis of test is all the parameter values are unchanged between the sample and post sample period. The statistic is asymptotically distrusted as $\chi 2$ with $T*-T$ is degree of freedom. $Forescat\ Chi2=MSEf.(T*-T)\sigma 2$

A model specification test on the constancy of model parameters over the entire sample and post sample is formally calculated as following. $Chow\ Test=(RSS*-RRS)/\ (T*-T)RSS/(T-K)$

Where $RSS*$ shows residual sum of square from the estimated model using both sample and post sample data. The null hypothesis of test is same above the $Forescat\ Chi2$ test. The chow test asymptotically follow the F -distribution with $(T*-T)$ and $(T-K)$ degree of freedom .

Data Coherent: The model error should not predictable, no serial correlation between the residuals, they should not predictable from their past history.

4.1.2.1 Redundancy Test

The variables which are unimportant, should be excluded from the econometric model to obtain meaningful results. On one hand, if insignificant variables are included in the model, it increases the variability of estimators. While on the other hand, if an important variables is not included in the model, it will give baised results of estimators. So it is not hit and trail to add or exclude any variable from the model but it should be done in a systematic manner. Therefore, to obtain parsimonious model, we have applied redundancy test of coefficients. This test compares the original model and redundant model then decides which variables are to be excluded from the original model.

Chapter 5

5 Results and Discussion

5.1 Models Used In Study

1: Salih Turan Katircioglu, (2006) in his study "Causality between agriculture and economic growth in a small nation under political isolation: A case from North Cyprus", used the following model for measuring economic growth led by agriculture.

$$\log(y) = \alpha + \sum \alpha_i \, logy_{t-1} + \sum \beta_i \, logagr_{t-j} + \mu_i$$

y is representing real GDP and real agricultural production is presented by AGR in their natural logarithms.

2: The bases of this model is on Branson (1988). This model is obtained by augmenting Solo production function and is augmented for energy variable.

$$\log(y) = a + \sum \delta_i \, logy_{t-i} + \sum \alpha_i \, logl_{t-i} + \sum \beta_i \, logk_{t-j} + \sum \gamma_i \, loger_{t-k} + \sum \theta_i \, logen_{t-l} + \mu_i$$

Where Y is representing GDP, L is representing labor, K is representing capital, A is the total factor productivity, ER is the Electricity Production obtained by renewable resources and EN is the total Electricity Production.

3: Economic growth in relation to elasticity consumption is checked by Shahbaz and Feridun (2011) for Pakistan. They find long run relationship between growth of the economy and electricity consumption using the time period of 1971-2008. Their results recommend

That economic growth and electricity consumption has long term equilibrium relationship. Their model was:

$$\log(y) = \beta_0 + \beta_{1t} + \sum_{i-1}^{m} \beta_2 \log(y)_{t-i} + \sum_{i-0}^{m} \beta_3 LEC_{t-i} + \beta_4 \log(y)_{t-i} + \beta_5 LECT_{t-i} + \varepsilon_i$$

Where, log (y) represents growth rate of real GDP and LEC represents Log of Electricity Consumption. Real GDP per capita is used as proxy of Economic growth and electricity consumption per capita in KWH is used as a proxy for electricity consumption and is denoted by EC.

4: This equation was used by Liaqat Ali (2012) which is based on equation used by Barro (1991) and Sala-i-Martin (1997), (Optimum quantity theory of money).

$$log\ (y) = \alpha_0 + \sum \delta_i\ logy_{t-i} + \sum \alpha_i\ loginf_{t-i} + \sum \beta_j\ loginv_{t-j} + \varepsilon_i$$

Where $log\ (Y)$ is the rate of growth of real GDP, inf is the rate of growth of CPI, inv is the ratio between investment and GDP and ε is the error term.

5.2 Standard Errors of the Models

Table 1: Standard errors of the models for Pakistan

		PAKISTAN		
	GDP	MGDP1	MGDP2	MGDP3
M1	0.030	0.030	0.100	0.174
M2	**0.011**	**0.011**	**0.060**	**0.067**
M3	0.024	0.024	0.095	0.162
M4	0.020	0.020	0.084	0.128

Table 2: Standard errors of the models for India

		India		
	GDP	MGDP1	MGDP2	MGDP3
M1	0.032	0.029	0.199	0.181
M2	**0.011**	**0.011**	**0.190**	**0.145**
M3	0.033	0.031	0.192	0.187
M4	0.032	0.030	0.190	0.184

Table 3: Standard errors of the models for Sri Lanka

		Sri Lanka		
	GDP	MGDP1	MGDP2	MGDP3
M1	0.028	0.027	0.068	0.081
M2	**0.019**	**0.019**	**0.060**	**0.080**
M3	0.028	0.026	0.086	0.101
M4	0.028	0.026	0.094	0.110

Model 2 has the smallest standard errors in all the cases. So we check that either all the models are encompass by model 2 or not.

5.3 Encompassing

5.3.1 Pakistan

Table 4: Hypothesis testing using Pakistan data

Hypothesis	Test	GDP	MGDP1	MGDP2	MGDP3
M2 encompasses M1	Cox	0.7776 [0.4368]	2.061 [0.0393]	0.8645 [0.3873]	-1.486 [0.1374]
	Ericsson	-0.6375 [0.5238]	-1.371 [0.1705]	-0.5302 [0.5960]	1.301 [0.1932]
M2 encompasses M3	Cox	1.103 [0.2701]	0.8140 [0.4156]	-0.9748 [0.3296]	-1.883 [0.0596]
	Ericsson	-0.9303 [0.3522]	-0.5460 [0.5851]	0.8093 [0.4183]	1.520 [0.1285]
M2 encompasses M4	Cox	-3.729 [0.0002]**	-3.213 [0.0013]**	-10.23 [0.0000]**	-9.362 [0.0000]**
	Ericsson	2.488 [0.0129]*	1.881 [0.0600]	6.553 [0.0000]**	5.617 [0.0000]**

Note: *** presents significance @ 1 percent, ** presents significance @ 5 percent and * presents significance @ 10 percent.

According to the encompassing results shown in the table 4 above, it is clear that the null hypothesis M2 encompasses M1 is accepted. Similarly the hypothesis M2 encompasses M3 is also accepted and the hypothesis M2 encompasses M4 is rejected in all the cases of GDP, MGDP1, MGDP2 and MGDP3. Now the variables of model 4 would also be included in the general model for each case.

The general model would be as follows,

$$\log(y) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

As the result of the encompassing technique, the above equation is obtained. This model have six independent variables i.e. labor, capital, Electricity Production obtained by renewable resources, the total Electricity Production, Inflation and Investment. This model would be estimated separately for GDP, MGDP1, MGDP2 and MGDP3.

For GDP the model would be,

$$\log(GDP) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

For MGDP1 the general model would be,

$$\log(MGDP1) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

For MGDP2 the general model would be,

$$\log(MGDP2) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

For MGDP3 the general model would be,

$$\log(MGDP3) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

5.3.2 India

Table 5: Hypothesis testing using India data

Hypothesis	Test	GDP	MGDP1	MGDP2	MGDP3

M2 encompasses M1	Cox	-1.142 [0.2534]	-1.963 [0.0497]	2.494 [0.0126]	0.3375 [0.7357]
	Ericsson	0.9445 [0.3449]	1.606 [0.1082]	-1.914 [0.0556]	-0.2328 [0.8159]
M2 encompasses M3	Cox	0.6844 [0.4937]	0.7045 [0.4811]	0.1193 [0.9051]	1.306 [0.1915]
	Ericsson	-0.5784 [0.5630]	-0.5961 [0.5511]	-0.08973 [0.9285]	-0.9337 [0.3505]
M2 encompasses M4	Cox	-0.6351 [0.5254]	-0.3439 [0.7309]	-10.37 [0.0000]**	-4.175 [0.0000]**
	Ericsson	0.5274 [0.5979]	0.2886 [0.7729]	5.497 [0.0000]**	2.495 [0.0126]*

Note: *** presents significance @ 1 percent, ** presents significance @ 5 percent and * presents significance @ 10 percent.

According to the encompassing results shown in the table above, it is clear that the null hypothesis i.e. M2 encompasses M1 is accepted. Similarly the hypothesis M2 encompasses M3 is also accepted and the hypothesis M2 encompasses M4 is rejected only in the cases of MGDP2 and MGDP3. Now only the model 2 is estimated for the case of GDP and MGDP1 and the variables of model 4 would also be included in the model 2 for MGDP2 and MGDP3 cases to make a general model.

For MGDP2 the general model would be:

$$\log(MGDP2) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

For MGDP3 the general model would be:

$$\log(MGDP3) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

5.3.3 Sri Lanka

Table 6: Hypothesis testing using Sri Lanka data

Hypothesis	Test	GDP	MGDP1	MGDP2	MGDP3
M2 encompasses M1	Cox	-0.3441 [0.7308]	-0.4464 [0.6553]	-2.704 [0.0068]	-2.651 [0.0680]
	Ericsson	0.2882 [0.7732]	0.3730 [0.7091]	2.0420 [0.0411]	2.037 [0.0617]
M2 encompasses M3	Cox	-0.6397 [0.5224]	-0.6843 [0.4938]	0.6317 [0.5276]	0.4874 [0.6260]
	Ericsson	0.5342 [0.5932]	0.5711 [0.5680]	-0.5374 [0.5910]	-0.4128 [0.6798]
M2 encompasses M4	Cox	-2.250 [0.0245]	-2.806 [0.0050]**	-1.495 [0.1349]	-1.712 [0.0869]
	Ericsson	1.803 [0.0714]	2.211 [0.0271]*	1.231 [0.2182]	1.404 [0.1604]

Note: *** presents significance @ 1 percent, ** presents significance @ 5 percent and * presents significance @ 10 percent.

According to the encompassing results shown in the table above, it is clear that the null hypothesis M2 encompasses M1 is accepted. Similarly the hypothesis M2 encompasses M3 is also accepted and the hypothesis M2 encompasses M4 is rejected in the cases of MGDP1 only. Now the model 2 is estimated for GDP, MGDP2 and MGDP3 and the variables of model 4 would also be included in the model 2 for MGDP1case to make a general model.

For MGDP1 the general model would be,

$$\log(MGDP1) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

5.4 Estimation

5.4.1 Pakistan

Estimations of models by general to specific methodology using all variants of GDPs separately for Pakistan is as follows:

G2S Modelling using GDP of Pakistan:

Table 7: Estimation using GDP of Pakistan

	EQ1	EQ2	EQ3	EQ4	EQ5	ECM
	Coefficient (t-prob)	Coefficient (t-prob)	Coefficient (t-prob)	Coefficient (t-prob)	Coefficient (t-prob)	Coefficient (t-prob)
lgdp_1	0.508 (0.033)	0.626 (0.004)	0.685 (0.000)	0.779 (0.000)	0.793 (0.000)	-- --
lgdp_2	-0.154 (0.493)	-- --	-- --	-- --	-- --	-- --
Constant	-0.107 (0.746)	-0.211 (0.415)	-0.112 (0.524)	-0.273 (0.011)	-0.283 (0.008)	0.015 (0.000)
lab	0.014 (0.099)	0.008 (0.310)	0.006 (0.187)	-- --	-- --	-- --
lab_1	0.005 (0.611)	-0.002 (0.761)	-- --	-- --	-- --	-- --
lab_2	-0.008 (0.313)	-- --	-- --	-- --	-- --	-- --
lk	0.643 (0.000)	0.568 (0.000)	0.566 (0.000)	0.587 (0.000)	0.578 (0.000)	0.560 (0.000)
lk_1	-0.268 (0.131)	-0.393 (0.023)	-0.436 (0.002)	-0.500 (0.000)	-0.510 (0.000)	-- --
lk_2	0.274 (0.180)	0.218 (0.022)	0.181 (0.020)	0.189 (0.009)	0.188 (0.009)	-- --
len	0.173 (0.597)	0.300 (0.277)	0.148 (0.069)	-- --	-- --	-- --
len_1	-0.613 (0.095)	-0.154 (0.581)	-- --	-- --	-- --	-- --
len_2	0.654 (0.071)	-- --	-- --	-- --	-- --	-- --
inf	0.002	0.001	0.001	--	--	--

	(0.283)	(0.575)	(0.602)	--	--	--
inf_1	-0.001 (0.631)	0.000 (0.895)	-- --	-- --	-- --	-- --
inf_2	0.001 (0.612)	-- --	-- --	-- --	-- --	-- --
ler	-0.261 (0.059)	-0.216 (0.077)	-0.149 (0.089)	-0.066 (0.365)	-- --	-0.116 (0.144)
ler_1	0.360 (0.013)	0.289 (0.023)	0.273 (0.009)	0.256 (0.011)	0.207 (0.012)	-- --
ler_2	-0.321 (0.011)	-0.224 (0.024)	-0.246 (0.005)	-0.228 (0.002)	-0.223 (0.002)	-- --
inv	-0.007 (0.481)	-0.001 (0.924)	-0.006 (0.339)	-- --	-- --	-- --
inv_1	-0.008 (0.562)	-0.007 (0.453)	-- --	-- --	-- --	-- --
inv_2	-0.013 (0.286)	-- --	-- --	-- --	-- --	-- --
ECM	-- --	-- --	-- --	-- --	-- --	-0.620 (0.016)
Restrictions	lgdp_2,lab_2 len_2,inf_2 inv_2	lab_1,len_1 inf_1,inv_1	lab, len Inf, inv	ler		
F Stats	1.1152 [0.3993]	0.28026 [0.8869]	0.97142 [0.4430]	0.85086 [0.3648]		

The results of encompassing in case of GDP of Pakistan suggests that Model 2 encompasses Model 1 and Model 3 but model 4 was not encompassed by Model 2 in this case. So we make up a general model consisting of all the variables of model 2 and model 4. The general model is

$$\log(GDP) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

We use ARDL approach which is described earlier and estimate the model by OLS technique. We test exclusion restrictions on a set of insignificant variables i.e. lgd_2, lab_2, len_2, inf_2, inv_2 of the first step, lab_1, len_1, inf_1, inv_1 on the second step, lab, len, inf, inv on the third step and ler on fourth step. We came up with a final model which have all the significant variables. The final model actually explaining the determinants of GDP of Pakistan. According to our estimates

the determinants of GDP are GDP in its first lag, capital with its first and second lag and electricity from renewable resources in its first and second lag. Here the theoretical explanation of the determinants is not necessary because we are not interested in determining the effects of determinants but we are to compare the difference of determinants along the different measures of GDP.

G2S Modelling using MGDP1 for Pakistan:

Table 8: Estimation using MGDP1 of Pakistan

	EQ1	EQ2	EQ3	EQ4	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp1_1	0.521 (0.029)	0.655 (0.002)	0.764 (0.000)	0.780 (0.000)	-- --
lmgdp1_2	-0.118 (0.598)	-- --	-- --	-- --	-- --
Constant	-0.009 (0.976)	-0.158 (0.537)	-0.266 (0.011)	-0.277 (0.008)	0.015 (0.001)
lk	0.639 (0.000)	0.567 (0.000)	0.598 (0.000)	0.589 (0.000)	0.562 (0.000)
lk_1	-0.291 (0.101)	-0.419 (0.016)	-0.494 (0.000)	-0.504 (0.000)	-- --
lk_2	0.254 (0.222)	0.221 (0.023)	0.194 (0.007)	0.192 (0.008)	-- --
lab	0.015 (0.076)	0.008 (0.272)	-- --	-- --	-- --
lab_1	0.004 (0.641)	-0.003 (0.667)	-- --	-- --	-- --
lab_2	-0.008 (0.295)	-- --	-- --	-- --	-- --
len	0.118 (0.718)	0.233 (0.397)	-- --	-- --	-- --
len_1	-0.555 (0.126)	-0.097 (0.727)	-- --	-- --	-- --
len_2	0.656 (0.070)	-- --	-- --	-- --	-- --
inf	0.001 (0.228)	0.018 (0.529)	-- --	-- --	-- --
inf_1	-0.000 (0.660)	0.002 (0.824)	-- --	-- --	-- --
inf_2	0.000 (0.477)	-- --	-- --	-- --	-- --
ler	-0.248 (0.074)	-0.201 (0.105)	-0.069 (0.336)	-- --	-0.126 (0.113)

ler_1	0.333 (0.018)	0.266 (0.034)	0.240 (0.015)	0.188 (0.019)	-- --
ler_2	-0.325 (0.01)	-0.224 (0.024)	-0.220 (0.003)	-0.215 (0.003)	-- --
inv	-0.005 (0.558)	0.002 (0.867)	-- --	-- --	-- --
inv_1	-0.006 (0.656)	-0.007 (0.422)	-- --	-- --	-- --
inv_2	-0.013 (0.230)	-- --	-- --	-- --	-- --
ECM	-- --	-- --	-- --	-- --	-0.622 (0.016)
Restrictions	lmgdp1_2,lab_2 len_2,inf_2 inv_2	Lab,lab_1 Len,len_1 Inf,inf_1 Inv,inv_1	ler		
F State	1.1934 [0.3649]	0.48011 [0.8545]	0.95863 [0.3366]		

On the basis of encompassing results, the general model for MGDP1 of Pakistan is as follows

$$\log(MGDP1) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

This model consists of the variables of model 2 and model 4. The same approach and estimation technique is incorporated to estimates the coefficients i.e. ARDL and OLS respectively. Then we test exclusion restrictions on lmgdp1_2, lab_2, len_2, inf_2, inv_2 on the first estimation then on Lab,lab_1, Len,len_1, Inf, inf_1, Inv,inv_1 and finally on ler and exclude the insignificant variables. Our final model gives the same determinants for MGDP1 as that were for GDP. We have obtained MGDP1 by adding house hold production by female participants of our society in the value of GDP. This might be the reason that GDP and MGDP1 have the same determinants in case of Pakistan.

G2S Modelling Using MGDP2 of Pakistan

Table 9: Estimation using MGDP2 of Pakistan

	EQ1	EQ2	EQ3	EQ4	EQ5	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp2_1	0.027 (0.913)	0.069 (0.756)	-- --	-- --	-- --	-- --
lmgdp2_2	-0.177 (0.501)	-- --	-- --	-- --	-- --	-- --
Constant	4.738 (0.145)	3.410 (0.087)	4.200 (0.003)	4.996 (0.000)	6.033 (0.000)	0.038 (0.030)
lab	-0.030 (0.491)	-0.042 (0.242)	-0.026 (0.444)	-0.096 (0.000)	-- --	-0.018 (0.553)
lab_1	-0.057 (0.237)	-0.057 (0.202)	-0.073 (0.098)	1.139 (0.000)	-0.078 (0.000)	-- --
lab_2	-0.033 (0.444)	-0.017 (0.690)	-0.020 (0.601)	-- --	-- --	-- --
lk	-0.357 (0.494)	-0.340 (0.458)	-0.220 (0.597)	-- --	-- --	-0.596 (0.105)
lk_1	1.408 (0.020)	1.574 (0.009)	1.507 (0.009)	-- --	0.867 (0.000)	-- --
lk_2	0.405 (0.544)	0.126 (0.789)	0.107 (0.774)	-- --	-- --	-- --
len	1.553 (0.381)	1.776 (0.201)	-- --	-- --	-- --	-- --
len_1	-2.585 (0.148)	-2.732 (0.055)	-1.056 (0.077)	-0.503 (0.224)	-- --	-- --
len_2	-0.036 (0.986)	-- --	-- --	-- --	-- --	-- --
inf	-0.006 (0.471)	-0.001 (0.836)	-0.002 (0.777)	-- --	-- --	0.006 (0.223)
inf_1	-0.016 (0.037)	-0.018 (0.016)	-0.015 (0.029)	-0.013 (0.011)	-0.009 (0.019)	-- --
inf_2	-0.006 (0.442)	-0.003 (0.708)	-0.006 (0.271)	-- --	-- --	-- --
ler	0.029 (0.957)	0.084 (0.873)	-- --	-- --	-- --	0.105 (0.775)
ler_1	0.652 (0.315)	0.985 (0.072)	1.120 (0.014)	0.727 (0.024)	0.466 (0.045)	-- --
ler_2	0.789 (0.169)	-- --	-- --	-- --	-- --	-- --
inv	-0.090 (0.069)	-0.109 (0.025)	-0.099 (0.031)	-0.127 (0.000)	-0.127 (0.000)	-0.084 (0.012)
inv_1	-0.069 (0.336)	-0.034 (0.612)	-0.077 (0.185)	-- --	-- --	-- --
inv_2	0.062 (0.259)	0.064 (0.222)	0.079 (0.118)	-- --	-- --	-- --

ECM	-- --	-- --	-- --	-- --	-- --	-1.167 (0.000)
Restrictions	Lmgdp2_2 Len_2,ler_2	lmgdp2_1,len ler,ler_1	Lab,lab_2 Lk,lk_2 Inf,ifn_2 Inv_,inv_2	len_1		
F states	1.068 [0.396]	2.578 [0.077]	0.7612 [0.639]	1.549 [0.224]		

As like GDP and MGDP1, the results of encompassing said that model 2 encompasses model 1 and model 3 and not encompass model 4. In the light of these results we make a general model which have the union of the variables of model 2 and model 4. The model is

$$\log(MGDP2) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

We follow the ARDL approach and estimates coefficient by OLS. Then we test follow the same procedure of testing exclusion restrictions on the set of insignificant variables and in the light of the result of exclusion restriction we exclude the insignificant variables. The variables which are excluded at first estimation are Lmgdp2_2, Len_2, ler_2. The variables excluded at the end of second estimation are lmgdp2_1,len, ler,ler_1, after excluding these variables we estimate the model third time, len_1 became insignificant which is excluded before the final estimation. The final model evaluates the following determinants of the MGDP2. Labor in its first lag, capital in its first lag, inflation in first lag, renewable energy resources in its first lag and the current year's investment. These determinants are different from the determinants of GDP and MGDP1. We would compare the differences in detail in the comparison section.

G2S Modelling using MGDP3 for Pakistan:

Table 10: Estimation using MGDP3 of Pakistan

	EQ1	EQ2	EQ3	EQ4	ECM
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient

	t-prob	t-prob	t-prob	t-prob	t-prob
lmgdp3_1	-0.103 (0.626)	0.033 (0.860)	--	--	--
lmgdp3_2	-0.301 (0.198)	--	--	--	--
Constant	8.033 (0.076)	4.130 (0.129)	4.969 (0.005)	5.634 (0.001)	0.036 (0.398)
Lab	-0.074 (0.246)	-0.108 (0.059)	-0.107 (0.040)	-0.087 (0.057)	-0.063 (0.358)
lab_1	-0.103 (0.163)	-0.082 (0.173)	-0.082 (0.093)	-0.101 (0.032)	--
lab_2	-0.050 (0.435)	--	--	--	--
lk	-0.645 (0.422)	-0.390 (0.579)	-0.320 (0.616)	1.595 (0.000)	-1.164 (0.160)
lk_1	1.712 (0.057)	1.916 (0.032)	2.009 (0.003)	--	--
lk_2	0.893 (0.341)	0.256 (0.700)	--	--	--
len	2.023 (0.451)	2.585 (0.221)	2.068 (0.258)	--	1.003 (0.640)
len_1	-2.365 (0.366)	-4.747 (0.032)	-4.051 (0.024)	-2.087 (0.004)	--
len_2	-1.635 (0.565)	--	--	--	--
inf	-0.020 (0.108)	-0.015 (0.161)	-0.015 (0.128)	-0.019 (0.037)	0.001 (0.939)
inf_1	-0.018 (0.109)	-0.023 (0.037)	-0.023 (0.018)	-0.026 (0.004)	--
inf_2	-0.017 (0.132)	-0.010 (0.305)	-0.008 (0.317)	--	--
ler	0.479 (0.559)	0.653 (0.421)	0.913 (0.155)	1.455 (0.009)	0.795 (0.427)
ler_1	0.328 (0.729)	0.359 (0.684)	--	--	--
ler_2	1.826 (0.037)	1.243 (0.071)	1.289 (0.022)	0.998 (0.055)	
inv	-0.118 (0.107)	-0.109 (0.122)	-0.122 (0.038)	-0.144 (0.011)	-0.123 (0.084)
inv_1	-0.160 (0.139)	-0.135 (0.196)	-0.130 (0.145)	-0.101 (0.169)	--
inv_2	0.137 (0.106)	0.179 (0.033)	0.176 (0.022)	0.174 (0.005)	--
ecmMgdp3	--	--	--	--	-1.024 (0.012)

Restrictions	lmgdp3_2 lab_2,len_2	lmgdp3_1 lk_2,ler_1	Lk, len inf_2		
F-States	1.2606 [0.3286]	0.17488 [0.9118]	1.1176 [0.3667]		

The encompassing results regarding to MGDP3 of Pakistan shows that model 2 encompasses model 1 and model 3. Model 4 was not encompass by model 2, so the general model would be the union of model 2 and model 4. The model is

$$\log(MGDP3) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

The procedure is followed, ARDL approach and OLS technique is used to estimate the values of coefficients followed by the testing of exclusion restrictions on the set of insignificant variables. The variables which are excluded are lmgdp3_2, lab_2, len_2 at first instance, lmgdp3_1, lk_2, ler_1 at second instance, lk, len, inf_2 at the third instance. We end up with the model which gives labor with its first lag, capital, electric power consumption in its first lag, inflation with its first lag, renewable energy resources with its first lag and investment with its first and second lag.

Comparisons of GDPs of Pakistan:

Table 11: Comparisons of GDPs of Pakistan

	GDP	**MGDP1**	**MGDP2**	**MGDP3**
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lgdp_1	0.793 (0.000)	0.781 (0.000)	-- --	-- --
Constant	-0.283 (0.008)	0.781 (0.000)	6.033 (0.000)	5.634 (0.001)
lab	-- --	-- --	-- --	-0.087 (0.057)
lab_1	-- --	-- --	-0.078 (0.000)	-0.101 (0.032)
lk	0.578	0.589	--	--

	(0.000)	(0.000)	--	--
lk_1	-0.510 (0.000)	-0.505 (0.000)	0.867 (0.000)	1.595 (0.000)
lk_2	0.188 (0.009)	0.192 (0.008)	-- --	-- --
len_1	-- --	-- --	-- --	-2.087 (0.004)
inf	-- --	-- --	-- --	-0.019 (0.037)
inf_1	-- --	-- --	-0.009 (0.019)	-0.026 (0.004)
ler	-- --	-- --	-- --	1.455 (0.009)
ler_1	0.207 (0.012)	0.189 (0.020)	0.466 (0.045)	-- --
ler_2	-0.223 (0.002)	-0.216 (0.003)	-- --	0.998 (0.055)
inv	-- --	-- --	-0.127 (0.000)	-0.144 (0.011)
inv_1	-- --	-- --	-- --	-0.101 (0.169)
inv_2	-- --	-- --	-- --	0.174 (0.005)

We have estimated coefficients for every type of GDP. There seems to be differences in the determinants of GDPs. The determinants for GDP are GDP in its first lag, capital with its first and second lag and electricity from renewable resources in its first and second lag. The determinants of MGDP1 are same like GDP. The determinants for MGDP1 are labor in its first lag, capital in its first lag, inflation in first lag, renewable energy resources in its first lag and the current year's investment. We can clearly see that there is a difference in the determinants of MGDP2 as compared to GDP. The determinants of MGDP3 are labor with its first lag, capital, electric power consumption in its first lag, inflation with its first lag, renewable energy resources with its first lag and investment with its first and second lag. The determinants of MGDP3 are also different from remaining types of gdps. It is clear that if we change the way to calculate the value of GDP every year, the determinants of GDP would be changed.

5.4.2 India

Estimations of models by general to specific methodology using all variants of GDPs separately for India is as follows:

G2S Modelling using GDP for India:

Table 12: Estimation using GDP of India

	EQ1	EQ2	EQ3	ECM
	Coefficient t-prob P	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lgdp_1	-0.056 (0.818)	-- --	-- --	-- --
lgdp_2	-0.081 (0.796)	-- --	-- --	-- --
Constant	10.160 (0.006)	8.436 (0.000)	8.072 (0.000)	0.010 (0.047)
lab	-3.962 (0.008)	-2.433 (0.051)	-1.147 (0.025)	-2.221 (0.001)
lab_1	4.744 (0.039)	2.102 (0.276)	-- --	-- --
lab_2	-4.266 (0.013)	-2.595 (0.020)	-1.596 (0.001)	-- --
lk	0.812 (0.000)	0.719 (0.000)	0.732 (0.000)	0.696 (0.000)
lk_1	-0.002 (0.992)	-- --	-- --	-- --
lk_2	-0.010 (0.963)	-- --	-- --	-- --
ler	0.092 (0.258)	0.042 (0.512)	-- --	0.063 (0.291)
ler_1	-0.256 (0.022)	-0.117 (0.086)	-0.071 (0.057)	-- --
ler_2	0.130 (0.186)	-- --	-- --	-- --
len	-0.137 (0.331)	0.022 (0.065)	0.018 (0.098)	-0.125 (0.074)
len_1	0.190 (0.310)	-- --	-- --	-- --
len_2	-0.035 (0.810)	-- --	-- --	-- --
ecm	-- --	-- --	-- --	-0.994 (0.000)
Restrictions	lgdp_1,lgdp_2,	lab_1,ler		

	lk_1,lk_2, ler_2,len_1 len_2			
F-Stats	1.2708 [0.3159]	0.8059 [0.4575]		

The above is the estimation of model 2 by using GDP data of India. The model is

$$\log(GDP) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \varepsilon$$

Encompassing results declared that model 2 encompass all the other models, we only estimate model 2 in this case. The same approach of ARDL and estimating technique of OLS is used to estimate the value of coefficients. Then exclusion restrictions are tested and on the basis of exclusion restrictions we exclude the insignificant variables. Our final model give the determinants of Indian GDP are labor with its second lag, capital, renewable energy resources in its first lag and electric power consumption.

G2S Modelling using MGDP1 for India:

Table 13: Estimation using MGDP1 of India

	EQ1	EQ2	EQ3	EQ4	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp1_1	0.057 (0.819)	-- --	-- --	-- --	-- --
lmgdp1_2	0.020 (0.949)	-- --	-- --	-- --	-- --
Constant	9.495 (0.023)	9.143 (0.000)	9.396 (0.000)	9.036 (0.000)	0.011 (0.037)
lab	-5.089 (0.003)	-3.660 (0.008)	-3.304 (0.015)	-1.989 (0.001)	-2.931 (0.000)
lab_1	5.382 (0.034)	3.741 (0.094)	2.323 (0.265)	-- --	-- --
lab_2	-3.786 (0.034)	-3.370 (0.012)	-2.473 (0.038)	-1.288 (0.008)	-- --
lk	0.742	0.699	0.679	0.684	0.627

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
lk_1	-0.062 (0.711)	-- --	-- --	-- --	-- --
lk_2	-0.078 (0.702)	-- --	-- --	-- --	-- --
ler	0.090 (0.313)	0.018 (0.793)	-- --	-- --	0.082 (0.204)
ler_1	-0.306 (0.013)	-0.230 (0.015)	-0.109 (0.014)	-0.096 (0.024)	-- --
ler_2	0.162 (0.142)	0.134 (0.097)	-- --	-- --	-- --
len	-0.118 (0.440)	0.025 (0.111)	0.037 (0.004)	0.036 (0.005)	-0.138 (0.068)
len_1	0.199 (0.347)	-- --	-- --	-- --	-- --
len_2	-0.051 (0.749)	-- --	-- --	-- --	-- --
ecmMGDP1	-- --	-- --	-- --	-- --	-0.817 (0.001)
Restrictions	lmgdp1_1 lmgdp1_2 lk_1 lk_2 len_1 len_2	ler ler_2	lab_1		
F States	1.0453 [0.4295]	1.6297 [0.2169]	1.2957 [0.2654]		

In the case of MGDP1 of India, model 2 encompasses all the remaining models. So we only estimate model two.

$$\log(MGDP1) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \varepsilon$$

The same procedure is followed to evaluate the determinants of MGDP1 of India. The determinants are labor with its second lag, capital, renewable energy resources in its first lag and electric power consumption. We can see that the in case of India the determinants of GDP and MGDP1 are same as like in the case of Pakistan. This might be because in the calculation of MGDP1 we only adds the hose hold production and do not subtract anything.

G2S Modelling using MGDP2 for India

Table 14: Estimation using MGDP2 of India

	EQ1	EQ2	EQ3	ECM
	Coefficient t-prob P	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp2_1	0.426 (0.035)	0.395 (0.016)	0.407 (0.000)	-- --
Constant	-16.541 (0.690)	-1.940 (0.775)	-- --	-0.040 (0.747)
lab	18.817 (0.550)	-- --	-- --	-- --
lab_1	-8.025 (0.844)	-- --	-- --	-- --
lk	-0.007 (0.995)	-- --	-- --	-- --
lk_1	-0.816 (0.396)	-- --	-- --	-- --
inf	0.002 (0.897)	-- --	-- --	-- --
inf_1	-0.013 (0.543)	-- --	-- --	-- --
ler	-0.492 (0.786)	-0.422 (0.711)	-- --	-- --
ler_1	0.978 (0.534)	0.205 (0.843)	-- --	-- --
inv	-0.273 (0.308)	-0.406 (0.007)	-0.379 (0.000)	-0.443 (0.006)
inv_1	0.608 (0.024)	0.471 (0.004)	0.462 (0.000)	-- --
len	1.383 (0.631)	1.832 (0.443)	0.266 (0.000)	2.224 (0.220)
len_1	-0.922 (0.730)	-1.476 (0.504)	-- --	-- --
ecmMGDP2	-- --	-- --	-- --	-0.756 (0.053)
Restrictions	Lab,lab_1 Lk,lk_1 Inf,inf_1	Ler,ler_1 len_1	-- --	-- --
F states	0.52702 [0.7756]	0.16381 [0.9191]	-- --	-- --

The encompassing results regarding to MGDP2 of India shows that model 2 encompasses model 1 and model 3. Model 4 was not encompass by model 2, so the general model would be the union of model 2 and model 4. The model is

$$\log(MGDP2) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

The same procedure is followed, ARDL approach and OLS technique is used to estimate the values of coefficients followed by the testing of exclusion restrictions on the set of insignificant variables. We end up with the model which gives the determinants which are lmgdp itself in its second lag, current and last year's investment and electric power consumption.

G2S Modelling using MGDP3 for India

Table 15: Estimation using MGDP3 of India

	EQ1	EQ2	EQ3	EQ4	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp3_1	-0.569 (0.139)	-0.114 (0.608)	-54.045 (0.001)	-- --	-- --
Constant	-109.827 (0.023)	-59.698 (0.004)	-- --	-63.460 (0.000)	-0.025 (0.824)
lab	-33.960 (0.253)	-1.351 (0.939)	-- --	-- --	37.828 (0.107)
lab_1	85.203 (0.073)	31.541 (0.129)	27.677 (0.002)	33.972 (0.000)	-- --
lk	1.164 (0.217)	-0.004 (0.995)	-- --	-- --	-0.659 (0.443)
lk_1	-1.801 (0.055)	-1.234 (0.072)	-1.185 (0.001)	-1.077 (0.001)	-- --
inf	0.008 (0.457)	-- --	-- --	-- --	-- --
inf_1	0.006 (0.634)	-- --	-- --	-- --	-- --
ler	-1.799 (0.192)	-- --	-- --	-- --	-- --
ler_1	-1.668 (0.228)	-- --	-- --	-- --	-- --
inv	-0.180 (0.391)	-- --	-- --	-- --	-0.063 (0.766)
inv_1	0.435 (0.082)	0.623 (0.001)	0.598 (0.000)	0.621 (0.000)	-- --
len	3.982 (0.062)	3.144 (0.056)	3.093 (0.018)	0.989 (0.000)	1.565 (0.338)
len_1	-2.107 (0.234)	-1.931 (0.187)	-1.996 (0.086)	-- --	-- --
ecm	-- --	-- --	-- --	-- --	-1.166 (0.081)
Restrictions	Inf,inf_1 Ler,ler_1,inv	lmgdp3_1 lab,lk	len_1		
F states	0.86167 [0.5629]	0.17245 [0.9126]	3.4583 [0.0857]		

As like MGDP2, the results of encompassing said that model 2 encompasses model 1 and model 3 and not encompass model 4. So we make a general model which have the union of the variables of model 2 and model 4. The model is

$$\log(MGDP2) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

We follow the ARDL approach and estimates coefficient by OLS. Then we test follow the same procedure of testing exclusion restrictions on the set of insignificant variables and in the light of the result of exclusion restriction we exclude the insignificant variables. The final model evaluates the following determinants of the MGDP3 of India are labor in its first lag, capital in its first lag, investment in its first lag and current level of electric consumption.

Comparisons of GDPs of India

Table 16: Comparisons of GDPs of India

	GDP	MGDP1	MGDP2	MGDP3
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp1_1	-- --	-- --	0.407 (0.000)	-- --
Constant	8.072 (0.000)	9.036 (0.000)	-- --	-63.460 (0.000)
lab	-1.147 (0.025)	-1.989 (0.001)	-- --	-- --
lab_1	-- --	-- --	-- --	33.972 (0.000)
lab_2	-1.596 (0.000)	-1.288 (0.008)	-- --	-- --
lk	0.732 (0.000)	0.684 (0.000)	-- --	-- --
lk_1	-- --	-- --	-- --	-1.077 (0.001)
ler_1	-0.071 (0.057)	-0.096 (0.024)	-- --	-- --
len	0.018 (0.097)	0.036 (0.005)	0.266 (0.000)	0.989 (0.000)
inv	--	--	-0.379	--

	--	--	(0.000)	--
inv_1	-- --	-- --	0.462 (0.000)	0.621 (0.000)

As we have the first glance on the table of the comparisons of the determinants of GDPs, we came to know that the determinants of GDP and MGDP1 are the same. But the other two measures have totally different determinants. The determinants of Indian GDP and MGDP1 are labor with its second lag, capital, renewable energy resources in its first lag and electric power consumption. The determinants of MGDP2 are lmgdp2 itself in its second lag, current and last year's investment and electric power consumption. MGDP3 of India have labor in its first lag, capital in its first lag, investment in its first lag and current level of electric consumption. The difference in these determinants elaborates the point that if we would change the way of calculation of GDP, its determinants would also be changed which leads to change the policy regarding GDP.

5.4.3 Sri Lanka

G2S Modelling using GDP for Sri Lanka

Table 17: Estimation using GDP of Sri Lanka

	EQ1	EQ2	EQ3	EQ4	EQ5	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lgdp_1	0.866 (0.000)	0.880 (0.000)	0.679 (0.000)	0.679 (0.000)	0.679 (0.000)	-- --
lgdp_2	-0.289 (0.163)	-0.256 (0.146)	-- --	-- --	-- --	-- --
Constant	0.194 (0.825)	-- --	-- --	-- --	-- --	0.0196 (0.000)
lab	-0.017 (0.969)	-- --	-- --	-- --	-- --	-0.046 (0.911)
lab_1	-0.345	-0.344	-0.230	--	--	--

	(0.535)	(0.347)	(0.504)	--	--	--
lab_2	0.857 (0.083)	0.872 (0.032)	0.718 (0.062)	0.498 (0.001)	0.510 (0.001)	-- --
lk	0.495 (0.000)	0.481 (0.000)	0.507 (0.000)	0.499 (0.000)	0.490 (0.000)	0.481 (0.000)
lk_1	-0.464179 0.0049	-0.44556 0.0018	-0.37292 0.003	-0.338207 0.0001	-0.336068 0.0001	-- --
lk_2	0.187 (0.174)	0.164 (0.164)	0.029 (0.699)	-- --	-- --	-- --
len	0.070 (0.475)	0.065 (0.429)	-- --	-- --	-- --	0.001 (0.984)
len_1	-0.113 (0.621)	-0.131 (0.516)	-0.119 (0.521)	-0.152 (0.342)	-- --	-- --
len_2	0.382 (0.101)	0.377 (0.064)	0.399 (0.052)	0.435 (0.013)	0.296 (0.000)	-- --
ler	0.119 (0.053)	0.120 (0.0298)	0.086 (0.080)	0.084 (0.076)	0.089 (0.049)	0.037 (0.355)
ler_1	0.024 (0.669)	-- --	-- --	-- --	-- --	-- --
ler_2	0.020 (0.740)	-- --	-- --	-- --	-- --	-- --
ecm	-- --	-- --	-- --	-- --	-- --	-0.263 (0.038)
Restrictions	Lab,ler_1 ler_2	lgdp_2 len	lab_1 lk_2	len_1		
F states	0.12146 [0.9731]	1.261 [0.3022]	0.29692 [0.7457]	0.93527 [0.3421]		

The above estimation is of model 2 by using GDP data of Sri Lanka. The model is

$$\log(GDP) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \varepsilon$$

On the basis of encompassing results, it is clear that model 2 encompass all the other models, we have to estimate only model 2 in this case. The same approach of ARDL and estimating technique of OLS is used to estimate the value of coefficients. Then exclusion restrictions are tested and on the basis of exclusion restrictions we exclude the insignificant variables. Our final model give the determinants of Sri Lanka GDP are GDP in its first lag, labor in its second lag, current level of capital as well as last year's capital, electric power consumption in its second lag and current level of renewable energy resources.

G2S Modelling using MGDP1 for Sri Lanka

Table 18: Estimation using MGDP1 of Sri Lanka

	EQ1	EQ2	EQ3	EQ4	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp1_1	1.007 (0.001)	1.07 (0.000)	1.082 (0.000)	1.173 (0.000)	-- --
lmgdp1_2	-0.453 (0.062)	-0.41 (0.010)	-0.380 (0.016)	-0.385 (0.016)	-- --
Constant	2.213 (0.060)	1.61 (0.010)	0.807 (0.040)	0.395 (0.053)	0.021 (0.000)
lab	-0.387 (0.393)	-0.35 (0.110)	-- --	-- --	-- --
lab_1	-0.108 (0.847)	-- --	-- --	-- --	-- --
lab_2	-0.009 (0.987)	-- --	-- --	-- --	-- --
lk	0.497 (0.000)	0.47 (0.000)	0.469 (0.000)	0.432 (0.000)	0.425 (0.000)
lk_1	-0.471 (0.005)	-0.50 (0.000)	-0.547 (0.000)	-0.580 (0.000)	-- --
lk_2	0.248 (0.064)	0.23 (0.020)	0.251 (0.010)	0.287 (0.003)	-- --
len	0.138 (0.110)	0.12 (0.080)	0.074 (0.258)	0.137 (0.004)	0.033 (0.655)
len_1	-0.284 (0.224)	-0.26 (0.100)	-- --	-- --	-- --
len_2	0.387 (0.093)	0.33 (0.050)	0.136 (0.206)	-- --	-- --
inf	0.002 (0.027)	0.00 (0.000)	0.002 (0.003)	0.002 (0.000)	0.001 (0.121)
inf_1	0.000 (0.973)	-- --	-- --	-- --	-- --
inf_2	0.000 (0.947)	-- --	-- --	-- --	-- --
ler	0.093 (0.084)	0.08 (0.050)	0.076 (0.064)	0.075 (0.051)	0.022 (0.547)
ler_1	-0.017 (0.747)	-- --	-- --	-- --	-- --
ler_2	0.001 (0.992)	-- --	-- --	-- --	-- --
inv	-0.023 (0.024)	-0.02 (0.000)	-0.013 (0.020)	-0.013 (0.023)	-0.001 (0.868)
inv_1	0.000 (0.984)	-- --	-- --	-- --	-- --
inv_2	-0.010	--	--	--	--

	(0.286)	--	--	--	--
ecmMGDP1	-- --	-- --	-- --	-- --	-0.215 (0.035)
Restrictions	lab_1,lab_2 inf_1,inf_2 ler_1,ler_2 inv_1,inv_2	lab len_1	len_2		
F States	0.31414 [0.9467]	2.4065 [0.1146]	1.6944 [0.2059]		

On the basis of encompassing results, the general model for MGDP1 of Sri Lanka would be

$$\log(MGDP1) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \alpha_5 \ln(INF) + \alpha_6 \ln(INV) + \varepsilon$$

This model includes the variables of model 2 and model 4. Model 1 and model 3 are encompassed by model 2. The same approach and estimation technique is incorporated to estimates the coefficients i.e. ARDL and OLS respectively. Then we test exclusion restrictions on the set of insignificant variables and exclude the insignificant variables. Our final model gives the determinants for MGDP1 are MGDP1 in its first and second lag, capital with its two previous lags. Electric power consumption of the current year, inflation of the current year, renewable energy resources and investment of the current year.

G2S Modelling using MGDP2 for Sri Lanka

Table 19: Estimation using MGDP2 of Sri Lanka

	EQ1	EQ2	EQ3	EQ4	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp2_1	-0.054 (0.819)	0.530 (0.001)	0.462 (0.001)	0.462 (0.001)	-- --
lmgdp2_2	0.501 (0.024)	-- --	-- --	-- --	-- --
Constant	-2.235 (0.435)	0.456 (0.656)	0.713 (0.155)	0.708 (0.148)	0.027 (0.192)
lab	-0.113	--	--	--	--

	(0.940)	--	--	--	--
lab_1	1.430 (0.447)	-- --	-- --	-- --	-- --
lab_2	0.231 (0.893)	-- --	-- --	-- --	-- --
lk	-0.050 (0.855)	-- --	-- --	-- --	0.317 (0.364)
lk_1	0.347 (0.435)	0.346 (0.207)	0.020 (0.928)	-- --	-- --
lk_2	0.255 (0.447)	0.202 (0.479)	0.499 (0.052)	0.519 (0.000)	-- --
len	-0.403 (0.313)	-0.390 (0.147)	-- --	-- --	-- --
len_1	-0.295 (0.706)	-0.566 (0.399)	-- --	-- --	-- --
len_2	0.805 (0.317)	0.819 (0.212)	-- --	-- --	-- --
ler	0.006 (0.975)	0.406 (0.014)	-- --	-- --	-0.311 (0.096)
ler_1	0.420 (0.038)	-0.474 (0.005)	0.453 (0.006)	0.458 (0.003)	-- --
ler_2	-0.376 (0.063)	-- --	-0.327 (0.030)	-0.328 (0.027)	-- --
ecmMGDP2	-- --	-- --	-- --	-- --	-0.454 (0.038)
Restrictions	lmgdp2_1 lab,lab_1 lab_2,lk,ler	Len,len_1 len_2	lk_1		
F states	0.30939 [0.9242]	1.7353 [0.1854]	0.0083529 [0.9278]		

In the case of MGDP2 of Sri Lanka, model 2 encompasses all the remaining models. So we only estimate model two.

$$\log(MGDP1) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \varepsilon$$

The same procedure is followed to evaluate the determinants of MGDP2 of Sri Lanka. The determinants last year's value of itself MGDP2, second lag of capital, last two years value of renewable energy resources.

G2S Modelling using MGDP3 for Sri Lanka

Table 20: Estimation using MGDP3 of Sri Lanka

	EQ1	EQ2	EQ3	EQ4	ECM
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
lmgdp3_1	-0.067 (0.774)	0.450 (0.005)	0.518 (0.001)	0.465 (0.001)	-- --
lmgdp3_2	0.487 (0.026)	-- --	-- --	-- --	-- --
Constant	-3.082 (0.365)	-3.325 (0.177)	-3.663 (0.137)	-4.463 (0.045)	0.031 (0.195)
lab	-0.138 (0.938)	-- --	-- --	-- --	0.362 (0.876)
lab_1	1.907 (0.392)	1.952 (0.096)	1.558 (0.165)	2.145 (0.017)	-- --
lab_2	0.124 (0.951)	-- --	-- --	-- --	-- --
lk	-0.162 (0.623)	-0.133 (0.605)	-- --	-- --	0.276 (0.480)
lk_1	0.416 (0.427)	0.313 (0.434)	0.134 (0.630)	-- --	-- --
lk_2	0.351 (0.374)	0.400 (0.195)	0.542 (0.068)	0.639 (0.000)	-- --
len	-0.484 (0.293)	-0.444 (0.151)	-0.174 (0.349)	-- --	-- --
len_1	-0.295 (0.750)	-- --	-- --	-- --	-- --
len_2	0.857 (0.363)	0.530 (0.205)	-- --	-- --	-- --
ler	0.011 (0.963)	-- --	-- --	-- --	-0.337 (0.132)
ler_1	0.476 (0.046)	0.494 (0.010)	0.450 (0.015)	0.480 (0.005)	-- --
ler_2	-0.413 (0.082)	-0.407 (0.046)	-0.371 (0.066)	-0.274 (0.096)	-- --
ecmMGDP3	-- --	-- --	-- --	-- --	-0.608 (0.044)
Restrictions	lmgdp3_1,lab lab_2,len_1 ler	lk,len_2	lk_1 len		
F States	0.039044 [0.9990]	1.0824 [0.3548]	0.46139 [0.6355]		

For the case of MGDP3 of Sri Lanka, model 2 encompasses all the remaining models. So we only estimate model two.

$$\log(MGDP3) = \alpha_1 \ln(L) + \alpha_2 \ln(K) + \alpha_3 \ln(ER) + \alpha_4 \ln(EN) + \varepsilon$$

The same procedure is followed to evaluate the determinants of MGDP3 of Sri Lanka. The determinants MGDP3 itself by the last years value, previous years value of labor and capital, last two years value of renewable energy resources.

Comparison of GDPs of Sri Lanka

Table 21: Comparisons of GDPs of Sri Lanka

	GDP	**MGDP1**	**MGDP2**	**MGDP3**
	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob	Coefficient t-prob
gdp_1	0.679 (0.000)	1.173 (0.000)	-- --	-- --
gdp_2	0.510 (0.001)	-0.385 (0.016)	0.461 (0.000)	0.465 (0.001)
Constant	-- --	0.395 (0.052)	0.707 (0.148)	-4.463 (0.045)
lab_1	-- --	-- --	-- --	2.145 (0.017)
lk	0.491 (0.000)	0.431 (0.000)	-- --	-- --
lk_1	-0.336 (0.000)	-0.579 (0.000)	-- --	-- --
lk_2	-- --	0.287 (0.003)	0.519 (0.000)	0.639 (0.000)
len	-- --	0.137 (0.003)	-- --	-- --
len_2	0.296 (0.000)	-- --	-- --	-- --
inf	-- --	0.003 (0.000)	-- --	-- --
ler	0.089 (0.049)	0.075 (0.050)	-- --	-- --
ler_1	-- --	-- --	0.457 (0.002)	0.480 (0.005)

ler_2	-- --	-- --	-0.328 (0.027)	-0.274 (0.096)
inv	-- --	-0.012 (0.022)	-- --	-- --

We have estimated coefficients for every type of GDP for three countries. There seems to be differences in the determinants of GDPs. These differences with in the country as well as at cross country level. Here in the case of Sri Lanka, the determinants of GDP are GDP in its first lag, labor in its second lag, current level of capital as well as last year's capital, electric power consumption in its second lag and current level of renewable energy resources. The determinants for MGDP1 are MGDP1 in its first and second lag, capital with its two previous lags. Electric power consumption of the current year, inflation of the current year, renewable energy resources and investment of the current year. The determinants of MGDP2 are, last year's value of itself MGDP2, second lag of capital, last two years value of renewable energy resources. The determinants MGDP3 itself by the last years value, previous years value of labor and capital, last two years value of renewable energy resources. We can see that in case of Sri Lanka, no any two types of gdps resembles with respect to determinants un like Pakistan and India in which the determinants of GDP and MGDP1 are the same.

Chapter 6

6 Conclusion and Policy Recommendations

Gross Domestic Product is a market phenomenon that excludes non-market economy activities. The results of the study clarifies that there come large differences in the determining factors if we include neglected aspects in the GDP. Like the services provided by family members in his household, especially the depletion of women, foreign debt and external resources. Therefore, we can say that GDP underestimates or may be over estimates the actual level of economic activity and adjusting GDP is very important to the current economic status. In light of our study we can say that by the use of traditional GDP, the true picture of the economy cannot be represented. We have included important missing factors in GDP. For example if we talk about Women's work. Women account for about half of human resources and the role of women is an important determinant of society. Home-based women provide various family services, but their jobs are not recognized and valued in the national income account because of non-market activities. We classify women into two groups, either on the job market or unemployed, i.e., women working at home, and then calculate the proportion of unemployed women of working-age female population, the ratio of domestic production to HP's relative to gross domestic product . In addition, we assume that the value of services provided by women at home equals the value of male counterpart services offered in the marketplace. Therefore, the per capita value added by men in households is an approximation of the value of services provided by women at home.

In all four categories, HP's percentage relative to GDP ranges from 25% to 40%. Moreover natural resource depletion is also an important factor. Our study gives different determinants both in MGDP2 and MGDP3 cases which incorporates resource depletion and debt stock.

In the light of the above study, we can conclude that

- Different definitions of GDP lead to the entirely different models.
- It has been shown that MGDPs can better capture the economic activity.
- Therefor if the objective of the growth model is to improve welfare, the models with modified GDP serve better.
- This implies that literature on growth models requires serious re-thinking.

So it would be recommended that Home Production, Debt stock and Natural Resources Depletion should be taken into account while calculating the GDP. It would represent clearer picture of the growth of the economy and give the better understanding of the growth of the economy.

Home Production forms a big proportion of Gross Domestic Product and it should not be neglected in National Income Accounts

In National Income Accounts Debt stock and Resource Depletion should be included so that penalty could be applied for leaving a burden for future generations.

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