REGIONAL MACROECONOMETRIC TRADE MODEL FOR PAKISTAN

By

Sahar Arshad

Registration number: PIDE2015FMPHILETS05

MPhil Econometrics

A Dissertation Submitted to the Pakistan Institute of Development Economics, Islamabad, in partial fulfillment of the requirements of the Degree of Master of Philosophy in Econometrics

Supervisor

Dr. Ahsan ul Haq Satti

Co-Supervisor

Dr Mahmood Khalid

Department of Econometrics and Statistics

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CERTIFICATE

This is to certify that this thesis entitled: **"Regional Macroeconometric Trade Model for Pakistan"** submitted by Ms. Sahar Arshad is accepted in its present form by the Department of Econometrics and Statistics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in **Master of Philosophy in Econometrics**.

Supervisor:

Dr. Ahsan ul Haq
Assistant Professor
PIDE, Islamabad

Co-Supervisor:

Dr. Mahmood Khalid
Senior Research Economist
PIDE, Islamabad

External Examiner:

Dr. Abdul Rashid
Associate Professor (IIIE)
International Islamic University
Islamabad

Head,
Department of Econometrics and Statistics:

Dr. Amena Urooj

Disclaimer

This document represents part of the author's MPhil study program at Pakistan Institute of Development Economics. The views stated therein are those of the author and the work has been completed in a scheduled time.

Table of Contents

Dedication

Dedicated to my beloved Mother, Samina Arshad

My Pillar, My Strength & My Entire World.

Acknowledgements

First and foremost, I would thank **ALLAH** Almighty and his countless blessings that allowed me to complete this thesis.

I am very grateful to my supervisor and co supervisor, **Dr. Ahsan ul Haq Satti** and **Dr Mahmood Khalid**, for their kind supervision and continuous support. Their knowledge, deep insight and rational way of judgment paved way for this thesis. I am extremely thankful to their encouraging guidance, keen attention to details, precious assistance through beneficial remarks and suggestions during the research works, which contributed to the completion of this study.

Next, I would like to thank my **mother** from the bottom of my heart for her selfless love, prayers and for her endless guidance and support both morally and financially towards the completion of this.

Lastly, I am forever grateful to my friends **Iqra, Muneeza** and **Furwa.** Their support and patience became my strength and their insight had a huge impact on this study. I will forever cherish this friendship.

Thank you all so much.

Sahar Arshad

Abstract:

Here we estimated the regional Macro econometric trading model for Pakistan. Where we defined the region by taking the countries as Pakistan, India, Sri Lanka and Bangladesh. And we took China as the major trading partner. We wanted to estimate the model and see if regional variables are actually playing a role and should they be seen while making policies. For such purpose, we took number of variables in which some were made into regional by taking their weights accordingly and the rest were taken corresponding to them. We took these variables to create Product function, Investment function, consumption function, export function, import function and price function which formed our production, aggregate demand, trade and aggregate supply block respectively. We will use GMM for estimating the model and since we have number of equations will use system GMM. Since we have time series data, we tested the time series properties through ADF for the variables and saw that there were different order of integration, hence we proceeded to see the short and the long term relationships by applying ARDL and ECM within system GMM. We took the data from 1971-2015. From the results we got it could be seen that in most cases regional variables are affected by the regional variables. But till that date China, as a singular country did not affect regional variables, although gets affected by them. So, it could be deduced that policy makers do need to consider how regional variables act and how their policy makers make policy and create policies accordingly.

This study added to the existing literature by acting as a model for this region on which work has not been done. Its imperative however to see this region, especially with emergence of CPEC, and this model could pave way for further future researchers to further check the relationships with more updated data. This model could also be used for forecasting and to check the shocks. The result showed that regional GDP has an autoregressive behavior i.e. gets impacted by its lag and by regional gross capital formation and vice versa. Consumption also has an autoregressive behavior and gets impacted by regional CPI and National disposable income. Regional CPI and GDP affect imports. Regional prices get affected by

regional nominal exchange rate and also by Pakistan's prices. Thus, these conclusions could be used as to create feasible policies for our country, like inviting more FDI, which has been done in a way by CPEC and is an immensely right step in the progressive direction.

List of Abbreviations:

FDI: Foreign direct investment

WTO: World trade organization

EU: European union

NAFTA: North American free trade agreement

Pak: Pakistan

USA: United States of America

CPEC: China-Pakistan economic corridor

GMM: Generalized method of moments

CGE: Computable general equilibrium

ARDL: Autoregressive distributed lag model

ECM: Error correction model

GNP: Gross national product

GDP: Gross domestic product

CPI: consumer price index

NDI: National disposable income

WDI: World development indicators

IMF: international monetary fund

ADF: Augmented Dickey Fuller

List of Tables:

CHAPTER: 1

Introduction:

1.1 Overview:

This chapter contains the introduction. It is further subdivided into the following: trade and its importance, Pakistan and trade, Regional trading model, Literature gap and objective of study, outline of the study. It tells about the importance of trade in the world and Pakistan's different trade agreements. There is explanation on what is regional trading model. It is followed by the gaps in the literature and objective of the study and finally we explain the outline of the entire study.

1.2 Trade and its Importance:

Trade is basically the action of buying and selling of goods. Humans are limited in their capability of production and so are the countries. Thus they need to rely on each other to fulfill their demands. In the beginning, barter trade system was used and then with the evolution came the usage of money. It has been seen the countries that have trade openness perform fairly well e.g. South Korea in contrast to North Korea as Noland(2011) did a thorough comparison of Korea's performance as a whole in the past and gave policy implications for future as well.. Trade helps the developing countries in a lot of ways e.g. Increases choices and competition, reduces poverty, strengthen ties, enhances employment opportunities etc. Kastelle and Liesch(2014) emphasized on how trade is important for economic development by taking the case study of Australia. Belloumi(2014) also saw the impact of trade openness on foreign direct investment and growth of the economy for the case study of Tunisia.

There are two types of trade agreements that are international:

1. Multilateral (or Regional) Agreements

They are the rules that pave way for trade between many countries. The international trade unions are based on these agreements, like WTO etc. For example, the WTO is overseen by the General Agreement on Trade and Tariffs. Similarly the European Union is observed by several treaties like the Rome treaty, etc.

2. Bilateral Agreements

Rules are set between two countries for trade. For example, there are Canada-Peru, EU-South Africa, and many other agreements for free trade.

These agreements might be for certain kind of services and goods or maybe for a certain kind of barrier on entry level in the market. Agreements of different kinds outline the level of integration on international level from the free trade to unions like the custom union and economic union.

1.3 Pakistan and Trade:

Pakistan faced problems in trying to stabilize itself after getting independence in 1947.Pakistan being a very resourceful country relied and still does rely on its agriculture sector more than its industrial sector. During the 60's Pakistan had amazing economic growth with industrialization happening and South Korea adapted the five year plan of Pakistan. There was trade openness and Pakistan had an amazing growth rate but it declined after the war of 71 where Bangladesh got separated and there was a period of recession. After that with changing governments, the policies kept changing like came nationalization, which was followed by privatization and liberalization. But the ongoing political changes did impact the growth of Pakistan and not in a positive way and hence also the trade. The industrialization that was booming in the 60's slowed down a lot and again Pakistan's major export became agriculture goods. During the 70's there was a surplus of imports rather than exports. Mustafa et al.(2016) looked at how trade barriers effected the trade between Pakistan and China. Pakistan has different trade agreements as well like Pakistan-Afghanistan transit trade agreement, Agreement on South Asian free trade which involves India, Bangladesh and Sri Lanka among many other countries. Then there is Pak-Malaysia trade agreements, Pak-China

trade agreements, Pak-Sri Lanka free trade agreement, Pak-Iran preferential trade agreement, Pak-Mauritius trade agreement, and Pak- Indonesia preferential trade agreement.

1.4 Regional trading model:

We now live in a global village where everyone is connected to everyone. Countries are also connected to each other with their open economies and free trades. So there is a web connection. Now with all these trade agreements and connections, one would think that, could it be that the shift or shock in one country could affect the other country. With the emergence of regional trade agreements, this question is not just limited to countries but has rather become a regional phenomena that change in regions could effect a country and vice versa or not.

Different macro econometric models were made. E.g. Regional trading models were also made like for Central America and Dominican republic Iraheta and Carlos (2007) which would be used as my reference article to create my regional macro econometric trade model.Hanif et al.(2011) gave a small macroeconometric model for Pakistan economy using OLS method. So work was done in this particular area keeping in mind the need to for a regional trading model. This kind of model is important so that it could be known that if the shifts in other economies is really something to be looked upon. With CPEC in Pakistan, China has become of even more importance to us and hence it needs to be seen if it really affects us. But why stop at only us, why not the entire region, since we all are connected through trade. Regional trade models are important because since we all are connected, so its important to see whether the shock in a country impact a country and a region. Hence, in such a way countries can create policies to prevent from going into a downfall. There have been enough huge economic catastrophes in the past like the great depression and the recent recession, to say that it is imperative for countries to know that whether its just their shocks or the surrounding shocks too that can effect them and this is where the regional trade model steps in. Like China undermines its currency which in turn increases its exports since it's cheaper and that impacts the exports of the other countries, since countries prefer to do trade

with it rather than the others. Hence, we can see that policy of one country has a ripple effect on the rest of the countries and thus to see such that if this prevails and for which variables does it hold, there is a need for regional trade model.

1.5 Literature gap and Objective of study:

Our literature review has been divided into two parts i.e. one where we reviewed the articles with the same methodology (i.e. using GMM or usage of same variables in the functions) like Khan and Din(2011) gave a macro econometric model for Pakistan and the other where we reviewed the articles with the same issues(i.e. creation of regional trade model or discussion of trading models, regional agreements and models etc). Naranpanawa and Arora(2014) saw the effect between regional disparity due to trade liberalization by taking CGE model for India. Even though a lot of work has been done in estimating macro econometric model for Pakistan and for other countries along with regional trade models, but there has not been work for estimating a regional macro econometric trade model for the region on which we are working on which is Pakistan, India, China, Bangladesh and Sri Lanka. Hence this is the gap that we will try to breach through our work where we will give a regional macro econometric trade model for the particular region in Asia. Since we want to estimate a regional trade model, hence we use countries like Bangladesh, India, Sri Lanka and China, as they fall within the region of Pakistan and China would be the major trading partner due to its impact.

We wanted to estimate a regional macro econometric trade model. The region will be made by taking the following countries: Pakistan, India, Sri Lanka and Bangladesh. China will also be taken but as the major trading partner. China will be taken as one of the major trading partner since it's the largest trader in the region along with being a country whose economy is considered to have an impact on the surrounding and also due to CPEC, its importance in the region has increased and with Pakistan it has always had huge importance due to political and trading ties and also due to China's involvement within Pakistan. The other countries i.e. Pakistan, India, Sri Lanka and Bangladesh were taken since we wanted to estimate the macro econometric model for this region and also wanted to take countries with

whom Pakistan had trading ties with, They all are connected to each other through trade and trade agreements. There are a lot of regional trade model but we wanted to estimate a regional macroeconometric trade model for this particular region. Therefore our objective is to create a regional trade model for this particular region. This model then can be used by others for checking the shocks or seeing how the regions get effected by changes in the region or country. This model can also be used for forecasting. We will use GMM and since there are number of equations, we will use system GMM. So, we will collect the time series data and will check their time series properties. Due to different order of integration we will use ARDL and ECM within the system GMM. This model can then be used for forecasting and to check the shocks as well.

1.6 Outline of the study:

The study starts with introduction to the topic and the objective of the study. The 2nd chapter contains the literature review where we see the literature related to the same issue and the literature related to the same methodology. Then 3rd chapter contains the theoretical framework. The 4th chapter has the data and the methodology. The next chapter will contain the estimations and result followed by the chapter based on conclusion.

CHAPTER: 2

Literature review:

2.1 Overview:

This particular chapter is the literature review, which basically contains articles related to our topic. The literature reviews has been subdivided into two categories on the basis of methodology and issues. It contains articles using different countries and regions, to find regional trading model employing different techniques. It contains variety, which explains the construction, different hypothesis and results, different data for different countries and regions and similarly different methods.

2.2 Literature review of the articles with the same methodology:

Crow (1973) saw the larger open region's annual macro econometric model i.e. the northeast corridor of the United States. It was created within the income and product account. The structure of accounting was triple entry having gross domestic product from almost 10 industrial sectors of the economy including communication sector and many more. Also it had equation for employment, annual wage rate. The model was working with macro econometric models on national level and was used with Wharton forecasting model based on quarters to predict the effect of the expenditures on the army on the corridor. The link between national and regional activity was unidirectional that national can find and impact the activity on regional level but not other way round as per said by Klein. Also he saw the impact of different federal spending policies along with predicting revenues available to the government. This was also useful for private decision makers. The data was taken from 1949 to 1963 for north, central and southern regions and equation with endogeneity were determined by using method of two stage least square (TSLS). Simulations were then taken from 1952 to 1965 to tell what the model could have predicted if pre conditions and the

exogenous variables of the future were known. It became transparent that a person could not complete a macroeconomic model of large size but despite that for open regions, this model had a lot to offer as a tool to help and for research and shortcomings could be eradicated.

Sargent (1976) gave a definition based on statistics of the natural rate of unemployment. Hence, model satisfying the definition was put forth. The model had classical implications of policy pointing to a number of propositions of neutrality. He wanted to see how the data would reject a model having severe classical hypothesis. It estimated a linear classical macro econometric model of a smaller size for the after war US. He wanted to know the confidence level at which the data would reject them. He tested a version of classical model which, placed strict confinements on the arbitrary behavior of unemployment, interest rate and output. It pointed to that these 3 were exogenous. So government manipulation of fiscal and monetary would have no effect on them. The restrictions of this were; the radical version of unemployment's natural rate hypothesis, the expectations theory of the of interest rate's term structure and the notion that public expectations are reasonable. So he tested macroeconomic model with classical assumptions even though had Keynesian properties. Evidence to reject the model came but it was too little. The damaging was the wage, unemployment and interest rate in the longer term. Little proof came to reject the hypothesis that the monetary and fiscal policy given by the government does not cause joblessness or interest rate. It implied that the government does need to worry about feedback. To believe that rules containing comments are superior to those without a response, a model needed to outperform this model. Till this paper such did not exist.

Cooley and Leroy (1985) saw that the spurious nature of the limitations used to determine the macro econometric models led the researchers to come to an approach, which was less reliant on the former theoretical limitations that were important to the cowls commission. This development was called atheoretical macro econometrics, which was represented here

and also contrasted to the updated Cowles commission approach. It was deduced that though some exercised of this model were valid but those which called the most attention like exogeneity analysis, impulse response testing and analysis of policy using estimated vector autoregressive are based on wrong analysis. In this they started off with the introduction of a lot of time series methods consisting of description of vector autoregressions (VARs) that was non- technical. Then the Vras and their applications were explained. Then Cowles commission got reviewed including interpretations of deep and shallow parameters with exogeneity and endogeneity. Then causality and exogeneity of the atheoretical model was contrasted with the term causality of the older models. And it was seen that causality tested by Sims and granger was not the same as the Cowles. Then it was seen that many interpretations of the atheoretical model were not the same as thought of before. It was also seen that correlation does not cause causation. And if models structural then they require justification from theory. Thus conclusions were usually without support.

Taylor (1993) focused on that could a plan to reduce government budget deficit simulate an economy and if so, then what should be the deduction speed? All these questions involved the expectations and contingency rules for policy a

Pesaran and Smith (2006) further enhanced the global modeling approach introduced in the earlier paper above. Where specified models of countries in the form of VARX* were estimated by linking the domestic variable x_{it} to their international counterparts $x_{it}*$ and then summed to create global VAR(GVAR). Its depicted that VARX* model can be obtained and so the answer to dynamic stochastic general equilibrium (DSGE) in which over identification of long run theoretical relations can be analysed and applied. Hence this gave a very clear long-term structure. In the same way, the over identifying short run restrictions can be tested. They started with DSGE model and it could be seen solution has the VARX* structure. Then issues with using such a model in global context was seen and then this was

put together with GVAR and new results obtained using DdPS GVAR. The VARX* system permitted influences of global level on core domestic variables. It was also seen that shocks to equity prices, financial variables and interest rates, transmit much more swiftly than shocks to the real variables. International linkages were important but international financial linkages were more important which mostly global models do not provide. Further GVAR modeling had a neighboring integration of trade models for many countries and GVAR framework, checking the short and long run restrictions, estimation of equilibrium values, in depth analysis of business cycle and Predicting and used in risk analysis and asset management.

Iraheta and Carlos(2007) studied the regions of Central America and Dominican Republic and gave a regional macro model. He took the data from 1960-2006 .The approach adapted was Keynesian, thus it was demand oriented. He firstly checked the time series properties for them followed by applying Johansen and then applied ECM. After that made simultaneous equations and solved them to find a model which was used further for forecasting and also to analyze the shocks. It was seen that the inflation in these regions declined in 2007 but picked up again in 2008.

Kai and Despontin described the dynamically describe, analyzed and programmed the regional macro economic structurally developing an integrated multi functional regional macroeconomic model system. Model made integrated model that consists of three sub models that included the dynamic simulation model, the optimal investment structure model and the optimal sub regional allocation model. Simulation model had both the roles of description and programming. The descriptive side served the purpose of programming while the other was about planning. The other two models were used for assisting. It also used input-output, econometric optimal planning and multi criteria analysis. This paper used the Shanxi province of china as case study. The data was taken from 1977-1987. The core points for modeling were that region is open, there was link between provincial and central

government, regional employment and wages not influenced, regional macro economy disintegrated in 10 parts and input output coefficients constant. So it was seen If regional investment of favoring heavy industry is controlled by fixed investment, then more better for changing old ways into rational state. It was seen that future should be mainly focused on Shanxi coal, agriculture, textile, electricity and transportation. Also future investments should be done in sub regional levels where good geographical and economic conditions.

Benedictow (2008) created a macro econometric model of American economy of small size, which was made to work with a model called FRISBEE based on oil market of international level. The aim was to facilitate the communication between the oil market and the surrounding macro environment for predicting as well as historical comparison. US model was documented and throughout the simulations the oil prices were placed at the level of 12.7 barrel for 1988. A model was constructed with nine estimated equations enveloping huge national account variables, labour market, prices, and a number of identities. FRISBEE is a recursive partial dynamic equilibrium model of oil market on global level. World was separated into thirteen region. Implied prices of oil equal total demand and supply in all regions. Annual data taken starting from 1973 for G7 countries and eviews used. The modeling strategy used was general to specific. It was seen that oil prices has significant effect on the model i.e. when oil prices were increased by 10% it led to more inflation, less consumption of households, GDP and more joblessness.

Kasimati and Dwason (2008) examined the impact of Olympic games 2004 Athens on the Greek economy. Using an aggregate macro econometric model, one could easily see that such an event can boost the economy outweighing the preparation cost. Though the short term effects are quite strong, however the long term effects are quite modest. In before cases input-output I-O modeling was used as well as CGE i.e. computable general equilibrium but I-O uses strict restrictions leading to higher cost than estimated by CGE. Whereas CGE due

to over optimistic nature over estimated the financial gain and hence the choice for macro econometric model made. The model consisted of nine behavorial equations and three identity relations and annual time series data from 1958-2005 was used. Stationarity checked through ADF augmented dickey fuller and PP Phillip Peron test and Johansen co integration carried out. It was concluded that the games had favorable impact on the Greek economy and for the years from 1997 to 2005, the games led to an increase by 1.3% per year in the GDP and decreased the state of unemployment. But, these were the effects in the short term, however the effects in the longer time period were quite timid and not so much. But many other studies have shown contrasting result of the games on other economies. But more ex post economic assessment of major sporting events need to be made.

Rahman and Khatoon (2011) estimated a macroeconometric model for Bangladesh economy using annual time series data from 1980-2006 with seven blocks. Short run ECM was used and Hendry's approach of general to specific was followed. Minimal dummies used and even though sample small, still robust model. It was seen that it was good for forecasting and policy simulation.

Khan and Din (2011) estimated a macroeconometric model for Pakistan and used Engle Granger for short run and long run relationship. They used the data from 1972-2009. It was seen that increasing trend seen in the variables for the period 2009-2013.

2.3 Literature review of the articles with the same issues:

Nugent (1975) used the macroeconometric model for policy planning. He created small models for five countries of Central America and estimated them separately and then finally combined them and applied linear programming to them. And it was seen that policy coordination between Central American countries benefit upto 7% of the GNP.

Sapir (2001) used equation of standard gravity to check the assumption of domino effects in western part of the Europe. The basic question handled here is if the integration with the EC has affected the non-members in a negative way and in turn instigated them to apply for its membership. Regionalism has always attracted many economist like Viner(1950) and Bhagwati (1993). As seen by Leamer and Levinsohn (1995), the effect on trade by EEC was one of the roots of problems, which were tackled first by the gravity model. This line of investigation originated with Aitken (1973). McCallum(1995) included national border importance in regional trade partners. In this used equation of standard gravity to check the hypothesis of domino effects in western part of the Europe. The model used related trade flows that were bilateral to distance, income, and dummy variables in the gravity model. The model estimated here was annual for the period of 1960-1992. However the composition of PTA keeps changing and for that solution adapted was using 5 original i.e. EC-5 trading members of the EC. The basic result of this particular study conformed with the investigation by Baldwin et al. (1995), But, it contrasted sharply with the results of Bayoumi and Eichengreen (1998). The outcome of this study supported the hypothesis that domino effects had played an important role in Europe. This setback however affected each of the EFTA countries in a different way. EC enlarged and free trade setup. Beginning in 1989, EFTA's exports to both area partners and to EC countries became a lot less to within EC flows. The story could not have ended with addition of countries like Austria and more to EC in 1995. Domino effects would continue to shape the integration of EC and witness the growth in the memberships through the continuous applications by the eastern part of the Europe.

Czuriga (2009) did study on Portugal and came to see that structural development did not happen in the same manner and it did not lead to growth, as it did not reach all areas equally but rather to the better off places. The regions within Portugal did not converge since they did not receive equal support and rather the reason for its downfall was the structural support funds.

Georges et al.(2013) estimated the positive outcomes for the older growing North countries by diversifying some of their trade for other Southern countries. For this, they used a six-region overlapping generations model that took into account the demographic patterns and trade patterns of 21st century. Shirotori and Molina (2009) also reported that for in between 1995-2005, trade between South–South showed an increased rate of growth than international trade. The objective here was to check the positive outcome for the North countries by branching out some of its trade for south countries while considering the population ageing in North. The model economy was adapted from Mérette and Georges (2010), and was made up of six regions: North-America has been the aggregation of the US and Canada. Europe has been accumulated into 1 region which is (EU-15). Asia has been divided into 3 countries such as Japan, as it represented a country in the developed category at the promoted level of ageing in population, and China and India for they form the prospering countries with different aspects of demography. All other countries form the rest of the world i.e. ROW so to close the model. Here, they firstly created the case that, given the quite unbalanced ageing among population between different regions of the world, trade policy could play a role as the forthcoming trends in demography may change the terms of trade in a big way. Secondly, by enhancing the six-region overlapping generation computable general equilibrium model, they depicted that different diversification in trade schemes do create an impact to which the ageing in population has an effect on welfare for the Northern parts. Especially, they concluded that under the light of a population that is ageing, there would be benefit for North by diversifying its trade with the South. And also if north could have a positive impact from north and south diversification then likewise, south can benefit from the south and south diversification.

Belloumi, (2014) saw that relationship between foreign direct investment, openness in trade and growth in economy among hosting countries stayed as the highlighting issue in the literature and was met with revised enthusiasm in current years mainly due countries facing

unemployment and lack of progress in technology. He examined this problem for Tunisia for the years 1970-2008 by using the bounds testing (ARDL) approach to cointegration. The tests suggested that the variables of interest were bound when dependent variable was the FDI in the long term. The significance of error term also pointed to the actuality of a longer relationship. It also indicated that there was no Granger causality that was significant from FDI to growth in economy, from growth in economy to FDI, from trade to growth in economy and vice versa in the shorter term. Although there was a common belief that FDI could create positive externality spillover for the hosting country, however his empirical findings failed to conform with this belief for Tunisia. They went against the widely accepted idea keeping in mind that there is positive impact on the growth of economy through FDI. The findings for Tunisia can be made general and can be compared to other countries that are developing, which also share the same ground in attracting investments from abroad and liberalization in trade.

Allen et al.(2014) carried a study of volatility spillover effects from Australia's main trading partners, which were, Japan, US, China and the Korea, from 12th September 2002 till 9th September 2012. This caught the effect of the Global Financial Crisis (GFC). They applied the Diebold and Yilmaz (2009) Spillover Index, created in a VAR framework, to check spillovers in returns across the said markets and in their volatilities. The inspection confirmed that the Hong Kong and US markets had the biggest influence on the Australian once. They moved to a GARCH framework to further analyse and used a trivariate Cholesky GARCH model to analyze the impacts from the Chinese and US market, as represented by the Hang Seng Index. Gorton (2010) gave a suggestion that the GFC was not actually different from the former crises except that, before 2007,investors did not know the involved markets. Diebold and Yilmaz (2009) based their calculation of volatility spillover and returns on vector autoregressive (VAR) models, under the light of Engle et al. (1990). They focused on how the GFC affected volatility spillovers across the world to the market of equity in

Australia. Their focus was on the impact of the Chinese market in the analyses. They used a time series Vector Autoregressive (VAR) framework. The data was from 1/1/2004 till 30/6/2014. Allen and Powell (2012) gave combined evidence of the increase in risks of the banks in Australia during the GFC period. Allen and Faff(2012), surveyed some aspects of the general impact of the GFC on Australian markets.

Huang and Chen (2014) saw that with globalization and integration in regions, regional markets erupted with a common ground fro currency, through which investors could trade freely among markets. Studies showed movement of commodity prices or correlation in returns and that too globally. They used nonlinear dynamic model. Created on the classical market-maker framework of Day and Huang (1990), a HAM model for two markets was created, which stood true to all the assumptions. They also were successful in showing that the smaller markets did not actually benefit from such opening in markets.

Naranpanawa and Arora (2014) saw that in previous years, there had been an icreasing interest among researchers in comprehending the link between liberalization in trade and regional disparities among countries. So they created the single-country multiregional Computable General Equilibrium (CGE) model, to check this link in India. And results indicated betterment among the rich states but worsening in the poor regions. Regional disparities increased after the reforms in India and the convergence or vice versa had been the focus of study for many. Bhattacharya and Sakthivel (2004) made some common state income series. They came to conclusion that disparities among regions increased from 90s . The CGE model comprised of 17 regions and for this the global trade and analysis project (GTAP) version seven database (2004) was used as main for the CGE model. Overall results showed that liberalization in trade would have good impact on already growing and rich states but the poorer states would suffer from a negative impact.

Arias and Rosas (2016) saw that the study of productivity of the Mexican Northern Border offered an interesting case study for the objective. Since it combined both mobile growth

factors due to regional reallocation of economic activity and factors that were considered immobile in literature like education, infrastructure were localized in central Mexico. So here its shown that the add up of immobile factors and the efficiency in its advantages had been determining the economic growth. So here conducted the study of the effects of trade integration with the United States on productivity growth in Mexican manufacturing across states after 20 years within the framework provided by the new growth empirics and economic geography. In this perspective, economic analysis has shown that the relationship between productivity growth and trade liberalization is mediated by conditional factors. Relevant researches by Sachs and Warner (1995), Rodrıguez and Rodrik (2000) and Wacziarg and Welch (2003). Study on this done by Romer (1986, 1990), Grossman and Helpman (1991), and Young (1991). de León (2003) said that manufacturing spatially close to the United States did not show a better performance in economic growth. The data of Mexico had been taken from 1970-2014. They used Ols equations and ran test on them. They found evidence for explaining the change in productivity performance as related to the recent accumulation of endogenous growth factor in Northern Border states. However, they also found the Northern Border states are still less efficient than other regions in embodying these factors into sustainable economic growth. Some possible explanations for this fact may be related to absence of economic activities. They also believed that the approach developed in this article presented potential to be extended in several ways, such as, using data on total factor productivity, control for spatial integration with the U.S. Southern Border states, and the role of institutions as suggested in the recent literature on economic growth.

2.4 Summary:

So, in above our literature review has been divided into two parts i.e. one where we reviewed the articles with the same methodology and the other where we reviewed the articles with the same issues. In articles with the same methodology, there were articles that had estimation of the macro econometric model using different techniques. This gave us an insight of which techniques to be used and the variables that could be used in our estimation, while also

providing us with a guideline of how to proceed with our methodology. The other part contained a few regional trade models, which helped us to see exactly how they approached the topic and how they analyzed the shocks along with the kinds of variables used to estimate and the techniques, thus equipping us better to handle our topic. Even though a lot of work has been done in estimating macro econometric model for Pakistan and for other countries along with regional trade models, but there has not been work for estimating a regional macro econometric trade model for the region on which we are working on which is Pakistan, India, China, Bangladesh and Sri Lanka. Hence this is the gap that we will try to breach through our work where we will give a regional macro econometric trade model for the particular region in Asia. Which could further be used to analyze the shock as well as used for prediction. All the study above has helped us in a way to identify what is needed in estimating our regional macro econometric trade model i.e. the a variables needed and the techniques needed and how to approach the topic. The above have also given insight on how the shocks impact the regions or countries and used various techniques to estimate the model and analyze the shock which has helped us in finding the technique for estimating our model along with the variables needed to be used in the model along with the construction of the functions.

CHAPTER: 3

Theoretical Framework

3.1 Overview:

This chapter contains the theoretical framework, on which our entire work is going to be based.

Keeping in mind that we are going to work with the regional model we have taken the regional variables of Pakistan, Bangladesh, Sri Lanka and India while have taken China as the major country with whom trade is being done. The underlying reason for why we have taken China as the major country is that we as A Pakistani nation have a very close knit relationship with China especially ever since the corridor with China has opened and even before that, our trades with china and their incorporation in our country has always been a very focal point. Be it the projects with them for the ports or the routes or trade or their support in us as a friend and nation. Since the start of CPEC that bond has become even more stringer and the need to see and study china has become even more pressing. E.g. that how their policies or any shocks that they have will effect us, e.g. them undermining their exchange rate for export enhancements effect on Pakistan. The countries being used by us are: China, Pakistan, India, Bangladesh and Sri Lanka. We are going to construct a regional trading model for them by using the article of Iraheta and Carlos(2007). The equations (behavioral equations) that we are going to use are as following:

Production block:

$$Y_t = f(y_t^*, RF_t, I_t)$$

where

Y_t is regional GDP

y_t^* is GDP of china

RF_t is the regional broad money

I_t is the regional gross fixed capital formation

In economics, basically a production function relates the physical output of a to factors of production. Production function basically tells that how total real gross domestic product (real GDP) depends on available inputs in an economy. Since we are calculating the regional model hence we will be needing the regional variables to diagnose the impacts. Here in this function regional GDP has been taken as the dependent GDP for Pakistan, India, Bangladesh and Sri Lanka and since our main trading country is China, so we want to see how the change in China GDP effects the regional GDP or does it even effect or not? Then broad money in any form including bank or other deposits as well as notes and coins. So we are using the broad money as well to see the impact on regional GDP and then we have the gross fixed capital formation, which includes spending on improvements of land (ditches, fences, and so on); machinery, plant, and equipment purchases; road construction, private residential dwellings, railways and buildings. Fixed asset disposal is taken from the total. Emphasis is being lay on capital formation as the major determinant of economic growth. Capital formation is important for achieving long term, short term economic growth, rapid or persistent growth. Its availability for growth and development depends on investment spending which in turn affected by the level of savings in the economy. We are using regional gross capital formation since we are doing regional modeling. The product function was created using the mentioned variables since they all have an economic significance to the production and can in turn verify whether there is relationship or not and of what kind.

China plays an imperative role as our trading partner, hence its taken as the major player to be observed. We are basically making regional GDP as the dependent variable on GDP of china as we want to see that if there is any change in the GDP of china, then will it effect inadvertently the regional GDP and hence Pakistan too and this is very important in order to figure out the relationship between the economies. Its commonly thought that increase in one GDP and especially like that of china who is playing such an important role in building our

infrastructure will have positive effect on our GDP too. Then we took broad money which we have taken as regional broad money and we basically know that increase in money supply has positive effect on GDP and thus taking that as the underlying factor we have incorporated this variable in this function as well and lastly regional capital formation, which means that increase in investments and infrastructure does mean positivity for GDP and hence that too taken as the variable in this function. So going through these basic notions, we created the production function.

Aggregate Demand (block):

The investment function:

$$I_t = f(y_t, i_t, RISK, RF_t)$$

where

I_t is the regional gross fixed capital formation

y_t is regional GDP

i_t is the interest rate

$RISK$ is risk due to price changes

RF_t is the regional broad money

When we talk about investments, it basically implies looking at different aspects and risks to see whether the transaction would be profitable e.g. before investing in stocks, one would see the history of the progress of that company and their upcoming projects and their trend from couple of years. When we talk about investment on a country level then many aspects come into play like the GDP, interest rate, unemployment, inflation, exchange rate and political unrest. To create an investment function, we took regional gross fixed capital formation as the dependent variable which is taken as a function of regional GDP and its commonly believed that they have a positive relation since more GDP means more betterment in the

country and hence more spending capacity for the country and since we are the regional capacity, hence the variable are also taken as regional. Interest rate is also taken since its believed that interest rate has negative relation with gross fixed capital formation as more interest rate means less investment and hence less capital formation. Regional broad money is taken to encompass the aggregate wealth effect and the risk s the oil prices deflated by CPI and its basically thought that if oil prices more then less capital formation and since oil prices has an effect on investment as all the machines and transport are dependent on it, hence it's the part of the function as well.

The consumption function:

$$C_t = f(IND_t, i_t, RISK, RF_t)$$

where

C_t is the consumption

IND_t is the disposable income

i_t is the interest rate

$RISK$ is risk due to price changes

RF_t is the regional broad money

Now moving onto consumption function, we want to see consumption being effected by which variables and on that basis it is known that consumption is effected by disposable income. Here household consumption is dependent on the disposable income and its economically observed that there is positive relation between disposable income and consumption i.e. more the income there is to spend more will be their consumption. Interest rate is commonly thought of to have ambiguous effect due to substitution and wealth effect. But on a common basis one might see that if interest rate more, then consumption would reduce since people wont take loans but also on the other hand if more then people getting

interest on their money saved in banks would get more and hence more consumption. Risk is associated again with oil prices and believed that if oil price more then consumption would be less since prices of things would hike as production cost due to more oil prices would be more. And the broad money is taken to encompass the wealth effect, which was done through regional consumer price index.

Trade Block:

The export function:

$$X_t = f(y_t, TI_t)$$

where

X_t is exports at constant prices

y_t is regional GDP

$TI_t$is term of trade

Moving towards the export function, we have made the export as the dependent variables, which is a function of regional GDP and terms of trade. Its believed that more the GDP, more will be the export and regional GDP will effect the exports. And same is with the term of trade i.e. Terms of trade (TOT) refers to the relative price of exports in terms of imports and is defined as the ratio of export prices to import prices. It can be interpreted as the amount of import goods an economy can purchase per unit of export goods. Also for term of trade it is believed that more term of trade then exports would be more as its believed that it has simulating effect on the producers. Hence the function created.

The import function:

$$M_t = f(Y, TI)$$

where

M_t is the imports at constant price

Y is regional GDP

TI is term of trade

The import function as taken as imports being the function of regional GDP. Again using regional GDP since we are working in the regional framework and by regional GDP we mean the regional demand. So if regional demand is more then imports would also be more. Hence its believed that positive relation between GDP and imports. Term of trade also taken but its taken as the price of imports which if increased would discourage the imports and hence for that the regional CPI is used in the estimations.

Aggregate Supply (block): (by using Phillips curve)

The price function:

$$P_t = f(p_t^*, TCN_t, Y_t^{gap})$$

where

P_t is regional price

p_t^* is the prices of trading partner

TCN_t is region's nominal exchange rate

Y_t^{gap} is output gap

We are using the aggregate supply side by taking the Phillips curve instead of using the factor market. Going towards the price function, we know that we are working in a regional model where the economies are open and thus can be very much effected by each other and which is

also to be seen. Hence regional price is taken as the function of prices of Pakistan i.e. if increase in price, then regional price would also increase. Similarly exchange rates changes also causes ripples like a country constantly underplaying their exchange rate would have more exports and thus price changes or if some in comparison the exchange rate changes, then their would be effect on the prices, and lastly output gap taken i.e. if output gap more, the pressure on demand which would effect the price and most probably more the output gap then more the prices. Hence all these variables effect prices and thus are taken in the price function.

CHAPTER: 4

Data And Methodology:

4.1 Overview:

This chapter is Data and Methodology. Its further subdivided into data description and source, and Econometric methodology. It basically contains list of variables and their explanation along with the methodology and econometric framework.

4.2 Data description and source:

We took the data from World bank, IMF, OECD and data stream for China, India, Pakistan, Sri -Lanka and Bangladesh. We took the data ranging from 1960-2015. But for most we were able to find the data from 1971, hence used the data from 1971-2015 in our estimations.

The variables we used are as follows: regional GDP, GDP of China, regional broad money, interest rate, risk (international oil prices deflated by regional CPI), regional nominal exchange rate, regional CPI, Pakistan CPI, regional gross fixed capital formation, disposable income for China, current transfers for China, Household consumption for China, Exports, Term of trade for China, real interest rate for China, imports for China, nominal exchange rate and regional output gap .

We made the regional variables using Pakistan, India, Sri Lanka and Bangladesh. And China was not taken as the part of the regional variable but rather an independent variable to create a regional trade model. China has special importance especially in case of Pakistan due to it being the major partner and its increasing importance due to CPEC. The other countries, which were taken as a part of the region (India, Bangladesh, Sri Lanka) also are part of the agreements with Pakistan like the South Asian free trade agreement.

REGIONAL GDP:

We first took the GDP deflators from WDI (for Pakistan, India, Sri Lanka and Bangladesh) and made their base years same i.e. for 2010. Then to get real GDP, we divided the GDP with the GDP deflator with same base year(2010).

Real GDP= GDP/GDP deflator

Then we took the weights of the economy by formula: GDP/sum of GDP. And multiplies the GDP by the weights and took the sum to get the regional GDP i.e. sum of Pakistan, Indian, Bangladesh and Sri Lanka.

REGIONAL INFLATION:

To create this, we took the CPI from WDI and made their base years same i.e. for 2010. We already had the GDP with same base year(2010) and thus to make weights we applied the formula: GDP/sum of GDP.

Then we multiplied the GDP weights with the CPI and we took their sum to get regional CPI (for Pakistan, India, Bangladesh and Sri Lanka).

To get regional inflation, we used the formula: ((log current of regional CPI)-(log previous of regional CPI))*100.

REAL EXCHANGE RATE:

We took real exchange rate from WDI for all the countries i.e. Pakistan, China, Sri Lanka, Bangladesh and China.

REGIONAL TERM OF TRADE:

We got the term of trade data from WDI. We then calculated the weights by the formula: GDP/sum of GDP.

And then, to obtain regional term of trade, we multiplied the term of trade data with the weights and took the sum of Pakistan, India, Sri Lanka and Bangladesh and thus got regional term of trade.

NOMINAL AND REAL INTEREST RATE:

We got Real Interest rate data from WDI for all countries. We already had the CPI with same base year.

To get simple inflation, we took: log of current-log of previous*100.

To get nominal interest rate, we used the formula= real interest rate + inflation.

REGIONAL NOMINAL EXCHANGE RATE INDEX:

We already had the real exchange rate from WDI. We had the CPI data as well as the regional CPI.

Then to obtain nominal exchange rate, we used the formula : real exchange rate*(domestic price level/foreign price level).

We then calculated the weights by the formula: GDP/sum of GDP.

And then, we multiplied nominal exchange rate with the weights and we took their aggregate (for Pakistan, India, Sri Lanka, and Bangladesh) to get the regional nominal exchange rate index.

REGIONAL BROAD MONEY:

To make regional broad money (for Pakistan, India, Sri Lanka and Bangladesh), we took the broad money data from WDI. Then we calculated the weights by the formula: GDP/sum of GDP. We multiplied the regional broad money data with the weights and took their aggregate to get regional broad money.

REGIONAL GROSS CAPITAL FORMATION:

To get regional gross capital formation (for Pakistan, India, Sri Lanka and Bangladesh), we took the gross capital formation data from WDI and then we made their base years same i.e. for 2010. We then calculated the weights by the formula: GDP/sum of GDP. After that, we multiplied the gross capital formation data with same base year with the weights and took their aggregate to make regional gross capital formation.

INTERNATIONAL OIL PRICES:

For international oil prices deflated by regional CPI, we took the oil prices data from the WDI. To deflate it, we divided the oil prices data with the regional CPI (for Pakistan, India, Sri Lanka and Bangladesh), and thus we obtained international oil prices deflated by regional CPI.

NATIONAL DISPOSABLE INCOME:

To calculate national disposable income for China, we used the formula: net income +net current transfer +taxes. We got the net income data for China from WDI but we got the current transfers and taxes from data stream.

EXPORTS:

To obtain Exports, we took the data of exports at constant prices from IMF

IMPORTS:

We took the data of imports at constant prices for China from IMF.

OUTPUT GAP:

To get regional output gap, we estimated it from eviews by using quadratic formula on the series of GDP of China and then got the actual, fitted and residual series and from there we got our output gap.

4.3 Econometric methodology

We collected our time series data for different variables and converted those variables into regional variables according to our need. So, now the next step after the creation of regional variables which have been identified above in the variables description was to see unit root testing. This was mandatory so to see the order of integration, which would pave the way for further co integration testing. The unit root testing is done by Augmented dickey fuller test.

In particular, *ut* will be autocorrelated if there was autocorrelation in the dependent variable of the regression (Δyt) which we have not modelled. The solution is to "augment" the test using *p* lags of the dependent variable.

General ADF model: $\Delta Y_t = \alpha_0 + p_1 Y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + u_t$

General ADF model: $\Delta Y_t = \alpha_0 + p_1 Y_{t-1} + \alpha_2 T + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + u_t$

ut is a pure white noise error term and ΔYt-1 =(Yt-1 –Yt-2), ΔYt-1 =(Yt-1 –Yt-2), etc. The number of lagged difference terms to be included is often determined empirically.

In ADF *p=0 is still tested and follow the same asymptotic distribution as DF statistic.* H_0*:* p_1 *=0(p ~ I(1)), against* H_a *:* $p < 0(p \sim I(0))$.

From here, we saw that all of our variables were integrated of order I(0) and I(1). And thus we proceeded to applying ARDL. But we also saw that the same i.e. I(1), hence for those we applied ECM. Due to different level of integration, i.e. our level of integrations were around

I(0) and I(1),thus we used ARDL method and for I(1) we used ECM within system GMM. We will be able to see the long and short run relationships of the variables.

The error correction term stands for I(1). The t-stats of λ will follow the assumption that closer to the normal distribution than the Dickey-Fuller. Since the remaining variables are all I(0), so their distribution are not actually affected by ($\widehat{\varepsilon_{t-1}}-1$) being I(1), hence there is in actuality no harm of spurious results through including the ECM. This has a strong assumption of long run relationship and its good to have an adjustment of long term relationship.

We checked the time series properties through ADF and found the order of integration. So firstly, due to the different order of integrations, we used ARDL and ECM. Secondly, we also faced the problem of endogeneity, for which we used GMM and rather system GMM due to system of equations (Cooley and Ogaki 1996).

Endogeneity is a problem that occurs when an explanatory variable is correlated with an error term. It can arise due to the result of measurement error, autoregressive with autocorrelated errors, simultaneous causality and omitted variable. Two common causes of endogeneity are: an uncontrolled confounder causing both independent and dependent variables of a model, and a loop of causality between independent and dependent variables of a model. Its usually caused by causal process.

Since we have the problem of endogeneity, we need to correct this. And for this we move towards GMM. And since we have number of equations, hence system GMM. In econometrics and statistics, the generalized method of moments (GMM) is a generic method for estimating parameters in statistical models. The Generalized Method of Moments, as the name suggest, can be thought of just as a generalization of the classical MM. A key in the GMM is a set of population moment conditions that are derived from the assumptions of the econometric model. Given data on the observable variables the GMM finds values for the

model parameters such that corresponding sample moment conditions are satisfied as closely as possible. We could only use p number of moments to estimate the parameters but by discarding the $q - p$ (> 0) additional moments, we would loose the information confined in those conditions. The solution for this situation was given in the econometrics literature by *Hansen* [1982] in his famous article and it is called GMM. The motivation behind GMM estimation is that once it is not possible to solve the system of equations given by the sample moment conditions, but we can still have an estimate of θ which brings the sample moments as close to zero as possible.

Let $E\lceil f(x_i, \theta)\rceil$ be a set of q population moments and f_n (θ) the corresponding sample counterparts. Define the criterion function Q_n (θ) as

$$Q_n(\theta) = f_n(\theta)' W_n \square_n(\theta),$$

Where Wn , the weighting matrix, coincides to a positive definite matrix W as n grows larger. Then the GMM estimator of θ_0 is given by

$$\hat{\theta} = \arg\min Q_n(\theta).$$

In actuality the GMM estimator is a way of using the information from our general form of population moment conditions. When the number of moment conditions equals the number of parameters that are unknown i.e. GMM = MM. When $q > p$ then the GMM estimator is the value of θ nearest to solving the sample moment conditions and $Q_n(\theta)$ is the measure of closeness to zero. Usually there are 3 questions that are important:

–Is the model specified in a correct way?

–Does the model contain restrictions that are satisfied?

– Which model is more consistent with the data?

The first question is important. Remember that the population moment conditions were taken from an underlying economic model and all our conclusions are going to be based on them. As our estimate is relying on the information enveloped in the moment conditions, it is

imperative whether the actual model is consistent with the data or it appears to be a better representation of the data. If the hypothesis of the model that led us to the moment equations in the first place is wrong, then at least some of the sample moment restrictions will be violated. This result provides the basis for a test of the over-identifying restrictions and if we have more moments than parameters, we have future for testing that. The test is a simple test called j test, which is just the sample size times the value of the GMM criterion function evaluated at the second step GMM estimator

$$nQ_n(\hat{\theta}) = [\sqrt{n}f_n(\widehat{\theta})]'(Est.Asy.Var[\sqrt{n}f_n(\theta_o)]^{-1} = [\sqrt{n}f_n(\widehat{\theta})].$$

The second question asks whether the model has restrictions that are satisfied. Thankfully all the well-known likelihood- based testing procedures have their GMM counterparts with very similar implementations. The GMM LR test is calculated by using nQ_n instead of *ln L* in the t stat. The GMM Wald statistic is calculated same as the likelihood by using the estimates of GMM instead of the ML estimates. The LM test is based on the identical logic used on derivative of criterion function for GMM . The third question is basically which model to be selected. The previously mentioned tests can be used for nested models but for non-nested models, distributions will have to be selected.

4.4 Econometric model:

Here we will represent the econometric model by using the functions already told in chapter 3. We will define their instruments and finally give a matrix representation for simplification.

Product block:

$$Y_t = \phi_1 + \alpha_1 y_t^* + \beta_1 RF_t + \gamma_1 I_t + \varepsilon_{i1} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

$$Y_{i1} = \phi_1 + \alpha_1 y_i^* + \beta_1 RF_i + \gamma_1 I_i + \varepsilon_{i1} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

$$y_{i1} = z_{i1}'\delta_1 + \varepsilon_{i1} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

$$z_{i1} = [1, y_i^*, RF_i, I_i]' \qquad \delta_1 = [\phi_1, \alpha_1, \beta_1, \gamma_1]'$$

$$L_1 = [Y_{i1}, y_i^*, RF_i, I_i, Y_{i1}(-1), I_i(-1)]$$

$$y_1 = Z_1\delta_1 + \varepsilon_1 \dots\dots\dots\dots\dots\dots\dots\dots (4)$$

where L_1 represents instruments.

The variables that create the problem of endogeneity are regional GDP along with regional gross fixed capital formation. Due to same level of integration we used ECM.

Aggregate Demand (block):

Investment function:

$$I_t = \phi_2 + \alpha_2 y_t + \beta_2 i_t + \gamma_2 RISK + \pi_2 RF_t + \varepsilon_{i2} \dots\dots\dots\dots\dots\dots (5)$$

$$Y_{i2} = \phi_2 + \alpha_2 y_i + \beta_2 i_i + \gamma_2 RISK_i + \pi_2 RF_i + \varepsilon_{i2} \dots\dots\dots\dots\dots (6)$$

$$y_{i2} = z_{i2}'\delta_2 + \varepsilon_{i2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (7)$$

$$z_{i2} = [1, y_i, i_i, RISK_i, RF_i]' \qquad \delta_2 = [\phi_2, \alpha_2, \beta_2, \gamma_2, \pi_2]'$$

$$L_2 = [Y_{i2}, y_i, i_i, RISK_i, RF_i, Y_{i2}(-1), y_i(-1), RF_i(-1)]$$

$$y_2 = Z_2\delta_2 + \varepsilon_2 \dots\dots\dots\dots\dots\dots (8)$$

where L_2 represents instruments.

Interest rate is real interest rate. Regional gross capital formation and regional GDP are creating endogeneity here. The broad money RF is used as regional CPI in deflating oil prices and since its used as dependent in price function, hence its also creating endogeneity. On the basis of level of integration, we used ARDL.

Consumption function:

$$C_t = \phi_3 + \alpha_3 IND_t + \beta_3 i_t + \gamma_3 RISK + \pi_3 RF_t + \varepsilon_{i3} \dots\dots\dots (9)$$

$$Y_{i3} = \phi_3 + \alpha_3 IND_i + \beta_3 i_i + \gamma_3 RISK_i + \pi_3 RF_i + \varepsilon_{i3} \dots\dots\dots (10)$$

$$y_{i3} = z_{i3}'\delta_3 + \varepsilon_{i3} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (11)$$

$$z_{i3} = [1, IND_i, i_i, RISK_i, RF_i]' \qquad \delta_3 = [\phi_3, \alpha_3, \beta_3, \gamma_3, \pi_3]'$$

$$L_3 = [Y_{i3}, IND_i, i_i, RISK_i, RF_i, RF_i(-1)]$$

$$y_3 = Z_3\delta_3 + \varepsilon_3 \dots\dots\dots\dots\dots\dots\dots\dots (12)$$

where L_3 represents instruments.

Oil prices not used as a whole variable but rather as part of the function. Broad money is used as regional CPI and hence it is creating endogeneity. Interest rate is the real interest rate. Due to different level of integration, we used ARDL.

Trade block:

Export function:

$$X_t = \phi_4 + \alpha_4 y_t^* + \beta_4 TI_t + \varepsilon_{i4} \dots\dots\dots\dots\dots\dots (13)$$

$$Y_{i4} = \phi_4 + \alpha_4 y_i^* + \beta_4 TI_i + \varepsilon_{i4} \dots\dots\dots\dots\dots\dots (14)$$

$$y_{i4} = z_{i4}'\delta_4 + \varepsilon_{i4} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (15)$$

$$z_{i4} = [1, y_i^*, TI_i]' \qquad \delta_4 = [\phi_4, \alpha_4, \beta_4]'$$

$$L_4 = [Y_{i4}, y_t, TI_i]$$

$$y_4 = Z_4\delta_4 + \varepsilon_4 \dots\dots\dots\dots\dots (16)$$

where L_4 represents instruments. Due to same level of integration, we used ECM.

Import function:

$$M_t = \phi_5 + \alpha_5 Y + \beta_5 TI + \varepsilon_{i5} \dots\dots\dots\dots\dots\dots (17)$$

$$Y_{i5} = \phi_5 + \alpha_5 Y_i + \beta_5 TI_i + \varepsilon_{i5} \dots\dots\dots\dots\dots\dots (18)$$

$$y_{i5} = z_{i5}'\delta_5 + \varepsilon_{i5} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (19)$$

$$z_{i5} = [1, Y_i, TI_i]' \qquad \delta_5 = [\phi_5, \alpha_5, \beta_5]'$$

$$L_5 = [Y_{i5}, Y_i, TI_i, Y_i(-1), TI_i(-1)]$$

$$y_5 = Z_5\delta_5 + \varepsilon_5 \dots\dots\dots\dots\dots (20)$$

where L_5 represents instruments.

Term of trade has price effect, so in its place regional CPI is used. Therefore this and Regional GDP both create endogeneity. Due to same level of integration, we used ECM.

Aggregate Supply (block):

Price Function:

$$P_t = \phi_6 + \alpha_6 p_t^* + \beta_6 TCN_t + \gamma_6 y_t^{gap} + \varepsilon_{i6} \dots\dots\dots (21)$$

$$Y_{i6} = \phi_6 + \alpha_6 p_i^* + \beta_6 TCN_i + \gamma_6 y_i^{gap} + \varepsilon_{i6} \dots\dots\dots (22)$$

$$y_{i6} = z_{i6}'\delta_6 + \varepsilon_{i6} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (23)$$

$$z_{i6} = \left[1, p_i^*, TCN_i, y_i^{gap}\right]' \qquad \delta_6 = [\phi_6, \alpha_6, \beta_6, \gamma_6]'$$

$$L_6 = [Y_{i6}, p_i^*, TCN_i, y_i^{gap}, Y_{i6}(-1)]$$

$$y_6 = Z_6\delta_6 + \varepsilon_6 \dots\dots\dots\dots\dots (24)$$

where L_6 represents instruments.

Instead of prices CPI are used, and so this and regional CPI create endogeneity. On the basis of same level of integration, we used ECM.

So its matrix representation would be as follows:

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \end{bmatrix} = \begin{bmatrix} Z_1 & & & & & \\ & Z_2 & & & & \\ & & Z_3 & & & \\ & & & Z_4 & & \\ & & & & Z_5 & \\ & & & & & Z_6 \end{bmatrix} \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \end{bmatrix}$$

CHAPTER: 5

Results:

5.1 Overview:

This chapter is the results. It basically is divided into descriptive analysis of the variables and results and discussion. It contains the detail of time series properties followed by the results and their interpretations by employing the system GMM technique.

5.2 Descriptive analysis of variables:

Descriptive analysis:

In table (i) in appendix, we have taken the mean, standard deviation and the stability ratio of the variable used in our functions for the model. From GDP China, we can do descriptive analysis by looking at the mean, the standard deviation and the stability ratio. Here we are analyzing the GDP of China and we see that over the time, the mean is increasing and a huge jump can be seen during 2006 - 2015. The standard deviation shows that there was variation over the years. Whereas the stability ratio which is the standard deviation as the percentage of mean shows that it's been instable over the years. Regional broad money's mean shows that it keeps on increasing over time. The standard deviation shows that there is variation but not that much. The stability ratio shows there is stability over time. Regional gross fixed capital formation's mean is fluctuating over time. There is huge deviation from 1971-1985 but after that there is not that much deviation but it exists. The stability ratio shows huge instability during 1971-1985 but after that there is stability but overall there is instability. Regional GDP's standard deviation shows that there is deviation but not that much. However, stability ratio shows that there is instability over time. Real interest rate's mean shows that t keeps on fluctuating over time. There is deviation as can be seen in standard deviation and it is unstable as shown through stability ratio. Oil prices standard deviation shows that there is deviation over time and the stability ratio shows that it is unstable over time. Consumption

mean shows that it keeps fluctuating over time i.e. it increases but declined during two time periods. The standard deviation shows that there is deviation and the stability ratio shows that there is instability over time. NDI's mean kept on increasing but only declined during 2001-2005. The standard deviation shows that there is deviation and the stability ratio shows there is instability. Term of trade's mean keeps on fluctuating over time. There is a huge jump in deviation from 1976-1990. The stability ratio shows that there is instability over time. Export's mean keep fluctuating but is mostly increasing. There is deviation in standard deviation and the stability ratio shows that there is instability. Import's mean show that its been increasing over time. There is deviation shown by standard deviation and the stability ratio shows that its unstable over time. Regional CPI mean shows that its increasing over time. There is deviation in standard deviation and stability ratio shows that it is unstable but not by huge magnitude. Regional nominal exchange rate mean shows that its increasing. There is deviation but not too much and its unstable as shown by stability ratio over time. Output gap means keeps on fluctuating and there is deviation but not alot with instability over time through the stability ratio.

Time series properties of variables:

Here we applied the augmented Dickey Fuller test, to check the order of integration of the variables used.

Table: 1 Time series properties

List of variables	Order of integration
GDP (China)	I(1)
Regional GDP	I(1)
Regional gross fixed capital formation	I(1)
Regional broad money	I(1)
Real interest rate	I(0)
Nominal interest rate	I(0)
International oil prices	I(1)
Exports	I(1)
Term of trade	I(1)
Imports	I(1)
Regional consumer price index	I(1)

Consumption	I(1)
National disposable income	I(1)
Regional nominal exchange rate	I(1)
CPI (Pakistan)	I(1)
Output gap	I(1)

The functions containing the I(0) and the I(1) order of integration among the variables would use ARDL method and the functions containing the variables of order of integration I(1) would use ECM. From there we would see that problem of endogeneity also exists due to which we will move towards GMM, specifically system GMM due to system of equations used.

5.3 Results and discussion:

So after finding the time series properties and concluding from there that production, trade (export, import) and aggregate supply block (price) were on same level of integration while aggregate demand block(investment, consumption) were on different level of integration. We used GMM to estimate the model and in it used system GMM due to number of equations. So, we used ARDL and ECM to see the short run and the long run relationships within the system GMM.

Production block:

After running the equation as a system of equation in system GMM, we got the results as follows:

Table: 2 Production block

List of variables	DLRY
Constant	0.04349
	(0.00)
Trend	-0.000355
	(0.174)
D(LRY(-1))	0.24457
	(0.021)
D(LY)	0.0652
	(0.4218)
D(LY(-1))	-0.0665
	(0.219)
D(BM)	-0.000976
	(0.1921)
D(BM(-1))	-0.0003577

	(0.6461)
D(RK)	0.129
	(0.00)
D(RK(-1))	0.281
	(0.5361)
EC(-1)	-0.1545
	(0.0085)

So here the dependent variable is the regional GDP. We can see from the results that the constant and the trend are significant. It can be seen that regional GDP has a positive and a significant relationship with a further lag of itself which implies that the regional GDP depends on its lag and is effected by it, but in a positive way i.e. increase in the previous regional GDP would mean increase in the next year regional GDP and vice versa. It can be seen in a way that if an economy is performing well for a period, then it would have a ripple effect and would perform better in the following years unless there was an unseen shock in the economy. If we take the assumption that the regional GDP was good in the previous year, then that would imply consumer were better off and good and services were produced and bought at higher rate and there was development, hence this would effect the future too i.e. next year the region would perform well with the development. However the regional GDP has no significant relationship with GDP of china or its lag, implying that regional GDP is not effected by the GDP of China. So if the GDP of China is good or bad, it doesn't effect the region(Pakistan, India, Bangladesh, Sri Lanka). It can be seen that when there are floods in China, it doesn't effect the GDP of Pakistan neither has the boost in the GDP of China effected our economy. So like Pakistan being one of the cities of the region, the rest follow the same flow and so it can be safe to say the regional GDP has no significant relation with China's GDP. The regional GDP also does not have a significant relationship with the regional broad money. So no significant relation with the previous or the one followed. This can be due to the fact that money of the transactions are not showed with things like money laundering. In this region especially where political corruption is at large, the transactions are usually done in an underground manner, which cant be estimated and hence the money

supply effect is not properly there on a regional level due to this, which in turn does not effect the regional GDP. Regional GDP does have a significant and positive relationship with regional gross capital fixed formation i.e. more the investment in the region the more will be the regional GDP, as there will be more employment opportunities and more development. However it has no significant relationship with the further lag, which means the investments in the lag of previous year does not effect regional GDP of the previous year, since employment opportunities were created in that period, so people had jobs then, but it does not automatically imply that with the completion of the projects people would retain the jobs or will be better off. If that would be the case then countries would progress in one year and would reap the benefits for the coming year. This trace of such channel was also given by Bergh(2008) in his article. Regional GDP has a significant relationship with error correction term and with a negative sign.

Aggregate demand block

Investment function:

After running the equation as a system of equation in system GMM, we got the results as follows:

Table: 3 Investment function

List of Variables	D(RK)
Constant	-50500
	(0.0012)
Trend	12800
	(0.00)
D(RK(-1))	-0.0382
	(0.5005)
D(LRY)	83900
	(0.007)
D(LRY(-1))	-1890
	(0.2762)
D(LOP)	8000
	(0.3143)
D(LOP(-1))	-777.0
	(0.2197)
D(RIR)	835000.0
	(0.8851)
D(RIR(-1))	-5070

	(0.2278)
ECT(-1)	-0.158
	(0.0082)

Regional gross capital formation does not have a significant relationship with its lag. This implies that the investment decision of the year, are not effected by the investments in the previous year in the region. It could be since the investment in the region not effected by previous as there could be shocks or how the region performing is a shift from how it was previously and the development increased, hence the previous regional gross capital formation does not effect the next regional gross capital formation. However it does have a significant relation with regional GDP, but not with the lag. Thus the regional gross capital formation depends on the regional GDP of that year but not on lag. Hence how the region performs effect the investment decision but again the previous does not matter since there could be shocks or the performance later could be a leap from how it was previously. This was reiterated by Iraheta and Carlos(2007) as well. The international oil prices does not effect the regional GDP, since the investments or projects are not always the kind that are effected by oil prices, as it could be the software development investment and also the profit brackets are seen before the investments which incorporate the oil fluctuations and since we are talking about regional gross capital formation, so the region is effected by the oil prices changes differently as compared to a unit country, hence the reaction is also different. Similarly the regional gross capital formation has no significant relation with China's real interest rate, as the regional investment decisions are not effected by a single country china which though is major but still the decisions are not impacted. So even though China is huge, its interest rate has no impact. It has a significant relation with error correction term and a negative one.

Consumption function:

So in system GMM, we get the following results.

Table:4 Consumption function	
List of variables	D(LHHC)
Constant	16.6
	(0.00)
Trend	0.153
	(0.0002)
D(LHHC(-1))	0.821
	(0.00)
D(LRCPI)	-0.671
	(0.0002)
D(LRCPI(-1))	0.619
	(0.0123)
D(NDI)	0.00103
	(0.0315)
D(NDI(-1))	-0.0182
	(0.1787)
D(RIR)	0.00580
	(0.3038)
D(RIR(-1))	0.00250
	(0.4031)
LHHC(-1)	-0.565
	(0.00)
LRCPI(-1)	-1.56
	(0.0002)
NDI(-1)	0.0394
	(0.0128)
RIR(-1)	0.00470
	(0.4492)

Here we can see that the consumption has a positive and significant relationship with its lag, hence consumption does depend on its lag, thus autoregressive. Hence the consumption previous pattern defines the next consumption pattern as its also influences by the inflow of income i.e. if you got a promotion then consumption pattern changes and if you are consuming a certain way that habitually that would prevail, which goes with Fuhrer (2003) work. The habit formed is also due to some other monetary and fiscal shocks that might prevail in the economy causing the consumer to behave in a certain way. The consumption also depends on regional consumer price index and its lag, hence autoregressive. However with the regional consume price index it has a negative relation, which can be that more the fluctuations in the prices of the region, the more the consumer will be disheartened, so less consumption. However with its lag it has a positive, which could be because the less it

fluctuated in the past, the more the people consumed afterwards due to having the ripple effect of the security blanket. CPI is also considered as the measure of inflation and basically consumers do suffer from money illusion while making their decisions which is precisely what its strengthening here. Branson and Klevorick (1969) said the same thing. So if there is regional CPI and its fluctuating, lets say giving inflation then the consumption pattern of single country would change accordingly like inflation, then less imports and less consumption of imports. Consumption also has a positive and significant relationship with national disposable income, which goes with the theory that the more you have to spend, the more will you spend and consume. Consumption here however is not effected by real interest rate, which is that if a person is not borrowing from a bank or lending, then they wont be effected by the interest rate in that sense and here the marginal propensity to consume and save would come into play and it could be that they cancel the effect of each other or that consumer remains confused about interest rate play in economy and does not act on it.

Trade block:

Export function:

After running the equation as a system of equation in system GMM, we got the results as follows:

Table: 5 Export Function

List of variables	EX
Constant	720.0
	(0.7584)
Trend	11.05
	(0.7574)
LRY	-255.0
	(0.7603)
T	-0.216
	(0.772)

Here its seen that exports do not have a significant relationship with regional GDP nor with the term of trade. Its believed that more the term of trade more will be the exports but here since we are talking about China, its thriving on its export industry and hence its exports

remain high with its currency rate downplay, so its not effected by the term of trade. Also, the exports of China are not affected by regional GDP, since its economy is huge and hence operates as a unit effecting others rather than being effected. It has its own monopoly that it holds and thus cannot be affected in such situation.

Import function:

After running the equation as a system of equation in system GMM, we got the results as follows:

Table: 6 Import function

List of variables	LM
CONSTANT	17.9
	(0.0004)
TREND	0.2436
	(0.0012)
LRY	-5.71
	(0.0022)
LRCPI	0.7645
	(0.00)

Here the imports of China are affected by the regional GDP but in a negative way. i.e. the more the regional GDP, the less would be the imports of China. And the more the imports of China, less would be the regional GDP as the imports lead to decline in importing countries GDP. Hence the regional would be the importing region GDP, which would decline with more imports of China. Imports of China also have a significant and positive relation with regional CPI, e.g. if regional CPI more, so we could say more prices, so inflation and hence the exports would be more expensive and the countries would rely more on the imports provided they are cheaper, which would be since there is inflation in the region. So the relation is justified.

Aggregate supply block:

Price function:

After running the equation as a system of equation in system GMM, we got the results as follows:

Table: 7 Price function

List of variables	LRCPI
Constant	2.54
	(0.00)
Trend	0.293
	(0.00)
Exchange	-0.0432
	(0.00)
LPC	-1.35
	(0.0003)
OG	-0.002.90
	(0.8058)

So the regional price is effected by the regional nominal exchange rate i.e. significant relationship but negative. So more the regional nominal exchange rate less would be the regional prices. This can be seen through example if US dollar stronger, then lets say imported goods would be cheaper, so the domestic producer would lower there costs in order to attract buyers. So same applies in this case, if regional exchange rate more, then imported goods cheaper, hence they would lower their prices. Dornbusch (1987) also explained this. The regional price has a significant but negative relationship with Pakistan prices. So if Pakistan prices are high, then that means it would want to import more, so the regional countries would see it as a trading opportunity and lower the prices to attract buyers of Pakistan and increase there imports. However regional prices do not have relation with the output gap of China i.e. the output gap of China would not put demand gap pressure on the regional prices to increase the regional prices.

CHAPTER: 6

Conclusion:

6.1 Overview:

This chapter contains conclusion, policy recommendations and limitations.

6.2 Conclusion:

We estimated a regional macro econometric trade model for Pakistan, where at first we chose the countries as Pakistan, India, Bangladesh and Sri Lanka to from the region and China as the major trading partner. We took the data from 1971-2015. We first chose the variables to be used and made them regional accordingly. We will use GMM for estimating the model and since we have number of equations will use system GMM. Since we have time series data, we tested the time series properties through ADF for the variables and saw that there were different order of integration, hence we proceeded to see the long run and the short run relationships by applying ARDL and ECM within system GMM

We created blocks where there was production block having product function, Aggregate demand block having investment and consumption function, Trade block having exports and import function and Aggregate supply block having price function. The results showed the relationships and which relationships were significant and not in regional perspective. So it addressed the region's principal economic relationships. We estimated a regional macro econometric trade model. The results shed light on how the region gets impacted and hence paves way for further work and policy makers to make policies accordingly. The results showed that the regional GDP had a significant relationship with its autoregressive, hence showing that it regional GDP gets impacted by its performance in the past. Its also gets impacted by the regional gross capital formation and so does regional gross capital formation gets affected by regional GDP in return. So means the regional development in term so investment does effect the regional GDP. Consumption has a significant relationship with its

lag, so it's a habitual trend. It has a significant relationship with regional CPI and its lag, so consumption gets affected by the regional CPI and also by national disposable income. Exports does not get effected by regional GDP nor by term or trade but imports get affected by regional GDP and regional CPI. The regional prices have a significant relationship with regional exchange rate, and Pakistan's prices. So the results showed the relationships. This can be used as the basis for policy makers to make their policies and this model can further be used in forecasting as well.

6.3 Policy implications:

Its seen through and through that for the date till which data has been taken, i.e. till 2015 China has not had a significant relationship with regional variables i.e.in terms of impacting the regional variables. China did get impacted by the regional variable but not vice versa. It can be assumed that since CPEC did not start till then, hence it did not matter much. But now the policy makers have to be careful and monitor that even now, after CPEC does the relationship stays same or has China begun to start impacting regional variables. Its seen however that regional variables do impact each other, so its safe to say what one country does in this region is impacting for the region. Hence the policy makers need to monitor the policies of these countries and make their policies accordingly. Since regional GDP and regional gross capital formation has positive and significant relation, hence the policy makers need to make policies where investments are done and not be shy of doing FDI within the region. Regional prices also get effected by regional exchange rate, hence the policy makers need to be attentive with regional exchange rate, that they will impact the region. Pakistan's policy makers need to be attentive to the region and keep an eye on how they are performing since being the part of the region, Pakistan does get impacted by how the region is performing. Be it in terms of their prices, exchange rate, gross capital formation or GDP. And the policy makers need to especially get more FDI from the region here, since it wont be just beneficial for Pakistan but for the region too, as the results suggest and not to mention it

would create employment opportunities for us. The policy makers of the entire region also need to become more productive and take less imports for China to have better GDP. And the Pakistani policy makers need to keep their prices lower in order to attract imports, otherwise they would give an opportunity for the rest of the region to get more trading opportunity.

6.4 Limitations:

There can be limitations in the form that the data provided could be limited in some way for countries. There is a possibility that some variables important could have been missed as it's not possible to take all the variables. So some variables, explaining the relation could have been missed. The inclusion of labour prices and labour market would be of importance but the region's countries need to collect data. Also there is a lot of lack in availability of data in China. Also it's entirely possible that countries with which the other country has huge trading partnership was not taken. More research can be conducted and further blocks can be added and variables as well to further improve on this. More work can be done in terms of detailed relationship between financial/fiscal sector and real sector, since experience in other part of worlds show that there have been strong relationship between changes in portfolios, assumingly future portfolios and economic activity and this could be very valuable in forecasting.

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APPENDIX:

So here, we ran the system but with few instruments and saw that number of significant relations were less than what we have obtained in our used results.

System: SS
Estimation Method: Generalized Method of Moments
Date: 07/19/17 Time: 09:41
Sample: 1971 2015
Included observations: 45
Total system (unbalanced) observations 260
Kernel: Bartlett, Bandwidth: Fixed (4), No prewhitening
Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.038111	0.008956	4.255428	0.0000
C(2)	0.000171	0.000221	0.776398	0.4384
C(3)	0.147699	0.144513	1.022050	0.3079
C(4)	-0.093110	0.080017	-1.163619	0.2459
C(5)	0.021481	0.065376	0.328584	0.7428
C(6)	8.32E-05	0.001008	0.082548	0.9343
C(7)	0.001165	0.000790	1.475531	0.1415
C(8)	1.08E-11	6.47E-12	1.674652	0.0955
C(9)	1.46E-12	4.44E-12	0.328044	0.7432
C(10)	-0.010956	0.049070	-0.223277	0.8235
C(11)	476.9321	2406.595	0.198177	0.8431
C(12)	7.298105	36.80251	0.198305	0.8430
C(13)	-168.1271	861.3342	-0.195194	0.8454
C(14)	-0.148764	0.753446	-0.197444	0.8437
C(15)	18.33611	5.471223	3.351372	0.0010
C(16)	0.251350	0.083666	3.004202	0.0030
C(17)	-5.932074	2.053772	-2.888380	0.0043
C(18)	0.738243	0.110053	6.708083	0.0000
C(19)	-7.27E+08	4.01E+08	-1.811213	0.0715
C(20)	30771357	9339699.	3.294684	0.0012
C(21)	-0.351383	0.268499	-1.308691	0.1920
C(22)	4.30E+09	4.56E+09	0.942195	0.3472
C(23)	-5.76E+08	3.66E+09	-0.157509	0.8750
C(24)	2.50E+08	1.43E+08	1.753510	0.0809
C(25)	99122608	1.13E+08	0.879670	0.3800
C(26)	-4521283.	9566830.	-0.472600	0.6370
C(27)	-7352494.	7901600.	-0.930507	0.3532
C(28)	-0.057878	0.256103	-0.225996	0.8214
C(29)	17.50795	4.143293	4.225613	0.0000
C(30)	0.164344	0.042397	3.876353	0.0001
C(31)	0.829796	0.167889	4.942522	0.0000
C(32)	-0.710089	0.185729	-3.823256	0.0002
C(33)	0.665545	0.261932	2.540908	0.0118
C(34)	1.11E-13	5.93E-14	1.864635	0.0636
C(35)	-2.15E-13	1.49E-13	-1.443210	0.1504
C(36)	0.006369	0.006789	0.938029	0.3493
C(37)	0.003922	0.003527	1.111722	0.2675
C(38)	-0.596068	0.140714	-4.236013	0.0000
C(39)	-1.669161	0.435351	-3.834061	0.0002
C(40)	4.09E-14	1.70E-14	2.404718	0.0170
C(41)	0.002786	0.008075	0.345081	0.7304
C(42)	2.737348	0.453643	6.034149	0.0000
C(43)	0.309481	0.032473	9.530363	0.0000
C(44)	-0.044192	0.004928	-8.967313	0.0000
C(45)	-1.504249	0.343774	-4.375695	0.0000
C(46)	-0.000315	0.014835	-0.021207	0.9831

Now we tried to add extra instruments and saw that number of significant did not increase than the amount of instruments that we used. So hence, we stopped trying to add more instruments.

System: SS
Estimation Method: Generalized Method of Moments
Date: 07/19/17 Time: 09:45
Sample: 1971 2015
Included observations: 45
Total system (unbalanced) observations 254
Kernel: Bartlett, Bandwidth: Fixed (4), No prewhitening
Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.038992	0.006292	6.197150	0.0000
C(2)	-0.000159	0.000167	-0.952918	0.3417
C(3)	0.256695	0.073585	3.488436	0.0006
C(4)	0.071366	0.051022	1.398732	0.1634
C(5)	-0.084158	0.032417	-2.596141	0.0101
C(6)	-0.001366	0.000718	-1.902356	0.0585
C(7)	0.000145	0.000499	0.291501	0.7710
C(8)	1.09E-11	2.25E-12	4.844632	0.0000
C(9)	2.36E-12	3.23E-12	0.730620	0.4658
C(10)	-0.112929	0.040414	-2.794275	0.0057
C(11)	697.5903	2246.195	0.310565	0.7564
C(12)	10.69189	34.34279	0.311328	0.7559
C(13)	-247.1087	803.6554	-0.307481	0.7588
C(14)	-0.217483	0.712772	-0.305124	0.7606
C(15)	18.42796	4.355649	4.230818	0.0000
C(16)	0.250565	0.065945	3.799582	0.0002
C(17)	-5.984134	1.646839	-3.633710	0.0004
C(18)	0.774946	0.091894	8.433063	0.0000
C(19)	-5.20E+08	87280613	-5.960592	0.0000
C(20)	11993271	2085633.	5.750423	0.0000
C(21)	-0.018572	0.055531	-0.334440	0.7384
C(22)	7.57E+09	2.09E+09	3.619581	0.0004
C(23)	-3.96E+08	1.34E+09	-0.295879	0.7676
C(24)	68421955	61863176	1.106021	0.2700
C(25)	-65358830	47420954	-1.378269	0.1696
C(26)	163179.1	4268571.	0.038228	0.9695
C(27)	-4046137.	3343535.	-1.210137	0.2276
C(28)	-0.164185	0.043237	-3.797360	0.0002
C(29)	16.73813	3.596938	4.653439	0.0000
C(30)	0.155452	0.037071	4.193329	0.0000
C(31)	0.812098	0.129396	6.276069	0.0000
C(32)	-0.670920	0.161351	-4.158136	0.0000
C(33)	0.632251	0.222965	2.835653	0.0050
C(34)	1.06E-13	4.53E-14	2.333461	0.0206
C(35)	-1.89E-13	1.06E-13	-1.779219	0.0767
C(36)	0.006038	0.005204	1.160167	0.2473
C(37)	0.003114	0.002961	1.051516	0.2942
C(38)	-0.569943	0.121578	-4.687868	0.0000
C(39)	-1.583659	0.383066	-4.134169	0.0001
C(40)	3.96E-14	1.44E-14	2.757141	0.0063
C(41)	0.004082	0.005548	0.735718	0.4627
C(42)	2.562082	0.377593	6.785309	0.0000
C(43)	0.295918	0.026270	11.26455	0.0000
C(44)	-0.043511	0.003955	-11.00125	0.0000

C(45)	-1.364324	0.279283	-4.885103	0.0000
C(46)	0.003133	0.010861	0.288506	0.7732

*ECM is used in GMM as given in GMM estimation techniques, in generalized method of moments.

*To check whether the instruments were over identified or not, we applied the (Sargen Hansen test) J test where if J cal< $X^2_{m-k,}$ then do not reject H_o

Where H_o: Instruments are correct

Thus, our J cal was 0.23369 and that was less than critical value that i.e. 10.51< 25.041.

Hence concluded that instruments used are correct.

Table (i) Descriptive analysis						
	GDP (china)			Regional broad money		
years	mean	SD	SR	mean	SD	SR
1971-1975	3.63	0.31	8.67	32.29	2.19	6.78
1976-1980	4.79	0.64	13.43	39.11	3.22	8.24
1981-1985	7.38	1.38	18.63	43.54	2.09	4.80
1986-1990	12.16	1.43	11.74	46.75	1.13	2.42
1991-1995	19.54	3.77	19.29	49.86	2.12	4.24
1996-2000	31.67	3.92	12.38	51.24	0.74	1.44
2001-2005	48.51	7.42	15.30	59.43	3.21	5.41
2006-2010	82.95	13.09	15.78	66.98	0.82	1.22
2011-2015	127.29	14.34	11.27	68.47	1.77	2.58
	RGF			Regional GDP		
years	mean	SD	SR	mean	SD	SR
1971-1975	399374612.59	90409266.43	22.64	3.22	1.15	35.54
1976-1980	851784684.55	345629013.35	40.58	1.32	0.30	22.92
1981-1985	1238158059.46	87951046.42	7.10	0.67	0.15	22.33
1986-1990	1213835243.33	128317223.20	10.57	0.41	0.07	17.17
1991-1995	1306787214.24	127872262.26	9.79	0.22	0.04	17.55
1996-2000	1707580809.83	232519820.48	13.62	0.12	0.02	18.28
2001-2005	1944648406.48	269608826.02	13.86	0.08	0.00	0.98
2006-2010	2874972170.68	334835048.59	11.65	0.07	0.01	12.86
2011-2015	4841740131.52	414560236.72	8.56	0.05	0.00	8.47

	Real interest rate (%)			Oil prices		
years	mean	SD	SR	mean	SD	SR
1971-1975	1.28	0.44	34.66	5.11	2.65	51.80
1976-1980	1.20	0.02	1.62	8.50	2.59	30.50
1981-1985	3.20	3.67	114.45	7.13	1.43	20.07
1986-1990	1.80	2.58	143.03	1.35	0.18	13.43
1991-1995	-2.16	3.85	-177.83	0.84	0.19	22.38
1996-2000	5.71	1.99	34.91	0.65	0.17	25.73
2001-2005	2.27	2.30	101.04	0.88	0.18	20.23
2006-2010	0.77	3.08	399.14	1.16	0.22	18.61
2011-2015	3.06	2.60	85.00	0.88	0.26	30.16
	Consumption			NDI		
years	mean	SD	SR	mean	SD	SR
1971-1975	937141611413.27	16215713224.35	1.73	114998887462.46	19657071576.40	17.09
1976-1980	861686922111.58	33715344894.75	3.91	134980541364.94	9805012445.77	7.26
1981-1985	698770441585.07	73412579276.28	10.51	192375871816.93	46916174681.43	24.39
1986-1990	369727138999.00	124859538724.46	33.77	274971486623.52	30470419213.86	11.08
1991-1995	371374000000.00	84374042966.42	22.72	441633905847.73	121258920187.58	27.46
1996-2000	675433400000.00	112159545069.96	16.61	892340168257.59	113445908894.64	12.71
2001-2005	1091939600000.00	155327077069.00	14.22	1492215654307.42	309064390540.47	20.71
2006-2010	1787948000000.00	283196179388.07	15.84	3696691455211.22	1084438279769.73	29.34
2011-2015	2840372000000.00	344475922409.68	12.13	7755647055591.25	1195009420935.51	15.41
	TOT			EXPORTS		
years	mean	SD	SR	mean	SD	SR
1971-1975	112.34	0.83	0.73	7245.38	510.67	7.05
1976-1980	115.69	1.33	1.15	5068.52	781.02	15.41
1981-1985	105.33	12.58	11.94	5994.84	854.09	14.25
1986-1990	94.92	7.39	7.78	18171.64	6796.48	37.40
1991-1995	101.83	0.85	0.84	32017.06	6025.11	18.82

1996-2000	106.18	4.43	4.17	39379.00	4858.83	12.34
2001-2005	92.30	3.32	3.59	81381.08	31687.11	38.94
2006-2010	86.96	3.87	4.45	182992.40	24194.42	13.22
2011-2015	81.78	2.44	2.98	347861.72	52990.34	15.23
	Imports			Regional CPI		
years	mean	SD	SR	mean	SD	SR
1971-1975	1095.65	213.68	19.50	2.78	0.69	24.80
1976-1980	3053.30	1002.85	32.84	4.33	0.58	13.41
1981-1985	6242.62	1044.11	16.73	7.07	0.89	12.54
1986-1990	20194.98	7887.32	39.06	16.92	2.07	12.24
1991-1995	53226.24	12521.36	23.52	25.09	2.96	11.79
1996-2000	79491.90	7194.43	9.05	36.26	3.46	9.55
2001-2005	106789.78	19665.94	18.42	46.22	3.86	8.35
2006-2010	172785.00	17078.62	9.88	67.36	9.97	14.80
2011-2015	246458.31	19616.30	7.96	99.93	9.61	9.62
	Regional nominal ER			Output gap		
years	mean	SD	SR	mean	SD	SR
1971-1975	4.74	0.10	2.19	1.76	1.19	67.46
1976-1980	8.22	2.65	32.27	-1.64	1.74	-106.34
1981-1985	18.32	4.17	22.79	-0.78	1.97	-253.10
1986-1990	30.92	3.71	12.01	0.70	1.77	251.75
1991-1995	44.46	5.41	12.17	-0.21	1.46	-703.79
1996-2000	61.61	4.98	8.08	0.40	0.64	159.61
2001-2005	75.12	0.66	0.88	-0.76	0.12	-16.14
2006-2010	78.35	1.82	2.33	0.47	0.31	65.67
2011-2015	85.37	4.10	4.80	-0.06	0.52	-833.29