

**BALANCE OF PAYMENT CRISIS IN PAKISTAN: THE EARLY
WARNINGS OF DISTRESS**



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CERTIFICATE

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Abstract

Pakistan has been facing severe balance of payment crisis, mainly due to the fact that country has not been able to come up with proactive policies to hedge itself against external shocks. This proactive approach remained absent mainly because country has no indicator which can correctly reflect the building external vulnerabilities. This situation could have been avoided with the help of indicator, which should ideally be the aggregated position of all the relevant economic indicators. This study is an attempt to construct such index for Pakistan – called External Vulnerability Index. While doing the literature review, the research gaps found are the use of dynamic models and disaggregated approach to construct an aggregated index. This study has approached the aggregate vulnerability index by using multiple sub-indices to mitigate the chances of neutralization of sources of vulnerability. To bridge the research gap, this study has utilized Principal Component Analysis which provided static relationship between variables and Johansen Co-integration approach which provided dynamic results for long and short run as well also provide the speed of adjustment from disequilibrium to equilibrium. The inspection of EVI constructed through Principal Component Analysis. Every time the EVI was heading towards the upper band Pakistan ended up which approaching IMF or other International Financial Institutions for the bailout. The results of EVI is constructed through Johansen Co-integration is quite similar to the EVI constructed through PCA. There is an upward trend in EVI that was followed by bailout packages from IMF or other IFI's. the upward pressures could be seen in 2004, 2008, 2013, 2018 and in each of these years Pakistan approached IMF for bailout package. Results reveal that constructed EVI is a good Early Warning indicator for the Balance of Payment crisis of Pakistan.

Dedication

I dedicate this thesis to my father for supporting me in every way possible and for having faith in me.

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First of all, I would say thanks to Allah Almighty for giving me the strength and courage to complete this thesis successfully, without His mercy this would have never possible.

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BISMILLAH-HIR-RAHMAN-NIR-RAHIM

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1 Chapter 1: Introduction

Generally, dynamics of external sector¹ is considered an important determinant of long run pattern of macroeconomy of any country. Additionally, impact of external sector dynamics is more pronounced for developing countries. Volatile macroeconomy is always a concern for developing countries as this is a foundation and an image of underdevelopment. Generally, developing countries' macroeconomic volatility is a consequence of substantial external shocks, uncertain public policies, rigidities at grass root level of eco-system and feeble institutions. Unfavorable external shocks generally bring uncertainty in the public policies of developing countries – as the key focus is on fire fighting instead of going for some long run objective.

The weakness of an economy towards balance of payment crises upsurges continuously in case when international reserves starts decreasing or are inadequate. Low level of reserves is a common sign for balance of payment crises which indicates that an adequate level of reserves must be sustained by economies which is a difficult task. External creditors have significant impact on balance of payment crises. Short term debts which are to be paid in near future serve as a standard to judge the level of reserves that either they are satisfactory or not. In other cases, the appropriate assessment for the level of reserves will be debt payments to be paid, as it can be a source of capital outflows.

Loayza and Raddatz (2006) highlighted that external sector is the key contributor to volatility in macroeconomic situation for economies in general and for developing countries in specific. Fatas (2002) concluded that external shock led macroeconomic volatility not only have a potential to

¹ Dynamics of external sector are reflected by balance of payment situation of the country. Balance of payment of the country documents the foreign inflows and outflows. Foreign inflows are mainly in the form of exports, workers remittances, loans, inward investment and any other inward flow. Foreign outflows are mainly in the form of imports, outward remittances, payments against loans, outward investment and any other outward flows.

bring additional uncertainties to business cycle, but can also put the economy under recession. Mendoza (1995) did the seminal work on formally documenting the association between volatility in macroeconomy and growth trajectory and concluded the presence of strong association between them. Hnatkovska and Loayza (2005) reiterated the conclusion drawn by Mendoza (1995) and highlighted that volatility in macroeconomy is more prominent and damaging for developing countries. They also found that external shocks play an important role in causing macroeconomic volatility. Hnatkovska and Loayza (2005) went further and quantified the relationship between external shocks and macroeconomic volatility for developing countries. They concluded that external shocks could explain at least 10 percent of variation in economic growth and quarter percent of the growth volatility.

While presence of external linkage has potential to bring severe macroeconomic variations to the developing countries, absence of external sector could put the country on vicious circle of under development. Collins (1995) highlighted that presence of the external sector provides developing countries the opportunity to graduate from their developing status – especially through adoption of technology, market development and bridging demand supply gaps. Literature also suggests that the external sector significantly influences both demand and supply patterns of the economy. It ensures that domestic consumers have the right number of fair priced choices available for their consumption decisions. On the other side, it also ensures that domestic producers have access to the foreign markets and they do not have to limit their production to the domestic demand only.

The external sector can facilitate and accelerate economic growth for developing countries or can make it more difficult and slower. Developing countries, unlike advance economies, are usually more prone to external shocks due to high dependence on global economic activities. Generally, countries with strong external account can enjoy more freedom for their internal policies while the

weak external account can force governments to concede on internal policies. External sector led macroeconomic volatility is considered a pivotal source of inadequate economic performance. To have stability and consistency in macroeconomic management, acquiring equilibrium in domestic and external sector is the key. Achieving such equilibriums results in optimum domestic demand and exchange rate consistent with both internal and external and balances (Opoku-Afari 2004). However, such equilibriums can only be achieved if country is able to hedge against external shocks. Such hedging is possible if policy makers are able to adopt proactive approach in policy formulation, which demands complete assessment of external vulnerabilities.

In respect to external sector, vulnerability means the degree of defenselessness that an economy is actually confronting against a possible external shock. However, it is pertinent to mention here that presence of vulnerability does not make certain that a crisis is imminent; it only sets the stage for a crisis to happen. It is the panic (or trigger) that turns a vulnerable situation to an actual crisis. Experiences of crisis countries reveal that expectations of market participants play a crucial role in igniting a crisis. However, the degree of vulnerability can certainly amplify the scale of crisis to take place. Economic vulnerability is exposure to the exogenous shocks. Sources of shock can be environmental, external or domestic shocks. But the question here is that how can we measure this harmfulness. The main concern is the possible negative shocks on growth which is dynamic definition of vulnerability. Supriyada (2015) constructed a composite indicator of external vulnerability for Indonesia. Results showed that the composite index may give a warning of signal before the crisis occurs, therefore the twelve selected variables were able to describe the external vulnerability and can be used as early warning system to predict the crisis.

Pakistan has traditionally been a country with continuous distress for its balance of payment situation. Last three decades have proven that balance of payment distress remained a norm for

Pakistan rather an exception. Every couple of years, country was in a situation with no other option for balance of payment rather to go for a bailout package from international financial institutions. This puts Pakistan as a classic example, where external pressures and conversion of vulnerability into reality remained a norm rather an exception. Pakistan has been in consistent external pressures and bail out is more of a norm – in total 20 IMF programs² to overcome balance of payment crisis in the history. Basically, IMF has 189 countries and they contribute to a pool through the quota system so when a country has balance of payment crisis that country can draw from that pool which is referred to as bailout. A balance of payment crisis happens when a country is incapable to pay for imports or repay its external debt. The local currency also declines sharply in value. This results in a situation from which escape is very difficult so the IMF steps in to provide debt so the balance can be restored and the crisis can be resolved.

So, the balance of payment crisis can be linked with the IMF bailout packages that whenever there was a crisis in Pakistan, it reached IMF for bailout. Vulnerability of Pakistan's macroeconomy to external shocks has also increased substantially in last three decades. Last few decades have witnessed a substantial enhancement of connectivity of the country with the external world in the form of trade, investments and socio-political coordination. Pakistan's total trade that used to be less than \$30 billion in FY00 has grown to over \$83 billion in FY18. Inward foreign direct investments have increased 7 times when compared to FY00. Worker's remittances have flown up to \$19 billion in FY18 from a meager amount of \$1 billion in FY00. Threshold level of foreign exchange reserves has also increased multiple times since FY00. However, along with these positive developments, reliance on foreign loans through individual countries and IFIs has also

² Bailout packages from IMF are taken as the lead example, mainly because these packages are solely for improvement of balance of payment crisis while the assistance from other International Financial Institutions are sometimes for the budgetary support while for other times is for project financing.

increased notably. Moreover, past expansionary policies have also increased the gap between savings and investments, which is reflected through large current account deficits. All this along with so many other developments made the economy vulnerable to external crisis.

It is evident from the discussion on different parts of external sector of Pakistan, that assessment of health of external sector is important for the growth trajectory of the country. A mechanism of early warning system can enable the host government to introduce policies to minimize the effects of shocks originating from the foreign country. Such system brings proactive approach to the host government instead of reactive approach. However, building this warning system is not a straightforward task. A variety of macroeconomic indicators with a potential to proxy external sector are available and hence gives a huge discretionary power to the researcher and policy maker to report on the health of the sector. This discretion in selection of variable and possibility that each variable can provide contradictory conclusions on the health of external sector, gives policy makers a chance to play with numbers for their political gains.

This practice is more of a norm in Pakistan – previous government still claims that external sector was in good shape when they left the office while the current government is making huge outcry on the health of external sector. The difference is coming from the selection of variable – previous government using level of foreign exchange reserves as indicator for the health of external sector while current one is relying on debt repayments. Both are justified in their approach because no composite indicator is available in the case of Pakistan to assess the external sector. However, this has resulted in ambiguities about the actual level of vulnerability and could result in wrong policy prescription.

Pakistan has been facing problem with its balance of payment since independence, cotton and rice are the main exports of Pakistan, so whenever there is an external price shock the agricultural products are affected badly. Another factor is that Pakistan is being financed by foreign debt that increases the foreign debt. Our economy is dependent of remittances largely. The lack of continuity in government policies discourages the foreign investors to invest in Pakistan which can cause balance of payment problem. Globalization and development of different economies and financial markets have a direct impact on currency attacks and different balance of payment crises. Balance of payment crises occur due to many reasons. Every economy faces different situations and factors which cause balance of payment problems for that economy. (Rehman and Rashid (2006))

Eichengreen *et al.* (1995), Frankel and Rose (1996), Eichengreen and Rose (1998), Kaminsky and Reinhart (1999), Glick and Moreno (1999), Aziz *et al.* (2000) and Caramazza *et al.* (2000) are main proponents of qualitative comparisons. They advocate that visual inspection of economic indicators right after the financial crisis and their comparison with the trends of same in normal period or with the countries where crisis has not happened provides a solid ground for benchmarking different thresholds to investigate the probabilities of future crisis of similar nature.

Sachs *et al.* (1996), Eichengreen and Rose (1998) and Corsetti *et al.* (1998) are the main critiques of qualitative comparisons. Their main criticism on the comparison approach is that the structure of the economy is not static over time and not homogenous across countries. Hence apple to apple comparison of different macroeconomic indicators will be misleading. They have advocated that there should be some econometric models which can test whether the indicators being analyzed are associated with the probability of crisis and to incorporate the changing structure of economy. Edison (2000) and Goldstein (1998) are the founders of non-parametric approach and argued that it is practically difficult to include all the relevant indicators in an econometric model. They

highlighted that time and availability of data are constraints for econometric modelling approach. So, they proposed non-parametric estimation, which allows inclusion of even the variables with missing quantitative details. They also highlighted that signaling approach can be used in tandem with non-parametric estimation to ensure that every related dimension is included.

Unlike the differing views on the selection of methodology, literature has a consensus on the selection and inclusion of macroeconomic variables to assess the external vulnerabilities. There is an agreement that every variable, which has backward or forward linkage with the external sector needs to be included in the vulnerability index. However, there is need to assess that impact of one intervention or happening is not captured by multiple variables. In such case, researcher has to be made a decision on inclusion and exclusion from the variables capturing similar kind of external linkages. While constructing such aggregate measures, the focus is on selection of appropriate macroeconomic variables and the methodologies enabling such aggregation. There is plethora of research available on the appropriate variables while in respect of aggregation methodology the available literature can be divided in three main groups – qualitative comparisons, econometric modeling and non-parametric estimation. However, these groups of literature are more focused on building financial early warning system and very few have focused external vulnerability index.

Increasing pattern of balance of payment problems in Pakistan – mismatch in the external account of sufficient sized causing significant risk to repayment capacity of the country – has forced researchers and analysts to focus more on building the instruments, which can early predict such crisis. Relying on politically motivated selected variable to reflect external sector performance is quite a norm in Pakistan. Such practice has led the country to a situation where bail out packages are the only option to avoid crisis. This has also resulted in lack of proactive approach to hedge against the external shocks. Both these problems could be solved by constructing a composite

indicator of external vulnerability. Such indicator will function as the early warning system for policy makers. This study is an attempt to construct an index to gauge the degree of external vulnerability for Pakistan. Such an index will help in providing an informed judgment regarding the overall performance of external indicators.

1.1 Problem Statement

Assessment of health of external sector is important for the growth trajectory of the country. A mechanism of early warning system can enable the host government to introduce policies to minimize the effects of shocks originating from the foreign country. Such system brings proactive approach to the host government instead of reactive approach. However, building this warning system is not a straightforward task. A variety of macroeconomic indicators with a potential to proxy external sector are available and hence gives a huge discretionary power to the researcher and policy maker to report on the health of the sector. This discretion in selection of variable and possibility that each variable can provide contradictory conclusions on the health of external sector, gives policy makers a chance to play with numbers for their political gains. This practice is more of a norm in Pakistan – previous government still claims that external sector was in good shape when they left the office while the current government is making huge outcry on the health of external sector. The difference is coming from the selection of variable – previous government using level of foreign exchange reserves as indicator for the health of external sector while current one is relying on debt repayments. Both are justified in their approach because no indicator is available in the case of Pakistan to assess the external sector. However, this has resulted in ambiguities about the actual level of vulnerability and could result in wrong policy prescription.

To overcome this issue, literature suggests constructing a composite index of selected quantitative indicators to have a collective picture of changing external vulnerabilities rather than looking at different indicators in isolation – index known as External Vulnerability Index (EVI). Although plethora of research is available on external vulnerability indices, not even a single study has been conducted on Pakistan for indexation of entire external sector. There are few studies for Pakistan on the construction of index for debt servicing and sustainability and index for banking sector soundness. However, there is no study for Pakistan that covers the entire external sector. This composite indicator can work as the early warning system and helps countries to create policy shields against the external shocks proactively. However, Pakistan has miserably failed to proactively address the impacts of external shocks. Country failed to bring any proactive policy to protect itself from external shocks originated through the financial crisis of 2007. Policy makers only came to know about those shocks once impact start materializing in the form of low exports.

1.2 Research Questions

Although aggregation of different indicators under EVI provides a solution to the ad-hoc approach, it also originates few pertinent questions.

- What will be process through which the proposed aggregation has to be made?
- How to address the potential neutralization of external vulnerabilities in a composite indicator? – two different vulnerabilities can cancel each other in the aggregation process.
- How the variables will be selected?
- The foremost important is whether the constructed indicator has the potential to work as early warning system for Pakistan or not?

1.3 Objectives

Study has following key objectives:

- To construct External Vulnerability Index by following model-dependent approaches.
- To assess the capacity of constructed external vulnerability index to work as early warning system for balance of payment crisis.

2 Chapter 2: Literature Review

In this chapter there will be a complete literature review about the topic which will include the theoretical review as well as empirical review. This chapter is comprised of the Causes of balance of payment crisis, Major balance of payment crisis in the world, Early warning systems, Indicators of early warning, Models that has been used to construct the vulnerability and Balance of payment crisis in context of Pakistan. Then from this extensive literature review the literature gaps will be found and how this study will fill those gaps.

2.2 Theory

2.2.1 Causes of Balance of Payment Crisis:

In any economic system, different type of changes take place, and mostly in developing economies these changes are tremendous. These changes in Global financial markets and in emerging economies have a significant effect on origin of crisis. In traditional Balance of Payment Crises, the fundamental imbalance consists of several macroeconomic inequalities. These macroeconomic inequalities include financial discrepancies which are financed by money creations that some points become dissenting with an exchange rate peg. In contrast with the traditional Balance of Payment systems in Modern Balance of Payment Crises many issues occur including Self-Fulfilling Speculative Attacks, poor domestic financial markets. These serve as the most prominent causes in the upcoming capital movements. By nature, the two types of determinants of balance of payment crisis are not jointly exclusive and in some recent balance of payment crises the traditional macroeconomic disparity are clearly distinguishable (Berg *et. al* (1999))

Globalization and development of different economies and financial markets have a direct impact on currency attacks and different balance of payment crises. Balance of payment crises occur due

to many reasons. Every economy faces different situations and factors which cause balance of payment problems for that economy. Though factors causing balance of payment issues may differ from each other in every economy but there are different factors which are common in all these economies. International Assets may become too much low or external debt commitments level may increase too high compared to the existing resources. Prices of assets held globally may also follow a continuous pattern (Rehman and Rashid (2006))

It is evident that the above indicators are not as such useful if they are not measured in combination with “Fundamentals” i.e. domestic macroeconomic conditions and peripheral balances of the country. The vulnerability levels given by any foreign reserves would be different at the time when investors show their interests towards developing economies. Another set of indicators is found in international markets. When prior discussed factors were controlled then a development in prices may offer signs of high risks.

2.2.2 Major Balance of Payment Crisis in the World:

Several countries around the globe nevertheless developing or developed faced many financial crises which are either balance of payment crises or banking system failure. If we look at the history about balance of payment crises in the world than we can see that there are two decades which illustrates the progression of crises. There are three different models approaching these crises. (Agenor *et al.*, 1992) First one is the debt crises of 1980's which started when Mexico holds its payments in August 1982 and these crises sustained for almost a decade. These crises imitated a combination of domestic inequalities and external shocks which are developed behind the excessive capital inflows of preceding years.

Many researchers and policy makers have worked on finding the reason for debt crises and most of them are of the view that mostly debt crises are a result of blend of 1) different negative external

shocks, Such as: continuous decline in trade, sudden upsurge in U.S. Dollar interest rates, and Global economic slowdown 2) internal Macroeconomic Disproportions which affect numerous debtor countries. Such as: Financial deficits and Currency Overvaluation or Devaluation of Home currency.

Most of the policy makers and observers have drawn lessons from 1980's crises and they referred towards the need for suitable domestic macroeconomic policies and some structural reforms that will help in making the economies most robust against external shocks.

Cline (1995) opined policy perception of two types:

- To launch far-reaching structural reforms (Privatization and Trade liberalization)
- To pursue strong macroeconomic policies (With reference to financial deficits)

It is important to note here that problems associated to banking systems was unable to seek a prominent place in any type of analysis of debt crises of 1980's. Different debtor countries particularly in south faced many banking crises and the reason coated behind these crises was poorly regulated banking systems. This problem of the banking crises was not observed as the deficiency that is being caused by external debt defaults.

Second one is the Mexican crises of 1994/95 which is of some different sort as compared to crises of 1980's and hence it is having different explanations and fundamentals. Many economist ant policy makers have pointed towards self-fulfilling prophecies by market members which are considered responsible for the downfall of Peso. In addition to this it was also noted that susceptibility in the economy make the speculative attack.

Two measures were presented by Calvo and Mendoza (1996) aimed to precise the susceptibility of the Peso to a speculative attack. These measures are: Inadequacy of international reserves relative to M2 (which measures domestic liabilities of both the central bank and the banking system) and capability of international reserves relative to external short-term debts (which may be of both Government and Private Sector)

After these crises many policy makers and economist joined hands regarding tackle such economic downfall issues. They tried to draw conclusions about what are the reasons behind these crises and what could be the best way to deal with such problems. Summers (1995) proposed then lessons learned from Mexican Crisis which are different from the conclusions drawn from the debt crises.

The sustainability in domestic policies is still at the top of the list, here emphasis is to figure out the ways to deal with unpredictable financial markets. Another recommendation given by Summer's is to maintain current account balance within moderate bounds (where deficit is not exceeding 5% of GDP) to reduce speculative attacks in economy

In 1997/98 crisis occurred in Asia. These crises were very much different from the previous ones. These crises were not caused by any type of weak economic fundamentals or any type of sudden shifts in investor's confidence. As compared to all previous currency crisis, this time the Asian currency crisis was noted by poor supervision of financial sector which was followed by the profound / open capital markets. This thing initiated some sort of serious vulnerability in financial sector.

This initiated a thoughtful monetary sector vulnerability. Real estate sector supports a lot to economy as it is a big source of revenue generation. After these events, the real estate sector was enforced greatly. As many of the Southeast Asian countries have attached their currency to U.S.

Dollar, also they are having enormous current account deficits and they rely on foreign debts. These economies mostly depend on foreign investors and in some cases these investors have a strong influence on the economy of that specific country. Considering these economic improvements and suitable environment the Southeast Asian economies foreign capital investments in form of many shapes of investment in different fast-growing sectors. Investors were preferring to invest in these fast-growing economies, but they were surprised when currency crisis started in Thailand. These crises captured the whole region and as a result most of the foreign investors pull out their investments.

Chang and Velasco 2000 are of the view that after the currency crisis in Asia the third-generation models spotted the adverse impact of financial sector's susceptibility. The core issue of these theories was summarized by Pesenti and Tille (2000). Obvious and Implied government guarantees including fixed exchange rate system or a currency peg, eagerness of government bailout in some cases of distress initiated wrong inducements for the financial sector and upsurge moral hazards.

Mostly financial intermediaries are involved in highly risky projects where they ignore the risks associated with currency. Financial sector vulnerability is described by improper supervision of the financial sector in open capital markets, highly dependent on foreign investment or financing, maturity mismatch of assets and liabilities. In such conditions government takes different measures and sometimes starts rescue operations for these troubled financial systems which in result enforces a burden on the public. Third-generation theories focus on "contagion" which means the transmission of crises through different channels, like trade links and international capital flows.

In any economy the banking sector, foreign exchange and public sector are linked with each other. All these three theories are related to currency crisis. The first- and second-generation theories emphasis on interaction of public finance and foreign exchange markets, while the third -

generation theories focus on importance of financial sector in an economy. There are different currency exchange theories and they do not oppose each other instead they complement each other. These issues regarding external, financial, fiscal and real sector can be covered by conduction an advanced analysis of currency crisis in an economy.

Theoretical considerations indicate that a systematic distress in banking sector point out the financial sector vulnerability. Extreme financial deficits indicate the worsening of government finances and increase the chances of foreign debt crisis. The interdependency between Banking crisis and balance of payment crisis was illustrated by Kaminsky and Reinhart (1999) showing that the probability of currency crisis is higher when an economy is facing crisis in Banking Sector. The efficiency of an early warning system can be improved by differentiating between Currency Crises, Debt Crises and dual currency crisis. (Bauer *et al.*, 2007).

Economic and Financial crises affected several countries of the world. Turkey is also in the list of these affected countries. The most severe crises faced by Turkish economy happened on April 1994 and February 2001. Ari (2012) tried to demonstrate the potential causes of these economic crises. Amid this purpose he developed a Binomial and Multivariate Logit model to approximate the predictive ability of the Financial and Economic indicators. It is concluded that the Turkish economy crises occurred due to High Money Supply Growth, Excessive Budget Deficits, Sharp Rise in External Debts, Increasing Risks in Banking System and most probably External Shocks.

The global financial crises in 2007-08 grabbed the attention of economists, policy makers and higher authorities to develop such methods which can better forecast the financial crises going to happen in near future and to make mitigation strategies in advance to decrease the impact of crises in case if they happen. Papadopoulos *et al.*, (2017) tried to aid in this regard. Their important contributions are:

- Developed an Early Warning System that will provide 7-12 quarters advance warning of crises with highest accuracy rate.
- Their developed Early Warning System can be applied on regional basis around the globe. Most Importantly it was perfect for Europe.
- Methodology followed by this Early Warning System was transparent. As it was working on macro level economic data which is easily available in market.
- In Their Early Warning System Two new methodologies were introduced which are:
 - Ternary State Classification to make sure minimum warning period.
 - Fitting and Evaluation Criterion. Which prioritizes errors mostly occurring during classification.

Their Early Warning System was considered very useful for economists and policy makers because whoever uses this system enjoys a high probability of accuracy in predicting the future crises. Currency crises can occur in any economy which can also have a severe impact on that economy because it creates an uncertain economic condition which prohibits investors to invest in that economy. Currency crisis theories came long ago, and these theories and structural models are transformed to empirical models by joining the elements of currency crises in all three generations. For this purpose, many policy makers from both public and private sector are working on early warning systems and are using them in prediction of potential crises, so that they can be prepared for those crises and they can make some suitable strategies to tackle those crises.

2.2.3 Early Warning System:

Early warning systems were considered useful and many of them were very popular. The most popular Early Warning Systems were designed by Kaminsky *et. al* (1999), Berg and Pattillo (1999), and the IMF's Division for Developing Country Studies (Borensztein *et. al* 2000). These systems formed basis for several other models related to different forms of financial crisis, including: Early Warning System for Balance of Payment problems which was designed by Bussiere and Fratzscher (2006). They considered the current account. Similarly, another system named Early Warning System for Sovereign Debt Crisis designed by Ciarlone and Trebeschi (2005).

There are many Early Warning Systems developed and Implemented to predict the economic crises in different economies around the Globe. These systems are improved gradually but no system is perfect in this world which can predict the exact crises. Similar was with the Global Economic crises of 2008. No Early Warning System predicted them correctly. Several researches have shown that KLR model shows better performance made some amendment in KLR Financial Crises Early Warning System on the basis of actual economic environment. After amendments implemented this new model implemented on available data which showed more better performance. This new KLR Model after amendments can be applied on different economies to predict economic crises.

Early Warning Systems play important role in the prediction of economic crises and these systems have been developed by different economies. These systems warn policy makers about crises in near future. Different amendments are made in these early warning systems with the passage of time compared to trends in the economic environment. These early warning systems are based on empirical models and diverse approaches. Hence their performance is different. Alessi *et al.*, (2015) compared the performance of nine early warning systems predicting Banking Sector Crises

based on work of Macroprudential Research Network (MaRs) which was originated by European System of Central Banks. All these models were implemented on same data provided by MaRs just to make sure comparability. They evaluated these models based on their usefulness by comparing ratio of missed crises and false alarms. It was concluded that multivariate models, are better than simple signaling models. It was also recommended by the researchers that policy makers can be more benefitted by taking a broad methodological approach at the developing stage of these models.

2.2.4 Indicators:

Chui (2002) tried to find out the leading indicators of balance of payments. Aiming this purpose, he reviewed theories of balance of payment crises and their implications to classify the potential indicators of crises. The empirical approaches to balance of payments are also discussed which are: Discrete Choice, Signaling and Structural Approaches. It was concluded in the study that the list of indicators in any theory are valuable for policy makers as they can make their policies keeping in mind these indicators which may be helpful in averting financial uncertainty.

Reinhart (2000) conducted a study on early warning system to assess the vulnerability in emerging markets. Predicting the exact time of crisis remained an elusive task for the policymakers and academics. The top five indicators used in this study are real exchange rate, stock prices, M2/reserves output and exports for currency crisis. However, the single indicators don't use the information provided by univariate indicators because the different forecast ability of every single variable is not accounted. Therefore, a composite indicator is needed.

Herra and Garcia (2000) developed an early warning system of Macro vulnerability for several Latin American countries, they built a composite indicator that uses signaling approach to show that crises tend to happen in those situations. They differentiated their work through reducing the

set of variables to generate the signals and variables were aggregated first and then signals were issued that depends on the behavior or composite index that was opposite to Kaminsky and Reinhart (1997) where the signals were generated with each variable and then aggregation was done. The leading indicators that were used are Real effective exchange rate, domestic credit growth, inflation and M2/international reserves. It was shown that the variables clearly indicated the periods where crisis was more likely to happen.

Athukorala and Warr (2002) conducted a research to find out the root cause of Asian Economic Crises and found that macroeconomic situations of all countries facing crises were having three common attributes: 1) Domestic Lending Booms, 2) Overvalued Exchange Rates, 3) Rapid Accumulation of Mobile Capital. They concluded that in all these Asian countries the common mistake which led them in financial crises is “Policy Errors”. All those Asian economies which were having good and foreseeable policies did not faced such situations.

Frankel and Saravelos (2012) examined that whether leading indicators can explain the 2007-08 financial crisis. The indicators were determined by extensive review of literature. It is suggested that central bank reserves and real exchange rate were two leading indicators that was helpful in explaining the crisis. The other indicators included external debt, capital flows, GDP, Exports and Imports, Real interest rate, real effective exchange rate

Licchetta, M. (2011) applied a new technique to measure the determinants of currency crises. He used external Balance sheet variables as determinants of currency crises in developing economies. He Used Random Effect Probit Model and assembled a panel data of 40 countries for a time period 1980 – 2004. He concluded that: The most important role in crises is played by the Composition of country’s external balance sheet and Emerging Economies are more sensitive to external balance sheet variables. It was also found that Foreign Capital Flows plays a dominant role in

emerging economies. The chances of crises are increased when Real Exchange Rate Increases, A boom in Foreign Currency comparative to international reserves, Low GDP Growth Huge Current Account Deficits.

Bucevska (2011) examined the economic crises in EU member Countries (Carotia, Turkey and Macedonia). The aim of this examination was to find out the factors leading to financial crises in these economies and also to develop the best performing Early Warning System to predict these financial crises. A binomial Logit Model was used by the researcher for the quarterly data ranging from 2005-2009. It was concluded by the study that the Financial Sector Variables (Total Bank Deposits as compared to GDP and Domestic Loans) and Capital Account Variables (Total Foreign Debts relative to Exports) are having the maximum contribution to all early warning indicators. It was also known from the results that several variables lead these economies to financial crises. It was also suggested by the researcher that to these economies must have to decrease the stock of external debt and periodically analyze the financial status of their countries.

Mirko (2009) used probit model to test the impact of balance sheet variables on currency crisis in developing and developed countries. Developing countries are more prone to shocks related to external balance sheet variable than developed countries. Economies with fixed exchange rate regimes were more sensitive to external balance sheet liabilities than the flexible exchange rate regime. It was found that the chances of crisis increase when total liabilities increase particularly in developing countries and decreases when the share of foreign direct investment increase in total liabilities. As a large stock of external debt implies large dependence on foreign financing the country's vulnerability to crisis also increases with the increase in external debt. It is suggested that the foreign capital inflow is determined by external factors so if there will be the larger inflow, country will be more sensitive to the external conditions. The chances of crisis increase when real

exchange rate raise, large current account and budget are in deficit, GDP growth decreases and if the neighbor country is also in crisis. The first and second-generation models were not good at explaining the 1997 Asian crisis which lead to the emergence of third generation models. However large foreign direct investment inflows and high level of bank deposits reduce the country's vulnerability to currency crisis.

Berasaluce and Romero (2016) examined the relationship between Korean external sector and economic growth, imports, exports and foreign direct investment. Vector Autoregressive Model, Granger causality test, Johansen cointegration test and Wald test were used. It was concluded that foreign direct investment doesn't have much impact on economic growth.

Viktor (2018) examined the factors that triggered the banking and currency crisis by specific macroeconomic and financial variables. The study implemented dynamic binary choice panel data model with fixed effects which utilizes the maximum likelihood estimator with bias corrections to account for the incidental parameter bias. It is indicated that the change in exchange rate has positive effect on likelihood of currency and banking crisis.

Tuomas (2006) compared the commonly used probit model and new method known as multi-layer perceptron artificial neural network (ANN) model. Both the models signaled the currency crisis accurately in-sample but their power of predicting out of sample is poor. It was also confirmed that developing countries with fixed exchange rate regimes are less exposed to the currency crisis. However, constructing a more stable model that can predict currency crisis is a difficult task.

Babecky Jan *et al.* (2012) used panel vector auto regression to show that currency and debt crisis were preceded by banking crisis but baking crisis cannot be preceded by currency and debt crisis. The early warning indicators of crisis were identified for the developed countries by using

Bayesian model averaging. Currency crisis is preceded by increase in interest rates and also by deficits in government balances and decreasing foreign reserves. By using signaling approach it was shown that using a composite indicator increases the usefulness of model as compared to the best single indicator. However, determining the exact timing of crisis and end of crisis is a not possible.

Daniela *et al.* compared the early warning systems that are widely used among international financial institutions and private financial sector. KLR leading indicator approach is based on signaling, that is univariate approach and couldn't predict much accurately so then Berg and Pattillo (1999) crafted its extension by sing composite indicators using multivariate technique this technique was also called probit approach which outperformed the KLR-based probabilities. As far as market pressure index is concerned, Bussiere and Fratzscher (2002) designed a new multinomial logit model, they took changes in real exchange rate and changes in interest rate in index, they defined currency crisis as an event when the pressure index is at least two standard deviations above its country average. This multinomial approach performed better than the binomial approach in as well as out-of-sample. Abiad (2003) estimated Markov-switching model that focus on endogenous identification and characterization of crisis periods. However, the multivariate approach is better than univariate.

Savas *et. al* (2017) developed early warning system that provides 7-12 quarters warning with high accuracy in out-of-sample testing. Multinomial logit regression, discriminant analysis and neural networks was used. The early warning systems enjoys high accuracy. Discriminant analysis did best with accuracy of 85% and neural network with 94% accuracy. Further analysis showed that policymakers who use these methods enjoy high probability that future crisis will be signaled well

in advance and warning of crisis will not be false alarms. Early warning system correctly warns about the crisis but it fails to predict the timing of crisis.

Steven *et. al* (2001) developed an early warning approach to identify the impact of domestic and external factors in developing countries crisis. Probit models were used for 26 developing countries. It was shown adverse external shocks and large external imbalances contributed little to the probability of crisis in developing countries than the domestic factors, but they cause much more of the spikes in the chances of crisis to occur when the crisis actually happens. Therefore, it was suggested that domestic factors have also contributed to vulnerability of developing countries but external factor are also important in pushing economies into financial crisis. Flexibility in exchange rate may help to neutralize the impact of external shocks.

Balaga and Padhi (2017) examined the exposure of Indian economy to currency crisis by using KLR methodology. The focus was on building an early warning system to predict the future crisis. The variables used in the study were imports, oil prices, gold prices, current account deficit, exports, terms of trade, real exchange rate, reserves, real interest rate, stock process, bank credit, output and fiscal deficit. Results showed that there no single variable that gives the whole picture of crisis.

Oyong *et al.* (2018) conducted a study to address the early warning system for Indonesia and also proposed the early warning system with the early detection of vulnerability to the crisis. It's an effective step to determine the vulnerabilities which gives the policymakers plenty of time to response to prevent the crisis. Vulnerability indicators were also determined and an index was generated with fuzzy logic method. It only aims to capture the triggers of crisis, it cannot predict the timing and type of crisis. The variables used are external debt, exchange rate, inflation, imports, exports, reserves, real exchange rate, term of trade, M2, credit, current account and GDP. While

the significant variables are current account, credit, exchange rate, exports, M2, real exchange rate and term of trade.

The Glitches in Balance of Payments play an important role in financial crisis theories. In today's world there are three theories which deal with generation of currency and crisis in currency. First one is the Traditional Approach which is credited to Krugman (1979). He viewed crisis associated to currency as an attached exchange rate rules and regulations which are being made by unsustainable policies or essential disparities which affect the validity of an exchange rate. Any country which is maintaining a static exchange rate and runs monetary policies to provide finance to the excessive financial discrepancy. An immediate speculative attack can drain the foreign currency reserves and this thing can enforce the policy makers float the currency resulting in currency devaluation.

Krugman's model (Also named as First-Generation Model) was first modified by Flood and Garber (1984). Later it was also expanded to Crawling Pegs by (Connolly 1986) and Currency Bands by (Krugman and Rotemberg 1991). These models have been so long used to enlighten both Debts and currency Crisis in most emerging nations or developing countries in 1970s and earlier 1980s. But these models were unable to foresee the collapse of European Monetary System in 1992/93 and Later Devaluation of Mexican currency in 1994. This indicates that these theories need some modifications because of their poor functionality. And due to this reason, these theoretical frameworks intended for currency crisis were revised and extended

The second-generation models go back to Obstfeld (1986; 1996) and Krugman (1996). Focus of the first-generation theories was on currency crisis and they viewed currency crisis are because of poor economic fundamentals, While second-generation theories views currency crisis as sudden shifts in investor's confidence (Pesenti and Tille 2000). The product of collaboration among

expectations of investors and actions of policy makers is Multiple Equilibrium which leads towards “Self-Fulfilling Balance of Payment Problems”. This equilibrium is settled by the investor’s expectations regarding policy makers willing to uphold a peg or to float the currency.

Ciarlone and Trebeschi (2005) used Multinomial Logit model to check the early warning systems. This model differentiated between three regimes named: “Tranquil”, “Pre-Crises” and “Adjustment”. The model using a large set of macroeconomic factors the model was able to predict from the sampled variables. 78% of onset of crises while 34% Tranquil cases.

Comelli (2014) compared the parametric and non-parametric early warning systems for currency crises in developing economies. He concluded that the parametric early warning system is superior than non-parametric early warning system as the chance of errors are low in parametric early warning system.

Fontaine (2010) empirically tested several theoretical models to point out the dynamics behind currency crises. The main focus of the research was on developed countries which have strong economic and political environment and tried to find the impact of these two variables on currency crises. The output of the study suggests that in general conditions worsening in economic conditions and the chase of lax monetary policy engenders currency crises in an economy. It is also concluded that Exchange Rate Sustainability depends on quick and adequate response to shocks fragility of financial, economic and political system.

Ruslan *et al.*, (2018) examined the early warning systems for financial crises in developing countries. They used APT Multifactor Analysis and Early Warning System. Furthermore, Vector Auto regression was applied to the data within these approaches. The output showed that mostly the developing economies are more on more risk of financial crises resulting from Currency

Exchange Rates than Stock or Financial Position. In these developing economies the most appropriate approach to detect and lessen the impact of economic crises is to control the exchange rate.

Increasing pattern of balance of payment crisis in the developing countries – mismatch in the external account of sufficient sized causing significant risk to repayment capacity of the country – has forced researchers and analysts to focus more on building the instruments which can early predict such crisis. Significant portion of research – both from private as well as public sector – has been devoted to building of some aggregate measures which can be used as the early warning system. While constructing such aggregate measures, the focus is on selection of appropriate macroeconomic variables and the methodologies enabling such aggregation. There is plethora of research available on the appropriate variables while in respect of aggregation methodology the available literature can be divided in three main groups – qualitative comparisons, econometric modeling and non-parametric estimation. However, these groups of literature are more focused on building financial early warning system and very few have focused external vulnerability index.

Vulnerability means the risk of being negatively affected or harmed by unforeseen events. In economics these unforeseen events are called “shocks”, whereas economic vulnerability is exposure to the exogenous shocks. Sources of shock can be environmental, external or domestic shocks. But the question here is that how can we measure this harmfulness. The main concern is the possible negative shocks on growth which is dynamic definition of vulnerability. Guillaumont (1999) examined the economic vulnerability for low income countries that how it can be measured. He divided the vulnerability into three parts which includes shock, exposure and resilience. Indicators were aggregated into a composite index of economic vulnerability by drawing weights from their estimated impact on growth. The vulnerability of small country to the trade shocks that

is a primary commodity exporter results from the world price fluctuations because small countries are price takers, exposure to shocks through export to GDP ratio and from the capability of country to manage these shocks. (Guillaumont and Chauvet 1999) used close set of indicators to build composite indicator of vulnerability where the weights were drawn from an econometric exercise which reflected the estimated impact on economic growth of different indicators. The main components were instabilities in exports of goods and services.

Atkins *et. al* worked on commonwealth vulnerability index which is a composite index that includes separate variables to create a single indicator. It aimed to cover the quantifiable aspects of vulnerability. It's been argued that vulnerability is linked with the exposure to external shocks and environmental hazards. Principle component analysis was used to establish this index. Raw data was used and normalized before the aggregation was removed. Weights for the aggregation were estimated form the data. Economic exposure is associated with the country's trade and financial links with the international world, mainly dependence on international markets and susceptibility to external shocks. It can be reflected in trade openness, export concentration, capital openness, import concentration.

Norris and Gunduz (2012) developed an index that provided early warnings signals of growth crisis against large external shocks in low income countries. Multivariate regression analysis and univariate signaling techniques were used to map the indicators into a composite vulnerability index. Results showed the decline in vulnerabilities to a growth crisis in early 1990's. This index provides a tool to monitor individual country risks arising from the external shocks. Country fundamentals. Institutional quality, exchange rate regimes and size of shocks are important determinants of crisis. Probit model was used for multivariate regression to estimate the probability of crisis. While, univariate model uses each variable separately by averaging the indicators into a

summary index. The indicators that were used are GSP, external demand, terms of trade, foreign direct investment, aid, remittances and climatic shocks.

Supriyada (2015) constructed a composite indicator of external vulnerability for Indonesia. Study was conducted by selecting a number of variables by using signaling approach. The study got 12 indicators which were aggregated into a composite index of external vulnerability. Some of the main indicators are imports, exports, external debt, FDI and debt service ratio. As every indicator has different influence and performance that's why we need to assign weights to the indicators through weighted averaging. Each indicator had different scale of measurement therefore the normalization of indicators was done before aggregation into composite index, then each indicator was multiplied with its respective weight to obtain aggregate value to create the index. Supriyada (2015) showed in results that the composite index may give a warning of signal before the crisis occurs, therefore the twelve selected variables were able to describe the external vulnerability and can be used as early warning system to predict the crisis.

Eichengreen, Rose and Wyplosz (1995), Frankel and Rose (1996), Eichengreen and Rose (1998), Kaminsky and Reinhart (1999), Glick and Moreno (1999), Aziz *et al.*, (2000) and Caramazza *et al.*, (2000) are main proponents of qualitative comparisons. They advocate that visual inspection of economic indicators right after the financial crisis and their comparison with the trends of same in normal period or with the countries where crisis has not happened provides a solid ground for benchmarking different thresholds to investigate the probabilities of future crisis of similar nature.

Sachs *et al.*, (1996), Eichengreen and Rose (1998) and Corsetti *et al.*, (1998) are the main critiques of qualitative comparisons. Their main criticism on the comparison approach is that the structure of the economy is not static over time and not homogenous across countries. Hence apple to apple comparison of different macroeconomic indicators will be misleading. They have advocated that

there should be some econometric models which can test whether the indicators being analyzed are associated with the probability of crisis. They also stressed to assess whether changing structure of the economy needs to revisit the leading indicators from one crisis to the other. They shot down the idea to compare the indicators of crisis hit country with no crisis country and argued that every country is heterogeneous in the structure of their economy and hence is not comparable. Comparisons can only be made after establishing that indicators selected have similar impact on the economies of both kinds of countries. And to establish such relation, econometric models are essential.

Edison (2000) and Goldstein (1998) are the founders of non-parametric approach. They agreed with the proponents of econometric modeling approach, however highlighted that it is practically difficult to include all the relevant indicators in an econometric model. They highlighted that not only the time is a major constraint but also the availability of quantitative data on certain indicators is also a major blow to econometric modeling approach. They proposed non-parametric estimation which allows inclusion of even the variables with missing quantitative details. They highlighted that signaling approach can be used in tandem with non-parametric estimation to ensure that every related dimension is included.

Athukorala and Warr (2002) assessed Asian economies for vulnerabilities to currency crisis and found strong evidence that reserve adequacy and private sector credit to GDP ratio are significant leading indicators for balance of payment crisis. They also found that real exchange rate is a relatively weak indicator of balance of payment crisis – mainly due to the fact that most of struggling economies do not allow full pass through of external pressures to exchange rate. Study was conducted on 10 countries (5 each representing crisis and non-crisis) and utilized annual data from 1988 to 1997. Study relied on static approach – threshold levels were calculated through the

historical trends and comparison approach was used. Indicators selected breaching the threshold level of variation was considered as the signal for buildup of external vulnerabilities.

Loayza and Raddatz (2006) disagreed with the conclusion drawn by Athukorala and Warr (2002) by making a criticism that their study is incomplete in nature as they have not included any variable capturing external linkages. They also highlighted that Athukorala and Warr (2002) also failed to incorporate the dimensions of financial openness and financial depth of the economy. They have argued that without including variables of external linkages and structure of financial sector, conclusions made about potential of exchange rate and financial variables in identifying external vulnerabilities stands misplaced. They also highlighted that 12 annual observations and only 10 countries are too small a sample to draw any kind of conclusions. Loayza and Raddatz (2006) have utilized annual data from 1974 to 2000 for 90 countries and have included variables of trade openness, growth trajectory and financial structure of the economy. Using static signaling approach, they have concluded that trade openness and financial structure of the economy are the lead indicators for external vulnerabilities. They have also concluded that growth trajectory is only the outcome of effects of materialization of external vulnerabilities and does not contain any leading indicator content.

Results of Loayza and Raddatz (2006) are well aligned with the results of Razin and Milesi-Ferretti (1996), who have performed static analysis on annual data of more than two decades for six different countries. They have included exhaustive list of variables representing external and internal factor of the economy – current account balance, saving investment ratio, debt to GDP ratio, debt servicing burden, fiscal outlay, real exchange rate, growth trajectory and financial structure of the economy. Through static analysis, they have found out that structure of external liabilities, degree of openness, conversion ratio of saving into investment and real exchange rate

are the key determinants of current account dimensions of the economy. They have also concluded that current account itself is sufficient to vouch in for external vulnerabilities to an economy.

Results of Loayza and Raddatz (2006) are also in tandem with the results of Kaminsky, Lizondo and Reinhart (1999), who have performed static analysis on quarterly data of more than 25 countries. They have argued that developments in the external market are so dynamic that analyzing the annual data can waste the entire concept of early warning system. They have taken an exhaustive list of variables – structure of lending and borrowing in internal market, ratio of money supply and foreign exchange reserves, real exchange rate, growth trajectory, equity prices, short term debt, inflation, banking systems utilization of central bank lending facility, exports, imports and output gap. The study has concluded that exports, output gap and misalignment of real exchange rate are the key leading indicators for external vulnerabilities.

2.2.5 Balance of Payment Crisis in Pakistan:

Pakistan has been facing problem with its balance of payment since independence, rice and cotton are main exports of Pakistan, so whenever there is an external price shock the agricultural products are affected badly. Another factor is that Pakistan is being financed by foreign debt that increases the foreign debt. Our economy is dependent of remittances largely. The lack of continuity in government policies discourages the foreign investors to invest in Pakistan which can cause Balance of Payment problem (Rehman and Rashid (2006)

Khan and Saqib (2007) analyzed the vulnerability of Pakistan to economic crisis by evaluating the sustainability of external and fiscal position. They also determined the indicators of currency crisis that were domestic credit growth, exchange rate misalignments, real exchange rate, GDP, inflation,

external debt, oil prices, real effective exchange rate these are also the key indicators for Pakistan's economy.

Umer *et al.*, (2010) conducted a research aiming to analyse balance of Payments of Pakistan using Monetary approach. The study was conducted for time period 1980 – 2008. Error Correction Model, Co Integration and Reserve Flow equation were utilized in this study. The study concluded that Gross Domestic Product Growth Rate (GDPG) is positively associated with Net Foreign Assets (NFA), while there exists a negative relationship between Net Foreign Assets and Domestic Credit. NFA is also having a negative relationship with Interest. It was proposed by the author that monetary approach have a significant role, but Monetary actions are not only option for the economists to take corrective measures to maintain an equilibrium in balance of payments of an economy.

Felipe *et al.*, (2010) who were world bank analysts examined the degree to which Pakistan's economic growth is going to be which is forced by its Balance of Payments. They examined the supply and demand-oriented approach to economic growth of Pakistan. On ground Realities and Evidences proposes that the country's maximum growth rate is approximately 5% per year. This growth is far much below the target rate of growth in GDP of 7-8% per year. This balance of Payments forced approach provides inputs to policy makers of Pakistan. The Real Exchange rate is decreasing continuously, and this depreciation cannot lead to improvement in Current Account of the country. To improve the economic situation of the country Pakistan, have to lift the limitations on Exports and must have to increase the exports.

From the time of independence Pakistan has spent most of its time in crises and these crises have also made a bad image of Pakistan in foreign world. These Economic and Financial crises are due to poor Policies and negligence of governments. Atif Mian (2018) in his article proposed that there

are several reasons for the poor economy of the country in year 2018 but three most prominent reasons which lead Pakistan economy to this level are:

- The oil prices were very much lowered in previous year and at that time the government should have to take the advantage and must have to increase its foreign currency reserves.
- From the time of independence Pakistan is continuously facing a poorly managed financial system that enables tax evasion and helps to shift money out of Pakistan. This poorly managed financial system is directly affecting the balance of payments of the country as it is creating the financial and current account deficits.
- Number of exports of Pakistan are continuously decreasing and imports on the other hand are increasing rapidly. If we see our neighbor nations (Bangladesh and India) their exports are growing day by day which makes their economy strong. The government has failed to make any such policies to improve the exports.

Unlike the differing views on the selection of methodology, literature has a consensus on the selection and inclusion of macroeconomic variables to assess the external vulnerabilities. There is an agreement that every variable which has backward or forward linkage with the external sector needs to be included in the vulnerability index. However, there is need to assess that impact of one intervention or happening is not captured by multiple variables. In such case, researcher has to be made a decision on inclusion and exclusion from the variables capturing similar kind of external linkages.

Upal (2018) analyzed the market-based indicators to examine the external debt sustainability for Pakistan, in the study the marginal cost of external debt was examined through yields on Eurobonds and spreads in Credit Default Swaps traded in international market where the increase

in yields and spreads would signal that country's external debt is approaching an unsustainable level. Logit models were used to check if the changes in sovereign debt ratings of Pakistan can be predicted by the market-based indicators and concluded that the market pricing of Eurobonds and Swaps could give the signals regarding the marginal cost and external debt sustainability and could be used to manage the risk exposure of external debt of Pakistan.

State bank of Pakistan in its annual report has a chapter that includes the domestic and external debt assessment, there's a set on solvency and liquidity indicators used to assess the external debt sustainability of Pakistan. External debt sustainability only includes the debt portion of Balance of Payments and shows whether a country is able to pay its debt in future or not or is there enough reserves for the debt servicing. There is no index that includes the overall external sector and include imports, exports and remittances as well, so there's a need to analyze the whole external sector of Pakistan and how much vulnerable is the external sector to the shocks.

2.3 Literature Gaps

There are at least three distinct research gaps in the existing literature on external vulnerability index – no Pakistan specific study, no study using dynamic model and no study attempted the disaggregated approach to construct an aggregate index of external vulnerability.

Although plethora of research is available on external vulnerability indices, not even a single study has been conducted on Pakistan for indexation of entire external sector. There are few studies for Pakistan on the construction of index for debt servicing and sustainability and index for banking sector soundness. However, there is no study for Pakistan that covers the entire external sector. In recent decades, sustainability of Pakistan's external balances has become shakier mainly because of deteriorating trade account and declining repayment capacity of the country. Pakistan has

recently approached IMF for a bailout package – third time in last one decade. In total Pakistan has requested over 20 IMF programs since 1950. This has happened, because Pakistan has remained reactive to external shocks instead of opting for a proactive approach. Every time economy has a high growth for over three years, we have to seek a bailout package – mainly because of overheated economy and low resilience of the economy to external shock. Situation could have been different, if country had developed an early warning system and could have laid down proactive policies to neutralize impact of external shocks.

Almost all the available literature has relied on the static approaches – either simple averaging of different variables to construct an indicator or in very few cases weighted average but again from some static approach like principal component analysis (PCA). Although PCA provides the weights, it fails to incorporate the dynamic relation existing between variables of interest. It also fails to accommodate for the changing structure of the economy. Even not a single study has attempted to derive the weights for each indicator from a dynamic macro model.

Almost all the available literature has approached the external vulnerability index from a set of variables without differentiating the direction of relation between EVI and the variable under analysis. This is relatively a simpler approach to implement; however, it fails to address the issue of neutralization of external vulnerability by movement of two different variables.

2.4 How this study will bridge the research gap

This study will be the first of its kind for Pakistan and will attempt to provide an early warning system in the form of external vulnerability index to the policy makers to form proactive policies. Results of this study will enable policy makers to conduct counter factual simulations against the external shocks to bring continuity and consistency in the economic policies.

Study will be utilizing dynamic approaches to construct the external vulnerability index and hence will be contributing in the overall literature on the subject. Study will be the first one to construct such index from the dynamic macro econometric model and hence will be providing better interpretations for the index with the changing structure of the economy. Results of this study will supposedly be theoretically robust and hence will provide starting point for future research in this area.

As mentioned in the objectives, this study will attempt to construct the aggregate external vulnerability index through a disaggregated approach. And hence will address the issue of possible neutralization of sources of external vulnerability by movements in different variables. Study will attempt to construct the aggregate external vulnerability index by utilizing two sub-indices – trade related which have further two sub-indices and non-trade related. This will minimize the chances of neutralization of sources of vulnerability.

3 Chapter 3: Econometric Model and Specification:

3.1 Theoretical Framework

The literature found two reasons for the causes of balance of payment crisis. The first one is based on *contagion theory* that explains balance of payment crisis as a result of unpredictable financial panic and the second one is vulnerability theory which explain balance of payment crisis as an outcome of fragile macroeconomic fundamentals. Khomaik (2013) argued that Balance of Payment crisis shows weakening of fundamentals and establishment of contagion effect as the main factor of the crisis. If a country cannot defend itself from the Balance of payment crisis by its own policy, they should minimize impact of the contagion effect. Eichengreen *et al.* (1996), Kaminsky *et al.* (1998), Glick and Rose (1998), Kaminsky and Reinhart (2000) empirically investigated the concept of contagion. In most cases least squares and probit regressions prove evidence in favor of contagion, with trade channels favored over macroeconomic factors as transmission channels.

Gerlach and Smets (1995) considered two countries as linked together by trade in merchandise and financial assets. In their model, an effective attack on one country's exchange rate leads to its real depreciation, which increases the competitiveness of the country's goods exports. This produces a trade deficit in the other country, a slow decrease in the international reserves of its central bank, and ultimately an attack on its currency. Contagion can be transmitted when the crisis and deprecation in one country effects the import prices and overall price level in the other country by decreasing the import prices which in turn reduces its consumer price index and money demand by its residents, they try to swap domestic currency for foreign exchange which decreases the foreign exchange reserves in central bank so this situation can put the other country in crisis situation.

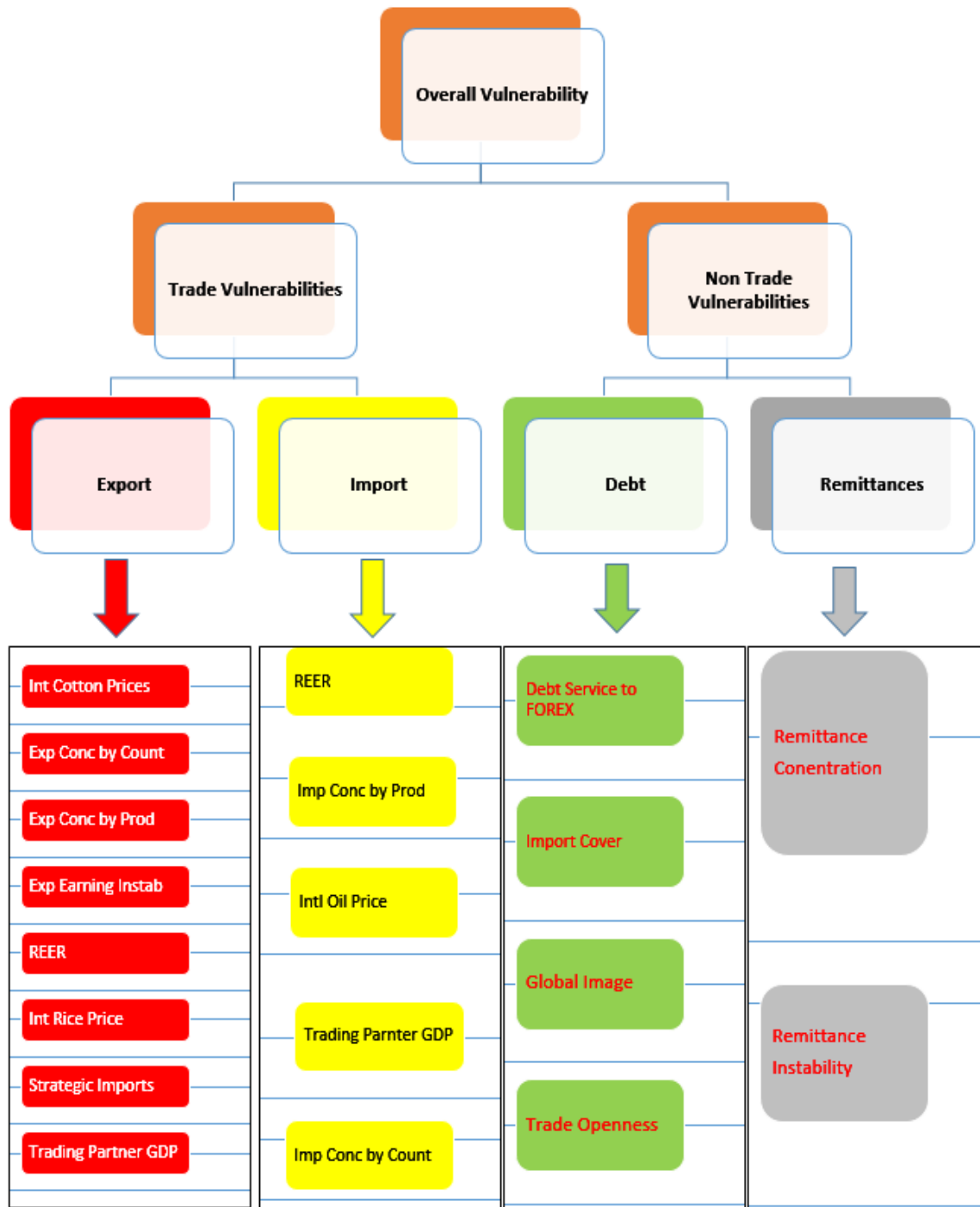
Kaminsky *et al.* (2002) used data for 20 industrial countries spanning more than three decades, and found that a speculative attack elsewhere in the world increases the chances of an attack on the domestic currency. They also tested for contagion in foreign exchange markets using a framework that distinguishes two channels of international transmission of speculative attacks. The first one is trade links, where attacks transmit contagiously to other countries with which the subject country trades. The second channel is macroeconomic similarities, where the attacks spread to other countries where economic policies and conditions are broadly similar. The results showed that the effect of contagion transmitting through trade is stronger than that of contagion spreading as a result of macroeconomic similarities.

Glick and Rose (1998) also argued that trade is certainly an important channel for contagion empirically, then the macroeconomic and financial influences. Most importantly it proves that trade links help explain the intensity as well as the incidence of currency crises as captured by measures of exchange rate pressure. They focused on explaining the pattern of contagion across countries for five different currency crisis periods. In trying to model contagion in currency crises, they did not miss the possibility of regional shocks common to a number of countries, nor the likelihood of contagion transmitting through non-trade related channels.

Eichengreen, *et. al* (1997) analyzed contagion in a group of 20 OECD countries. They defined contagion as an increase in the likelihood of crisis in a particular country given that there is a crisis elsewhere. Crises is identified as extreme high pressure in the foreign exchange market in their sample. They concluded that contagion seems to transmit more easily to countries that have close trade links than countries who have similar macroeconomic characteristics. Kaminsky and Reinhart (1998) used a similar strategy, although they used a larger sample of countries, define crises with a different criterion, and consider the effect of crises in alternative clusters of countries

on the likelihood of crisis in countries of that same cluster. However, they claim that financial links potentially are an important transmission mechanism. But they also argue that, due to the high correlation between trade and financial links, it is difficult to distinguish between the two channels.

So, in this study the trade and non-trade related variables are used to analyze whether changes related to these variables can affect the balance of payment of Pakistan by making its external sector vulnerable to external shocks. For trade related vulnerabilities Export and Import related variables are used. The main variables that effect the exports of Pakistan are International cotton prices, Export concentration by country, Export concentration by product, Export earning instability, Real Effective Exchange Rate, International rice prices, strategic imports, trading partner GDP. Import related variables are Import concentrated by country, Import concentrated by product, International oil prices, Trading partner GDP and Real Effective Exchange rate. Any change related to these variables will affect the imports and exports of country which can cause disturbance in balance of payment of Pakistan so this is the trade channel through which crisis can be transmitted or triggered in Pakistan. For non-trade related vulnerability, the variables taken are Debt and Remittances. There are variables that effect the external debt of a country which includes debt servicing to foreign exchange reserve ratio, import cover, global image, trade openness. Variables that effect the income from remittances are remittance concentration and remittance instability. So, all these variables affect the GDP of Pakistan and can make it externally vulnerable that's why these variables are used to measure the external vulnerability.



3.2 Econometric Specification:

For construction of export related external vulnerability index, this study has used nine variables to estimate the Johansen Co-integration. Variables includes index for international cotton prices, index for export concentration by country, index for export concentration by product, index for export earnings instability, index for real effective exchange rate, index for international rice prices, index for strategic imports of Pakistan, index for trading partner's GDP and Pakistan's overall exports.

For construction of import related external vulnerability index, this study has used six variables to estimate the Johansen Co-integration. Variables includes index for international import concentration by country, index for import concentration by product, index for international oil prices, index for real effective exchange rate, index for trading partner's GDP and Pakistan's overall imports.

For construction of overall external vulnerability index, this study has used sixteen variables to estimate the Johansen Co-integration. Variables includes variables like index for debt servicing to reserve ratio, index for export concentration by country, index for import concentration by country, index for import coverage ratio, index for remittance concentration, index for remittance instability, index for trading partner's GDP index for trade openness, index for international cotton prices, index for Export concentration by product, index for Export earnings instability, index for real effective exchange rate, index for International rice prices, index for import concentration by product, index for international oil prices and Pakistan's GDP.

3.3 Econometric Methodology;

To estimate the equations two methodologies will be used, Principal Component Analysis provides static weights while Johansen Co-integration provides dynamic weights which incorporates the structural changes in the economy as well.

3.3.1 Johansen-Juselius Co-integration Test:

For dynamic econometric models, this study will be relying on co-integration technique as it provides both short term and long-term dynamics and the information on adjustment process from disequilibrium to equilibrium.

Johansen cointegration technique actually shows a multivariate generalization of the Dickey-Fuller test used for unit root test. It is used to find out the long run relationship among variables. All conditions of Johansen cointegration test are satisfied for all variables.

Engel-Granger co-integration test is not appropriate in a multivariate set up and EVI remains a multivariate analysis in most of the cases. Therefore, Johansen-Juselius co-integration test is the most appropriate technique in the case of multivariate analysis when the order of integration is same. Johansen Co-integration procedure poses several advantages Engel-Granger Co-integration in testing for cointegration. Specifically, they may be summarized as follows:

- The Johansen Co-integration procedure does not, assume the existence of at most a single cointegrating vector, rather it explicitly tests for the number of cointegrating relationships;
- Unlike the Engle–Granger procedure which is sensitive to the choice of the dependent variable in the cointegrating regression, the Johansen Co-integration procedure assumes all variables to be endogenous;

- When it comes to extracting the residual from the cointegrating vector, the Johansen Co-integration procedure avoids the arbitrary choice of the dependent variable as in the Engle–Granger approach, and is insensitive to the variable being normalized;
- This procedure is established on a unified framework for estimating and testing cointegrating relations within the VECM formulation;
- It provides the appropriate statistics and the point distributions to test hypothesis for the number of cointegrating vectors and tests of restrictions upon the coefficients of the vectors.

There are several steps to follow to understand the Johansen-Juselius co-integration procedure and the estimation of error correction model. This particular section is spared for the understanding of this procedure.

Steps in Johansen Co-integration:

As most of macroeconomic data series are not stationary. Specially, the series which are considered to analyze the EVI are almost non-stationary in almost all of the countries. It is well documented in the time series literature that the OLS regression will produce a spurious regression in the case of non-stationary series. In the case of non-stationary series, we try to establish a long run relationship among the variables.

Step 1 Detecting the Order of Integration: The methodologies of detecting the long run relationship depend on the order of integrations. For this purpose, we use ADF test, Philips-Perron test or any other test depending on the situation. All series should be co-integrated of same order, ideally $I(1)$, so that we may proceed further to apply Johansen-Juselius co-integration test. However, if some of the series are $I(0)$ or $I(2)$ then we shall not apply Johansen-Juselius co-integration test.

$$EXP_t = \beta_0 + \beta_1 ICP_t + \beta_2 ECC_t + \beta_3 ECP_t + \beta_4 EEI_t + \beta_5 REER_t + \beta_6 IRP_t + \beta_7 SI_t + \beta_8 TPG_t + \varepsilon_t \quad (1)$$

$$IMP_t = \beta_0 + \beta_1 ICC_t + \beta_2 ICP_t + \beta_3 IOP_t + \beta_4 REER_t + \beta_5 TPG_t + \varepsilon_t \quad (2)$$

$$GDP_t = \beta_0 + \beta_1 DS_t + \beta_2 ECC_t + \beta_3 ICC_t + \beta_4 ICR_t + \beta_5 RC_t + \beta_6 RI_t + \beta_7 TPG_t + \beta_8 TO_t + \beta_9 ICP_t + \beta_{10} ECP_t + \beta_{11} EEI_t + \beta_{12} REER_t + \beta_{13} IRP_t + \beta_{14} ICP_t + \beta_{15} IOP_t + \varepsilon_t \quad (3)$$

Step 2 Choosing the Lag Length: Second important step in this regard is the selection of appropriate lag length. It is important to mention here that almost all of the AR models are sensitive to the number of lag length. It implies the stability of the models crucially depend on the optimal lag lengths. Generally, the optimal lags are selected through a grid search procedure. The researchers estimate a VAR model of higher order then re-estimate the model by reducing the number of lags until zero lag. The optimal number of lags is decided on the basis of AIC or SBC.

Step 3 Appropriateness of the model: The issue of entering the trend and intercept in the short run and long run equations should be discussed in estimating the model. Johansen (1995) discusses five possible ways. First, there is no intercept and time trend (deterministic trend) in co-integration equation. This model is applied when there are no deterministic components in the time series data. Obviously, practically, this is a very rare case. Second possibility postulates that there should be restricted intercept and there should not be a deterministic trend in a co-integration equation. Third is a common case, especially in the context of EVI. Johansen (1995) includes unrestricted intercept and no deterministic trend in co-integration equation and VAR model. Fourth one includes an unrestricted intercept and restricted trend in co-integration equation and VAR. Finally, an unrestricted intercept and quadratic trend are included in the co-integration equation in VAR model. Johansen (1995) notes that the first and fifth is a rare possibility to happen in the empirical

literature of time series. Therefore, a researcher has to decide about the appropriateness of the model among the rest of three possibilities.

Step 4 Determining the number of co-integrating vector: The next step is to determine the number of co-integrating vector or the number of long run linear relationships. There is a possibility of 'n-1' number of co-integrating vectors. Here n is the number of variables in the model. Johansen (1995) suggests a set of steps to determine the number of co-integrating vector. Specifically, this approach calculates the long run coefficients and the speed of adjustment. The speed of adjustment is generally known as the error correction term. The number of co-integrating vectors is determined through the set of two statistics. These statistics are called maximum Eigen values and the Trace statistics.

Step 5 Estimating the Error Correction Model: Consider a bivariate model, for the simplicity, for debt servicing and GDP.

We have to make sure that the both variables are integrated of order (1), that is, stationary at first level, test the existence of long run relationship among two series with appropriate lags

3.3.2 Principal Component Analysis:

Principal component analysis (PCA) is a statistical procedure that uses an orthogonal conversion to change a set of observations of variables that are correlated to each other into a set of values of linearly uncorrelated variables that are called principal components. Whereas, the number of principal components is less than or equal to the number of original variables (Jolliffe (1989).

According to Jolliffe (2002) the main idea of principal component analysis is to lessen the dimensionality of a data set in which there are a large number of correlated variables, while keeping as much as possible of the variation present in t data. This reduction is attained by

converting to a new set of variables, the principal components, which are not related to each other, and which are methodical so that the first few have most of the variation that is present the original variables. Calculation of the principal components decreases to the solution of an eigenvalue-eigenvector problem for a positive-semidefinite symmetric matrix. Hence the calculation of principal components is simple but, this apparently straightforward technique has a huge variety of different applications, as well as a number of different derivations.

It is a typical tool in modern data analysis - in various fields from computer graphics to neurosciences as it is a simple, non-parametric method for mining relevant information from complex data sets. With negligible effort PCA gives a roadmap for how to decrease a confusing data set to a lower dimension to show simplified structures that are hidden sometimes that frequently underlie it (Shlens (2014))

Subsequent to the identification of relevant indicators for EVI, an important step while constructing the index is to determine the relative weights of various indicators to be included. These weights reflect the importance of the respective variables in the transmission of external shocks on the state of domestic economy. Ideally, these weights should be determined from a macroeconomic model of the economy; however, in general, another popular methodology is the principal component approach (PCA). In PCA, a common factor is extracted from a group of economic variables that captures the most common variation among them. PCA transforms a number of large set of variables into a smaller number of variables and models the variance structure of a set of observed variables using their linear combinations. However, the drawback of PCA is that this is static in nature and doesn't incorporate the changing nature of structure of economy.

4 Chapter 4: Variable Construction and Data

In this chapter there will be overview of the data that from where data will be collected to construct the index and the explanation of all that variables that are used. Every variable has its own importance in context of Pakistan which is also supported by the literature.

4.1 Brief overview of the data

To maximize the chances of covering sources of vulnerability and to promote the constructed index as early warning system, study will utilize quarterly data of macroeconomic variables – list elaborated below – from January 1991 to June 2018. For variables from fiscal side, the source of data will be State Bank of Pakistan and IMF international financial statistics. For variables from monetary side, the source of data is State Bank of Pakistan while for variables representing external sector, we have preferred State Bank of Pakistan over Pakistan Bureau of Statistics. Reason for this preference is that State Bank of Pakistan compiles data on financial transactions while statistical bureau compiles data on physical movement of goods. The balance of payment crisis is more related to financial impact of the external transactions rather their physical movement, so the data from State Bank makes more relevance. Most of the final variables used in this study have been constructed on the basis of economic intuition and review of literature. For variables representing international markets and countries, data has been taken from IMF's international financial statistics

4.2 Variables:

On the trade side study is intending to use the following variables to capture vulnerabilities to exports and imports of Pakistan:

International Cotton Prices:

Textile sector is very important for the economy of Pakistan. While, Pakistan is 3rd largest consumer and 4th largest cotton producer in the world, therefore decrease in international cotton prices can negatively affect the economic growth of Pakistan (Abbas *et al.* (2015)). Fluctuations in the raw material prices can result in crisis in industry, exports, foreign exchange reserves and GDP. Cotton is top export item of Pakistan and any unfavorable development in the international cotton market can put Pakistan's economy off-track. Despite cotton being number one exporting item for Pakistan, country's share in total market is so tiny that it cannot influence the international cotton prices and hence had to remain a price taker.

Export Concentrations:

Export concentration by product will be calculated as the share of top three HS Code 6 items in total exports. Export concentration by country will be calculated as the share of top three export destinations in total exports. Higher the ratio higher the concentration will be. High concentration of export either regarding export destinations or export commodities can put the country to high vulnerability level to external shocks. Any unfavorable development in export destinations or markets of relevant commodities can put the economy at higher level of risk. Naseeb *et al.* (2008) recommended that Pakistan should have more export concentration on trade partners where demand of export is high, to improve the export performance. Gul *et al.* (2013) mentioned that country which is surrounded by fast growing economies gets more benefit. Tariq and Najeeb

(1999) mentioned that commodity and market concentration reduces the chances of neutralizing the effect of adverse price fluctuations in the international market and it is the major reason of export earnings instability in countries. They also said that it is assumed that due to concentration, the variations in some exports in one direction might not be balance by the counter-fluctuations by other commodities in other direction.

Export Earning Instability:

Export earning instability index will be constructed from the changing variance of export receipts. Tariq and Najeeb (1999) analyzed that the fluctuations in export earnings can have serious consequences for the economy of country, uneven export earnings effect the investment decisions, which can decrease the growth of industrial sector, moreover it also creates uncertainty in the economy. They also mentioned that commodity and market concentration reduce the chances of balancing the effect of adverse price fluctuations in the international market. They also said that it is assumed that due to concentration, the fluctuations in some exports in one direction might not be balance by the counter-fluctuations by other commodities in other direction. A country that's exports consists of only few commodities tend to have unstable export earnings. According to Rashid *et al.* (2012) export earning in stability can have adverse impact on the GDP of country and it also effects that government development plans because government takes export taxes to finance these plans. Private sector is solely focused on the levels and sustainability of their business profits. Export is mainly a private sector activity and hence government has to ensure a kind of business environment which can facilitate higher level of stability in export earnings

Real Effective Exchange Rate:

Real Effective Exchange Rate represents the PKR-USD parity adjusted for inflation and trading partner's currency movements. This reflects the level of competitiveness of local producers in the foreign markets. In the event of substantial capital outflow, an option for the government is to depreciate the real exchange rate. The reduction in real exchange rate improves the current account balance, through increasing the domestic expenditure on non-tradable goods relative to the tradable goods. However, to achieve real exchange rate depreciation, government and central bank will have to resort to contractionary fiscal and monetary policies so that there is decline in prices of non-tradable goods. Several studies like {Franel and Rose (2006). Razin and Ferrati (1996). Busier and Mulder (1999). Eichgreen *et al.* (1995). Collins (1995). Athukorala and Warr (2002). Kaminsky and Reinhart (1999)} took real effective exchange rate as a leading indicator of external vulnerability. According to Gul *et al.* (2013) the decrease in REER increases the demand of exports in Pakistan, which means there is negative relationship between Real effective exchange rate and export demand.

International Rice Prices:

Pakistan is 11th largest producer and the larger exporter of rice in the world and it accounts for 0.7% of GDP in Pakistan (Shahzadi *et al.* (2018)). Rice is the second most important crop of Pakistan, it's not only the source of food to the people but also a main source of getting foreign exchange reserves through its export {Shahzadi *et al.* (2018). Chaudhary *et al.* (2003). Ahmad *et al.* (2017)}. As we know that Pakistan is an agricultural country therefore its output has much importance than other sector. Any unfavorable development in the international rice market can put Pakistan's economy off-track. Despite rice being important exporting item for Pakistan,

country's share in total market is so tiny that it cannot influence the international rice prices and hence had to remain a price taker.

Strategic Imports:

Source and quantum of strategic imports also plays a key role in defining vulnerabilities to overall exports of the country. Strategic imports include the items that must be imported like surgical instruments and defense goods.

Trading Partner GDP:

Trading Partner GDP has been constructed by the author by using data of Industrial Production Index of respective countries and weights from the official REER. Exports are always the function of demand of foreign buyers and hence growth patterns in the trading partner countries play a pivotal role in defining the potential of exports of host country. According to Arora and Vamvakidis (2005) trading partner's growth has strong effect on domestic growth and the countries get benefit from fast growing and more developed countries. Naseeb *et al.* (2008) recommended that Pakistan should have more concentration on trade partners where demand of export is high, to improve the export performance.

Import Concentrations:

Import concentration by product will be calculated as the share of top three HS Code 6 items in total imports. Import concentration by country will be calculated as the share of top three import sources in total imports. Higher the ratio higher the concentration will be. High concentration of import either regarding import sources or import commodities can put the country to high vulnerability level to external shocks. Any unfavorable development in import source countries or markets of relevant commodities can put the economy at higher level of risk.

International Oil Prices:

International oil is an important variable because oil is largest import item of Pakistan and any unfavorable development in the international oil market can put Pakistan's economy off-track. According to Ahmed (2016) the changes in oil prices have considerable effects on the economic growth of both developed and developing countries, As most of the industries rely on oil to work when the oil prices go up the prices of other commodities also increases because of the increase in cost of production of goods made with petroleum products, which can result in inflation in the country that can reduce the economic growth. Oil prices also indirectly effect transportation cost. Still (2007) argued that five recessions out of last seven recessions in U.S were preceded by the increase in oil prices. Increased oil prices can shift the supply curve up for the goods where oil is an input. Despite oil being largest importing item for Pakistan, country's share in total market is so tiny that it cannot influence the international oil prices and hence had to remain a price taker. When the oil imports are inelastic and inflation-driven the demand for gold contributes for the current account deficit (Goyal (2014)).

On the non-trade side study is intending to use the following variables to capture vulnerabilities to debt and remittances of Pakistan:

Remittance Concentration:

High concentration of remittances regarding sources can put the country to high vulnerability level to external shocks. Any unfavorable development in remittance source countries can put the economy at higher level of risk. It includes the countries from which Pakistan is receiving the remittances. Hosny (2019) conducted a study to analyze the impact of high concentration of origin of remittance on GDP growth. Higher concentration causes the volatility in remittances. As we

know that most of the worker's remittances in Pakistan comes from the middle east countries so if something negative happens there, it will affect our economy as well, so it is important to measure the concentration of remittances of Pakistan to check how vulnerable the country is against external shocks.

Remittance Instability:

Remittances instability index will be constructed from the changing variance of remittances. Remittances are one of the key components of current account which has been absorbing the unfavorable dynamics of trade account for Pakistan for decades. According to Mughal and Makhoulf (2018) Pakistan is among top ten remittance receiving countries and sharp variations in remittance receipts might be the problem for the country. they also mentioned that instability of remittances depends upon different other factors like output fluctuations, exchange rate and socioeconomic conditions of home and host countries. So, as Pakistan is a large remittance receiving country the more unstable remittances the more country is vulnerable to the external shocks so this indicator is important to access the external vulnerability. Any instability in remittances can put the economy off track.

Trade Openness:

Trade openness has been calculated as the share of trade in overall GDP. It is also an important indicator to measure external shocks vulnerability of a country. a more open economy is more vulnerable to external shocks. The vulnerability further increases if an economy has a narrow base of exports with high imports of raw material. Pakistan's trade openness has also increased gradually in past few years. So, it's possible that through this channel our external vulnerability can be influenced. According to Katiala and Virkola (2014) trade openness reflects both imports

and exports of domestic economy and it also measures the inter-connectedness. Loayza and Raddatz (2006), used aggregate data to find that increased trade openness tends to increase the impact of negative external shocks on GDP growth as the high volume of trade shows larger share of economic activities that can be influenced by the trade prices. According to Barrot *et al.* (2016) when the trade openness increases the variance of contribution of global demand shocks decreases.

Import Cover:

Import cover reflects the repayment capacity of the country for its current deficit which is mainly arising from trade account. The reserves to import month ratio is traditional indicator of reserve adequacy that simply identifies the number of months a country can finance its imports. This indicator is valuable for countries like Pakistan that are largely dependent on imports and frequently needed sufficient reserves to absorb the impact of shocks to the current account.

Debt Servicing to Foreign Exchange Reserve:

A country is said to be vulnerable as its level of debt servicing is inconsistent with the level of foreign exchange reserves. Because it implies that country may not be able to meet its external obligations smoothly, Pakistan has also given a huge amount in its external obligations every year therefore it is important to maintain a reasonable amount of reserves. It is an important variable because debt servicing is increasing with time in Pakistan which puts pressure on the external sector. It reflects the repayment capacity of the country for its overall foreign liabilities including current and financial account components the huge repayment of debt decreases the foreign exchange reserves. Malik *et al.* (2010) analyzed the impact of external debt on growth of Pakistan and argued that Pakistan relied on external debt to finance its deficits and there is significantly negative relationship between external debt and growth. Debt servicing has also negative impact

on GDP. Checherita and Rothar (2010) also analyzed the effect of debt on economic growth which is negative. Supriyadi (2015) constructed composite index by using Debt service ratio as one of the main indicators.

Global Image:

Global Image will be proxied by share of FDI Pakistan is getting from the total FDI globally. Katiala and Virkola (2014) mentioned that FDI measures the direct cross-border linkages in the economic activity which concerns the long lasting and stable links between countries. They also mentioned that FDI can potentially transfer technologies and business internationally which can increase the market for local producers as well as financing possibilities for the small firms. The data provides the measure of interdependence that might not account for international trade flows. Supriyadi (2015) took FDI as an indicator of external vulnerability. According to Gul *et al.* (2013) the level of foreign direct investment remained low as compare to other developing countries because of the instable political atmosphere of Pakistan. They also mentioned that Pakistan has been making efforts to increase FDI to improve the economy because FDI also generates Foreign exchange and one of its major contribution transfers of technology.

5 Chapter 5: Results and Discussion

This chapter includes the results obtained through Johansen Co-integration and Principal Component Analysis. For Johansen Co-integration first the stationarity of data is checked because non-stationary data gives spurious results then weights are calculated through both methods. First the export vulnerability is calculated than import vulnerability is calculated and, in the end, overall vulnerability of Pakistan's external sector is calculated. All the results are explained below;

5.1 Unit Root and Stationarity

It is always essential to test the data for stationarity condition while using that in time series models. Almost every time series model, with an exception of very few, necessitate data to encounter the condition of stationarity. Time series models being used in this study specifically and all the models generally estimate the “on average” relations between the variables which requires that data being used to calculate such relations must revert to its average value – also called the Stationarity condition. Otherwise, the estimated relation will be misleading as the estimated results are for the on average relations while the data has no tendency to revert back to its mean value and hence has altogether different relationship to what the model has estimated. This is the very reason that stationarity condition has become so pivotal for such models and estimations.

For construction of export related external vulnerability index, this study has used nine variables to estimate the Johansen Co-integration. Variables includes index for international cotton prices, index for export concentration by country, index for export concentration by product, index for export earnings instability, index for real effective exchange rate, index for international rice prices, index for strategic imports of Pakistan, index for trading partner's GDP and Pakistan's overall exports.

For construction of import related external vulnerability index, this study has used six variables to estimate the Johansen Co-integration. Variables includes index for international import concentration by country, index for import concentration by product, index for international oil prices, index for real effective exchange rate, index for trading partner's GDP and Pakistan's overall imports.

For construction of overall external vulnerability index, this study has used fifteen variables to estimate the Johansen Co-integration. Variables includes variables like index for debt servicing to reserve ratio, index for export concentration by country, index for import concentration by country, index for import coverage ratio, index for worker's remittances, index for remittance instability, index for trade openness and Pakistan's GDP.

Augmented Dickey Fuller (ADF) and Phillips–Perron (PP) tests are applied at level and first difference of each data series. ADF test examines null hypothesis of having data series integrated of order one against the alternate of integration of order zero. ADF also assumes that the series follows ARMA structure – which makes selection of lag length an important decision. However, this turn out to be a major practical issue in using ADF test. If selected lag length is too small, results of the test will be biased as the remaining serial correlation could potentially make the errors biased. If selected lag length is oversized then it affects test power. PP test differ from ADF mainly on the parameters explaining how to deal heteroskedasticity and serial correlation in the residuals. While ADF relies on parametric approach to ballpark the structure of ARMA, the PP test take no notice of serial correlation. Advantage of PP test as compared to ADF is that it is more robust and does not involve any specific lag length. However, if the conclusions of ADF and PP test are similar then both tests enjoy similar power and theoretical acceptance.

Table 5 1 Results of Unit Root Test

	Level			Firs Difference		
	Intercept	Trend and Intercept	None	Intercept	Trend and Intercept	None
Log (Cotton)	0.9232	0.9069	0.9999	0.0000	0.0000	0.0000
Log (ECIC)	0.4078	0.8586	1.0000	0.0000	0.0000	0.0000
Log (ECIP)	0.6526	0.1995	0.9993	0.0073	0.0226	0.0310
Log (EEI)	0.5098	0.6486	0.4951	0.0000	0.0000	0.0000
Log (REER)	0.3804	0.7572	0.9127	0.0000	0.0000	0.0000
Log (Rice)	0.4445	0.4480	1.0000	0.0000	0.0000	0.0000
Log (SIM)	0.9916	0.9407	0.9999	0.0000	0.0000	0.0000
Log (TGDP)	0.3408	0.3463	0.8679	0.0000	0.0000	0.0000
Log (ICIC)	0.7076	0.6913	0.7843	0.0000	0.0000	0.0000
Log (ICIP)	0.1922	0.6430	0.7844	0.0000	0.0000	0.0000
Log (Oil)	0.4370	-0.0161	0.7837	0.0000	0.0000	0.0000
Log (DSRR)	0.2942	0.4330	0.2795	0.0000	0.0000	0.0000
Log (ImpCover)	0.1648	0.5416	0.6971	0.0000	0.0000	0.0000
Log (Remc)	0.2289	0.2324	0.7844	0.0000	0.0000	0.0000
Log (Remi)	0.7760	0.7251	0.7843	0.0000	0.0000	0.0000
Log (TOP)	0.2905	0.7413	0.8827	0.0000	0.0000	0.0000
Log (Exports)	0.5353	0.0822	0.8820	0.0000	0.0000	0.0000
Log (Imports)	0.3925	0.5313	0.3778	0.0000	0.0000	0.0000
Log (GDP)	0.2631	0.6399	0.7954	0.0000	0.0000	0.0000

For the variables under consideration for this study, both tests reported similar results on the level of Stationarity – hence results from PP taking into consideration intercept, intercept and trend and without intercept and trend are reported in the below table. P-values from PP test are reported to testify the null hypothesis of data being integrated of order one. At the levels, all the p-values turn out to be greater than 0.05 which explains that test fails to reject null hypothesis and concludes that tested variables at levels are non-stationary. While the P-values at first difference turns out to be less than 0.05, which supports to reject null hypothesis that data is integrated of order one. Rejection of null hypothesis concludes that at first difference data is stationary – which perfectly suits estimation of Johansen.

5.2 Export Specific External Vulnerability Index

Export specific EVI quantifies the vulnerabilities to Pakistan's exports from different potential risks associated with the external account in general and exports in specific. The direction of EVI Exports indicate whether the vulnerabilities are increasing or decreasing – EVI pointing upwards indicates the increase in the vulnerabilities. It is important to mention here that these vulnerabilities are just the risks and there is no guarantee whether such risks will materialize or not. Principal Component Analysis (PCA) and Johansen Co-integration tests have been utilized to calculate the relevant weight (coefficient) for each of the selected source of vulnerability. PCA has relied on the eigen values, while for Johansen we have taken exports as the dependent while the sources of vulnerabilities as independent variables. Results of PCA are in table 2, while table 3 presents the results for Johansen.

Table 5.1 1 Weights Calculated through PCA

International Cotton Prices	-0.5071
Export Concentration by Country	0.3250
Export Concentration by Product	0.4879
Export Earning Instability	0.3228
Real Effective Exchange Rate	0.3453
International Rice Prices	-0.1187
Strategic Imports	0.2504
Trading Partner GDP	-0.1056

Table 5.1 2 Weights Calculated through Johansen

Coefficient	Value	t-test	P-value
International Cotton Prices	-0.3309	-3.3314	0.0008
Export Concentration by Country	0.5403	2.8277	0.0011
Export Concentration by Product	0.7109	3.1261	0.0019
Export Earning Instability	0.5381	2.2374	0.0259
Real Effective Exchange Rate	0.5615	2.3310	0.0204
International Rice Prices	-0.0758	-2.8761	0.0007
Strategic Imports	0.4622	4.0445	0.0000
Trading Partner GDP	-0.0895	-4.6771	0.0000

Cotton prices play an important role regarding export related external vulnerabilities of Pakistan. Almost 60 percent of Pakistan's exports are from the textile sector, which directly or indirectly relates to cotton prices and its trends. Although share of textile and cotton related items is significant for Pakistan's overall exports, Pakistan's share in overall global textile market is only 1 percent. This low share in the global market makes Pakistan a price taker for cotton prices. Pakistan doesn't have the ability to influence the international cotton prices and hence is subject to price shock for cotton and its related exports. International cotton prices have been volatile off-late and have been a source of higher vulnerabilities of countries involved in cotton specific trade. As mentioned earlier Pakistan is a net exporter of cotton-based products increase in international cotton price is generally seen as a positive thing. However even the higher cotton prices contribute a lot in the volatility of cotton specific trade. Higher volatility reduces country's ability to pursue a longer-term trade policy. In the circumstances of changing cotton prices, it is always difficult for the country to set trade targets consistent with its overall economic framework.

Estimated coefficient for cotton price index is -0.5071 which explains that increase in cotton price index generally reduces export related vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is -0.3309 if the model is solved through Johansen co-integration. While the principal component analysis provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in international cotton prices generally reduces export specific vulnerabilities of Pakistan. The results are conformed with the study conducted by Abbas *et al.* (2005).

Export concentration by country is another indicator identified in the study as potential source of vulnerabilities for Pakistan's exports. Concentration of exports to few destinations is considered

bad for the longer-term perspective of any country's export potential. If a country is only exporting to fewer destinations, it is subject to a risk of collapsing exports in case of any change in the taste and preferences of the consumers of the destined countries, technological preferences of such countries and the SPS and security measures of the destined countries. Unfortunately, Pakistan's exports are highly concentrated to only few countries. More than 75 percent of Pakistan's exports are destined to EU, US, Afghanistan and UAE. In the recent past, country has witnessed substantial and sudden drops in its exports to these countries due to political issues.

Estimated coefficient for index of export concentration by country is 0.3250 which explains that increase in export concentration by country generally increases export related vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is 0.5403 if the model is solved through Johansen co-integration. While the principal component analysis provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in index of export concentration by country generally increases export specific vulnerabilities of Pakistan.

Export concentration by product is another indicator identified in the study as potential source of vulnerabilities for Pakistan's exports. Concentration of exports to few products is considered bad for the longer-term perspective of any country's export potential. If a country is only exporting few items, it is subject to a risk of collapsing exports in case of change of preferences of foreign buyers about those commodities and any change of regulations by the global partners about those products. More than 80 percent of Pakistan's exports are concentrated in few items like textile, rice, leather products and sports goods. Pakistan has already suffered due to its high concentration in textile products. While Pakistani producers continuing to manufacture man-made fiber., the

global buyer's preference has changed to synthetic fiber and has pushed Pakistan to a situation of continuous struggle to keep its market share intact.

Estimated coefficient for index of export concentration by product is 0.4879 which explains that increase in export concentration by product generally increases export related vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is 0.7109 if the model is solved through Johansen co-integration. While the principal component analysis provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in index of export concentration by product generally increases export specific vulnerabilities of Pakistan. The results for this variable is conformed with the studies conducted by Naseeb *et al.* (2008), Gul *et al.* (2013), Tariq and Najeeb (1999).

Pattern of export earnings is another important source of export related vulnerability. Export earnings generally have two-fold impact on the economy. It provides the much-needed foreign exchange inflows to the country and motivates and incentivizes the local producers to become an exporter. Any instability in the export earnings could put the country into a situation of inability to follow a longer-term vision for the economy – as they are not sure about the inflows through exports and hence cannot commit to spend. Lesser volatility in export earnings are more helpful in reducing country's external vulnerabilities. Less volatility also helps the country to achieve the longer-term goals. Even with low level of exports the muted volatility helps. Pakistan is one of the country's which has relatively low volatility for its export earnings. However, Pakistan is stuck low export zone for years.

Estimated coefficient for index of export earnings instability is 0.3228 which explains that increase in export earnings instability generally increases export related vulnerability. This coefficient has

been yielded from principal component analysis approach. Coefficient for the same variable is 0.5380 if the model is solved through Johansen co-integration. While the principal component analysis provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in index of export earning instability generally increases export specific vulnerabilities of Pakistan. The results are conformed with the studies conducted by Tariq and Najeed (1999), Rashid *et al.* (2012).

Real effective exchange rate is another important source of potential vulnerabilities to Pakistan's exports. REER is the reflection of country's competitiveness in the global market. Countries with better competitiveness normally wins most of the demands of the global buyers – as they offer better quality products at a lesser price. Index of REER is defined in a way that increase in the value of the index shows the loss of competitiveness. Any increase in the value of REER will put the country's exports at a disadvantage and hence potentially increase the vulnerability.

Estimated coefficient for index of REER is 0.3453 which explains that increase in REER generally increases export related vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is 0.5615 if the model is solved through Johansen co-integration. While the principal component analysis provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in index of REER generally increases export specific vulnerabilities of Pakistan. The results are conformed with the results of like {Franel and Rose (2006). Razin and Ferrati (1996). Busier and Mulder (1999). Eichgreen *et al.* (1995). Collins (1995). Athukorala and Warr (2002). Kaminsky and Reinhart (1999)}

International rice prices play an important role regarding export related external vulnerabilities of Pakistan. A substantial share of Pakistan's exports relied on the rice. Although share of rice is

significant for Pakistan's overall exports, Pakistan's share in overall global rice market is only 0.02 percent. This low share in the global market makes Pakistan a price taker for rice prices. Pakistan doesn't have the ability to influence the international rice prices and hence is subject to price shock. International rice prices have been volatile off-late and have been a source of higher vulnerabilities of countries involved in trade. As mentioned earlier Pakistan is a net exporter of rice and increase in international cotton price is generally seen as a positive thing.

Estimated coefficient for rice price index is -0.1187 which explains that increase in rice price index generally reduces export related vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is -0.0758 if the model is solved through Johansen co-integration. While the principal component analysis provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in international rice prices generally reduces export specific vulnerabilities of Pakistan. The results matched with the studies done by Shehzadi *et al.* (2018), Choudhry (2003), Ahmed(2017)

Imports of strategic nature is another potential source of vulnerability to the exports of Pakistan. Imports of strategic nature includes the import of such raw material or machinery which is essential to produce exportable. More the country has strategic imports, more it will be vulnerable to export shocks. Any price or quantity shock to such imports in the global market has a direct and significant impact on Pakistan's export potential.

Estimated coefficient for index of strategic imports is 0.2504 which explains that increase in strategic import index generally increases export related vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is 0.4622 if the model is solved through Johansen co-integration. While the principal component analysis

provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in strategic import share generally increases export specific vulnerabilities of Pakistan.

Trading partner GDP is the most important source of vulnerability for Pakistan's exports. Income level and growth trajectory is directly related to the buying capacity of the foreign buyer. Growth trajectory is also directly related to the inflationary scenarios in the foreign countries and hence can put the exported item at advantage or disadvantage. If an economy is doing good and is on a high growth trajectory, that is generally reflected in the income levels of the nationals of those countries and hence leads to more demand from the foreign buyers. Estimated coefficient for index of trading partner GDP is -0.1056 which explains that increase in index of trading partner GDP generally reduces export related vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is -0.0894 if the model is solved through Johansen co-integration. While the principal component analysis provides the static relations between the variables, Johansen captures the dynamic parts also. Both techniques yielded similar results and argues that any increase in trading partner GDP share generally reduces export specific vulnerabilities of Pakistan. The results are conformed with the studies done by Vamvakidis (2005), Naseeb *et al.* (2008)

Figure 5.1 1 External Vulnerabilities to Export Index by using Principal Component Analysis

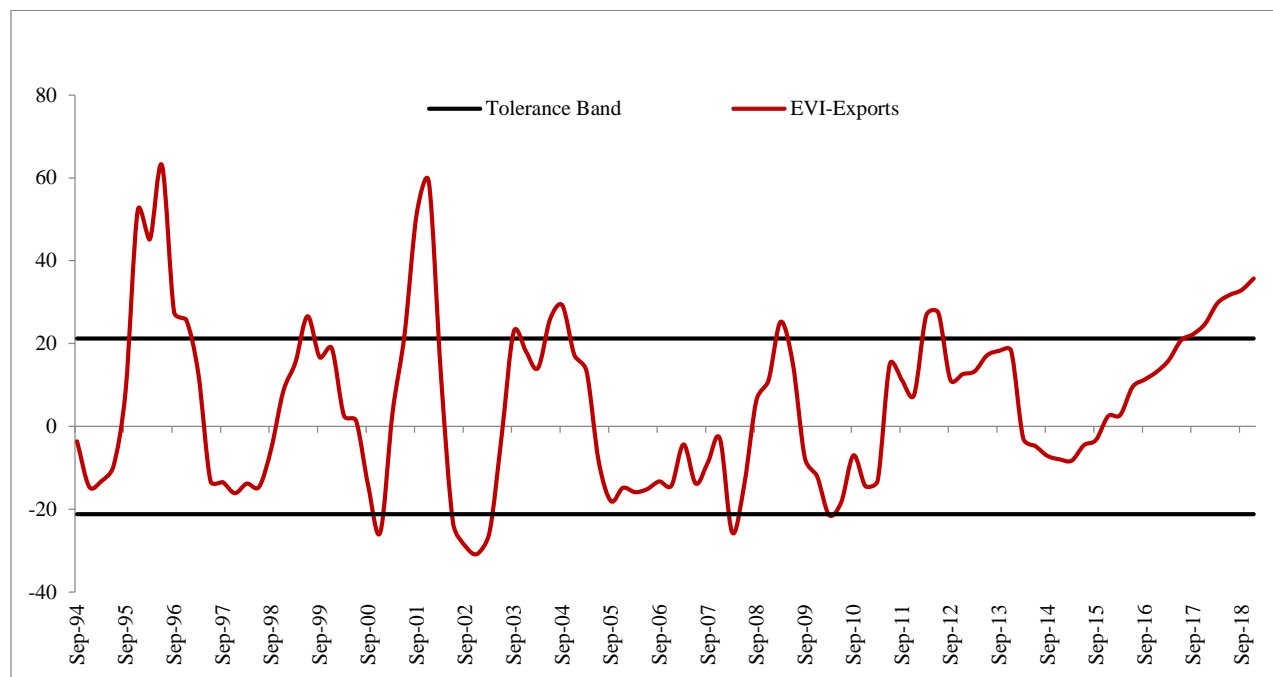


Figure 5.1 1 depicts the constructed export related external vulnerability index for Pakistan by using Principal Component Analysis. Red line depicts the constructed EVI, while the black lines indicate the tolerance band. The argument is that within the tolerance band, vulnerabilities are not causing any serious concerns for the country. While the EVI breaches the tolerance band, it indicates that special and urgent attention by the policy makers is needed. Inspection of the EVI constructed through PCA reveals that the constructed EVI remains a good early warning indicator for Pakistan's balance of payment crisis. Every time the EVI was heading towards the upper limit of the tolerance band, Pakistan ended up with approaching IMF or other IFIs for the bailout. EVI approached the upper band in 2004, 2008, 2013 and 2018. And all these years witnessed Pakistan approaching IMF for a bailout package.

Figure 5.1 2 External Vulnerabilities to Export Index by using Johansen Co-integration

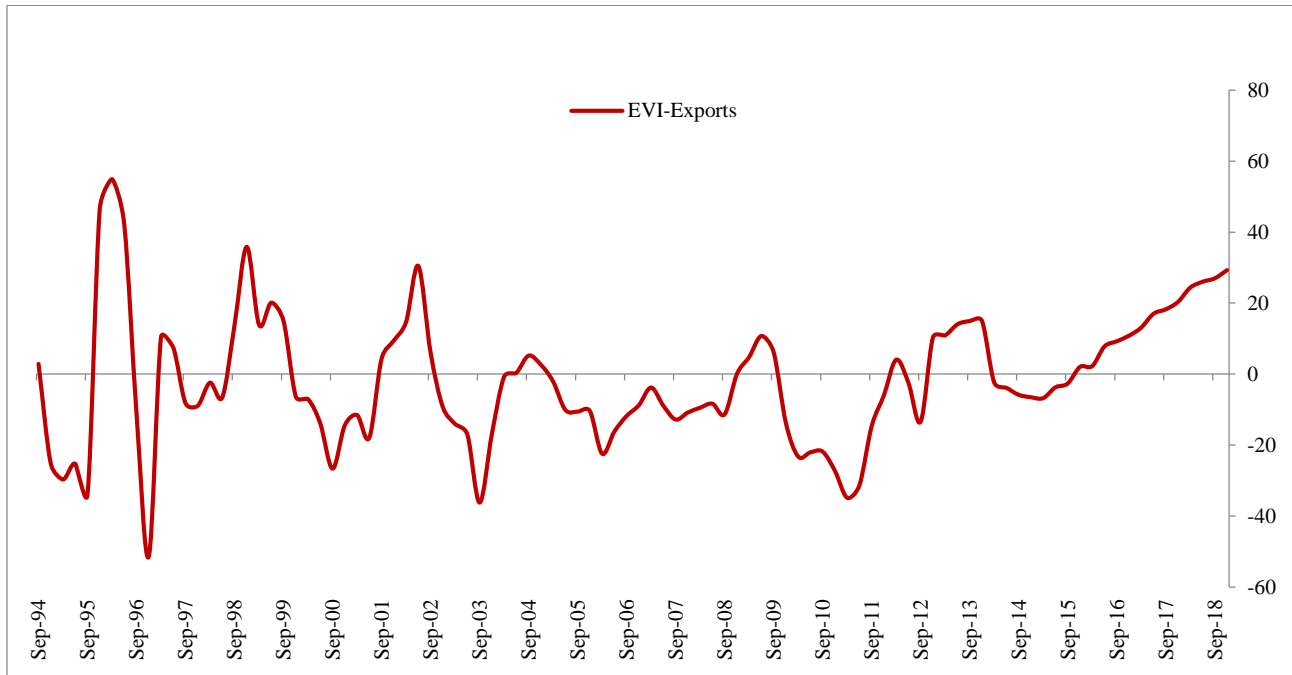


Figure 5.1 2 depicts the constructed export related external vulnerability index for Pakistan by using Johansen Co-integration. The shape of constructed EVI is quite similar to the EVI constructed through PCA. However, introduction of tolerance band is bit tough in the dynamic models. However, similar to the previous EVI, every time there is sharp upward trend in the constructed EVI, that was followed by bailout packages by IMF for other IFIs. Upward pressures on EVI could be observed in 2008, 2013 and 2018 and each of these years witnessed Pakistan approaching IMF for the bailout package. These constructed EVI makes a strong case of using such information as the early warning system for export related vulnerabilities.

5.3 Import Specific External Vulnerability Index

Import specific EVI quantifies the vulnerabilities to Pakistan's imports from different potential risks associated with the external account in general and imports in specific. The direction of EVI imports indicate whether the vulnerabilities are increasing or decreasing – EVI pointing upwards indicates the increase in the vulnerabilities. It is important to mention here that these vulnerabilities are just the risks and there is no guarantee whether such risks will materialize or not. Principal Component Analysis (PCA) and Johansen Co-integration tests have been utilized to calculate the relevant weight (coefficient) for each of the selected source of vulnerability. PCA has relied on the eigen values, while for Johansen we have taken exports as the dependent while the sources of vulnerabilities as independent variables. Results of PCA are in table 4, while table 5 presents the results for Johansen.

Table 5.2 1 Weights Calculated through PCA

Import Concentration by Country	0.5268
Import Concentration by Product	0.6499
International Oil Prices	0.6919
Real Effective Exchange Rate	-0.5519
Trading Partner GDP	-0.3168

Table 5.2 2 Weights Calculated through Johansen

Coefficient	Value	t-test	P-value
Import Concentration by Country	0.4186	4.2874	0.0000
Import Concentration by Product	0.5165	2.8277	0.0011
International Oil Prices	0.5498	3.2374	0.0015
Real Effective Exchange Rate	-0.4386	5.1847	0.0000
Trading Partner GDP	-0.2517	4.8916	0.0000

Import concentration is an important indicator that has been identified in this study as a potential source of Pakistan's imports. When the imports of a country are limited to few countries it is bad for the long-term perspective. If the country is only importing from few destinations the change in the political or economic conditions of that country can affect Pakistan's imports. The top five trading partners of Pakistan are China, United Arab Emirates, Saudi Arabia, Indonesia, Japan.

Estimated coefficient for index of import concentration is 0.52 which explains that increase in import concentration by country generally increases import related vulnerability. This coefficient was yielded from principal component analysis approach. Coefficient for the same variable is 0.41 when model is solved through Johansen co-integration approach. As the principal component analysis provides that static relations between variables, Johansen captures the dynamic parts also. Hence both the techniques have given same results and argues that any increase in index of import concentration by country increases the import specific vulnerabilities of Pakistan. The results are conformed with the studies conducted by Abbas *et al.* (2015)

Import concentration by product is another indicator that has been identified in this study as a potential source of import related vulnerabilities. The product concentration to few products is considered bad for the long-term perspective of any country's import potential. If there is any change in product or ban on product happens in the other country it is or if the taste and preferences of the customers of home country changes, it effects the imports negatively so the products should be diversified. Any change in the regulations regarding those products can also harm the imports of country. The top five imports of Pakistan are Refined Petroleum, Crude Petroleum, Palm oil, Petroleum gas and cars. Mostly imports of Pakistan are related to Petroleum so when the prices of oil get high in the international markets Pakistan suffers because of it a lot.

The estimated coefficient for index of import concentration by product is 0.64 which shows that when the import concentration by product increases the vulnerability related to import also increases. This coefficient has been yielded through principal component analysis approach. While the value of coefficient is 0.51 when solved through the Johansen co-integration approach. As the principal component analysis provides the static relations between the variables, Johansen captures the dynamic part also. Both techniques yielded similar results and argues that any increase in index

of import concentration by product generally increases import related vulnerabilities of Pakistan. The results are conformed with the studies conducted by Abbas *et al.* (2015)

Oil is the major import of Pakistan so oil prices play a vital role regarding the import related vulnerabilities of Pakistan. Pakistan is a price taker country so when the international prices increase it effects the imports of Pakistan negatively. High volatility in prices reduce the country's ability to pursue long term trade policy. When the prices are volatile it is difficult for a country to set trade targets consistent with its overall economic framework.

The estimated coefficient for oil prices is 0.69 that is calculated through principal component analysis. The figure shows that any increase in the oil prices increases the import related vulnerabilities of Pakistan. Coefficient for that variable is 0.54 when the model is solved through Johansen co-integration approach. Principal component analysis provides the static relationship between the variables while Johansen co-integration also covers the dynamic part. Both models yielded similar results that any increase in international oil prices increase the import related vulnerability of Pakistan. The results are conformed with the studies conducted by Ahmed (2016), Goyal (2014)

Real effective exchange rate is an important variable to access the import related vulnerability of Pakistan. It is the reflection of country's competitiveness in the global market. Countries with better competitiveness have more less demand from global sellers. The index of REER is defined in a way that increase in the value of index show increase in the competitiveness. Any decrease in the value of REER will put country's imports at disadvantage and increase the vulnerability.

The estimated coefficient for index of REER is -0.55 which shows that increase in REER reduces the import related vulnerability. The coefficient has been yielded from principal component

analysis approach. Coefficient for the same variable is -0.43 when solved through Johansen co-integration method. Principal component analysis provides the static relationships between the variables while Johansen co-integration cover the dynamic part as well. Hence both techniques have given similar results which shows that increase in REER reduces the import related vulnerability of Pakistan. The results are conformed with the studies conducted by Gul *et al.* (2013)

Trading partner GDP is the most important source of vulnerability for Pakistani importers. The growth trajectory of country is based on the GDP of producer country. If a trading partner has inflation then it will affect our imports as well and can put the country at risk. Economic conditions of trading partner are important for the growth of Pakistan and also important for the balance of payment.

The estimated coefficient for trading partner GDP is -0.31 which means that increase in the trading partner GDP reduces the Pakistan's vulnerability to imports. The coefficient has been calculated through principal component analysis. The same coefficient was calculated through Johansen co-integration and the result was -0.25. so, both techniques yielded similar results which means that growth of trading partner reduces the import related vulnerability but the principal component analysis shows the static relationships between the variables while the Johansen co-integration covers the dynamic part as well. The results are conformed with the studies conducted by Vamvakidis (2005) and Naseeb *et al.* (2008).

Figure 5.2 1 External Vulnerabilities to Import Index by using Principal Component Analysis

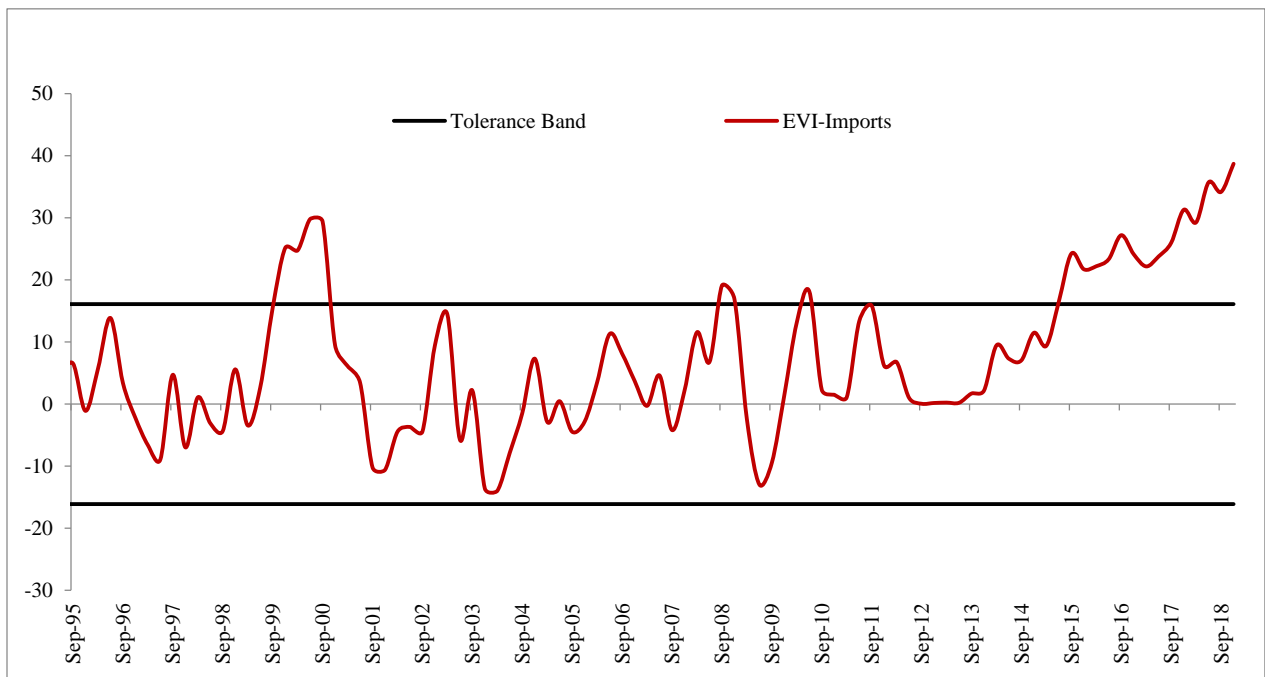


Figure 5.2 1 depicts that the constructed import related external vulnerability index for Pakistan through Principal Component Analysis the Red line depicts the constructed EVI, while the black lines indicate the tolerance band. The argument is that within the tolerance band the vulnerabilities are not causing any serious concern for the country. While when the red line breaches the tolerance band it indicates about the serious concerns for the country. As the EVI breaching the tolerance band indicated that urgent attention by policy makers is needed and they should take some necessary steps to keep the country from the materialization of risk. The inspection of EVI constructed through Principal Component Analysis reveals that constructed EVI is a good Early Warning indicator for the Balance of Payment crisis of Pakistan. Every time the EVI was heading towards the upper band Pakistan ended up which approaching IMF or other International Financial Institutions for the bailout. As we can see that EVI approached upper band in 2008, 2013 and 2018. All these years Pakistan approached IMF for bailout package.

Figure 5.2 2 External Vulnerabilities to Import Index by using Johansen co-integration

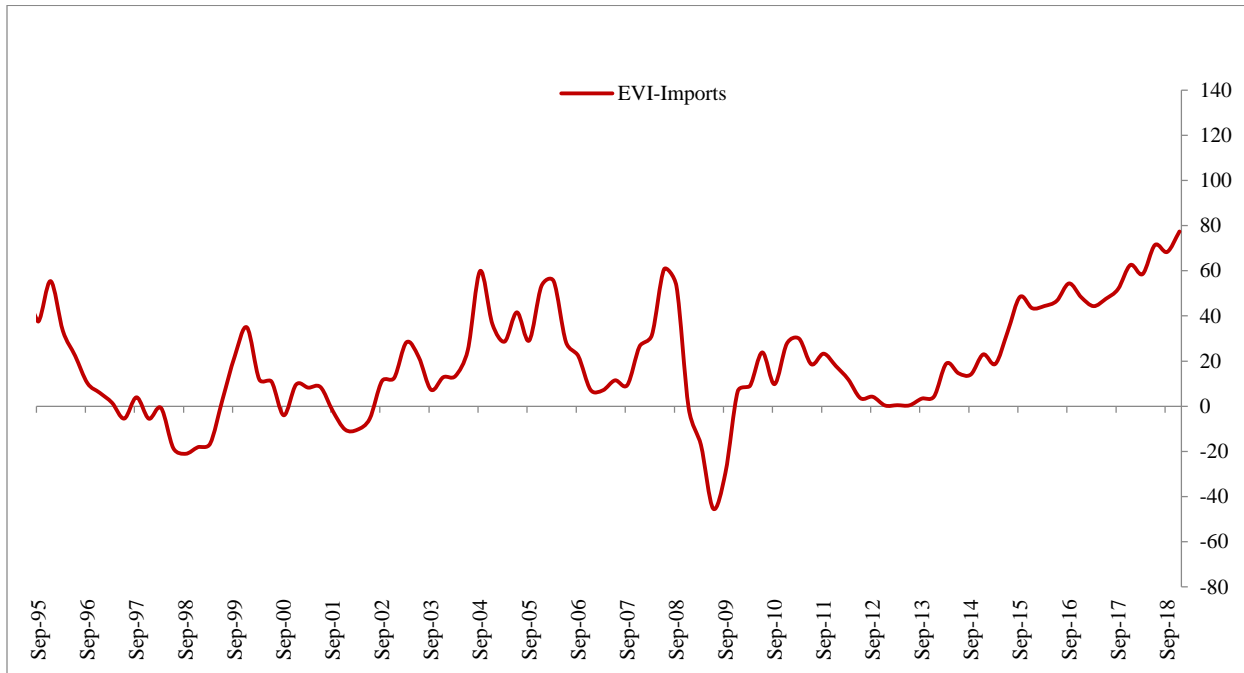


Figure 5.2 2 depicts the constructed import related External Vulnerability Index for Pakistan by using Johansen Co-integration. The shape of EVI is quite similar to the EVI constructed through PCA. However, the introduction of tolerance band is a bit hard in the dynamic models. Similar to precious EVI, there is an upward trend in EVI that was followed by bailout packages form IMF or other IFI's. the upward pressures could be seen in 2004, 2008, 2013, 2018 and in each of these years Pakistan approached IMF for bailout package. These constructed EVI make a strong case of using such information as an early warning system for import related vulnerabilities.

5.4 Overall External Vulnerability Index

External vulnerability index quantifies the vulnerabilities to Pakistan's external sector from different potential risks associated with the external account. The direction of EVI indicate whether the vulnerabilities are increasing or decreasing – EVI pointing upwards indicates the increase in the vulnerabilities. It is important to mention here that these vulnerabilities are just the risks and there is no guarantee whether such risks will materialize or not. Principal Component Analysis (PCA) and Johansen Co-integration tests have been utilized to calculate the relevant weight (coefficient) for each of the selected source of vulnerability. PCA has relied on the eigen values, while for Johansen we have taken GDP as the dependent while the sources of vulnerabilities as independent variables. Results of PCA are in table 6, while table 7 presents the results for Johansen.

Table 5.3 1 Weights Calculated through PCA

Debt servicing to reserve ratio	0.2024
Export concentration by country	0.0608
Import concentration by country	0.0058
Import cover ratio	0.2372
Remittance concentration	0.0223
Remittance Instability	0.0721
Trading partner GDP	-0.2287
Trade Openness	0.1582
Cotton Prices	-0.0411
Export Concentration by Product	0.0197
Export Earning Instability	0.0641
REER	-0.0694
Rice Prices	-0.2081
Import Concentration by product	0.0942
Oil Prices	-0.0156

Table 5.3 2 Weights Calculated through Johansen

Coefficient	Value	t-test	P-value
Debt servicing to reserve ratio	0.46307	-1.1703	0.2596
Export concentration by country	0.11806	7.2429	0.0000
Import concentration by country	0.011105	3.2950	0.0019
Import cover ratio	0.490659	2.2142	0.0227
Remittance concentration	0.043237	4.1424	0.0000
Remittance Instability	0.13984	1.1163	0.2652
Trading partner GDP	0.444162	7.2429	0.0000
Trade Openness	0.30727	3.2950	0.0019
International Cotton Prices	-0.07982	1.8838	0.0605
Export Concentration by Product	0.038355	3.1697	0.0018
Export Earning Instability	0.124342	2.2208	0.0271
REER	0.134814	2.5925	0.0117
International Rice Prices	-0.46421	6.8005	0.0000
Import Concentration by product	0.183064	-3.2314	0.0015
International Oil Prices	-0.03025	-3.0349	0.0026

The overall vulnerability is calculated by taking all trade and non-trade related variables as independent variables and taking GDP as dependent variable because the purpose of this study is to see the impact of all the vulnerabilities on the growth of country. The coefficients have been calculated through Principal Component Analysis and Johansen Co-integration method. These two techniques have been used because the PCA only estimates the static relationship between the

variables while the Johansen Co-integration covers the dynamic aspects as well. As every variable has different impact on the growth of country so that's why we need to give weights to variables according to their impact on GDP. Hence the structure of economy changes over the time so we also need to incorporate this effect that's why we need to calculate dynamic weights as well using Johansen Co-integration approach. The results calculated through both techniques are interpreted below;

Debt Servicing to Reserve ratio shows that from total reserves how much a country needs to pay for its debt. If a country has so much debt it effects the foreign exchange reserves negatively. So, the less ratio is better for the economy.

The estimated coefficient calculated through Principal Component Analysis is 0.2024 which indicates that the increase in Debt servicing to reserve ratio also increase the external vulnerability of the country and it exposes a country to risk. While according to Johansen Co-integration technique the value is 0.4630. Both techniques yielded similar results which showed that the increase in ratio increases the external vulnerability of Pakistan. The results are conformed with the studies conducted by Malik *et al.* (2010), Cheherita and Rothar (2010).

Export concentration by country means that if a country exports its products to only few countries then its exports are concentrated to only those countries, high concentration can be bad for the economy of a country because any change in the trade laws or the change in taste and buying behavior of that country can put Pakistan's exports at risk, so if the export concentration is high the more a country will be vulnerable externally.

The estimated coefficient is 0.068 when calculated through Principal Component Analysis which indicates that the increase in export concentration by country will increase the external

vulnerability of Pakistan. The coefficient calculated through Johansen Co-integration has value of 0.1180. Both techniques showed the similar results that when the export concentration by country increases the external vulnerability also increases.

Imports are concentrated when the imports of a country are limited to few countries which is bad for the long-term perspective. If the country is only importing from few destinations the change in the political or economic conditions of that country can affect Pakistan's imports. The top five trading partners of Pakistan are China, United Arab Emirates, Saudi Arabia, Indonesia, Japan.

Estimated coefficient for index of import concentration is 0.0058 which explains that increase in import concentration by country generally increases external vulnerability. This coefficient was yielded from principal component analysis approach. Coefficient for the same variable is 0.0111 when model is solved through Johansen co-integration approach. Hence both the techniques have given same results and argues that any increase in index of import concentration by country increases the external vulnerability of Pakistan.

Import Cover Ratio shows that how much a country can pay for its imports in next few months from its foreign exchange reserves that higher ratio is better theoretically but the results obtained from Principal Component Analysis shows that the value is 0.23 which means that if import cover ratio increases then the vulnerability also increases and the results from Johansen Co-integration have also given a positive value of 0.490 which contradicts from the theory but the results from both techniques are similar and show that when the import cover ratio increases the external vulnerability also increases.

Remittance concentration means that when there are only few countries from where the remittances are coming then it means the concentration is high. High concentration can be harmful

for the country because of the economic and political situation of the countries from where the remittances are coming from, if there are circumstances that unemployment gets high in that country then the residents will not earn much to send is back to the home country Most of Pakistan's remittances come from UAE and Saudi Arabia that's why when there was no work in Saudi Arabia they sent the workers back to Pakistan which effected the remittances.

The estimated coefficient calculated through Principal Component Analysis is -0.0223 which means that when the remittance concentration increases the external vulnerability also increases. The results from Johansen Co-integration approach was 0.043. Both techniques showed same results which means that when the remittances are concentrated to few countries the external vulnerability and exposure to risk will also be high. The results are conformed with the studies conducted by Honsy (2019).

Remittance Instability means the volatility in the remittance value. The constant change or increase/decrease in the value can expose Pakistan to the external risks and increase its external vulnerability. The estimated coefficient calculate through Principal Component Analysis is 0.0721 which means that when the remittance instability increases the external vulnerability of Pakistan also increases. The results from Johansen Co-integration was 0.1398. So, both techniques have given the similar results that the increase in remittance instability exposes a country to external shocks hence increases its external vulnerability. The results are conformed with the studies conducted by Mughal and Makhlouf (2018).

Trading partner GDP is an important variable to access the external vulnerability of Pakistan. Here we should take into the consideration that if the imports and exports are highly concentrated to

these trading partners by product and by country, then this can affect the economy negatively if there is any bad economic situation in the countries where Pakistan is trading its major part of imports and exports. High GDP can also change the buying behaviour of the consumers.

The estimated coefficient calculated through Principal Component Analysis is 0.228 which means that an increase in trading partner GDP will increase the external vulnerability of Pakistan. The results through Johansen Co-integration approach is 0.444. Hence the results calculated through both techniques are similar which indicates that the increase in trading partner GDP increases the external vulnerability of Pakistan.

Trade openness means that how much we are doing trade with the other countries, so when there is more trade openness there will be more risk that the external shocks can transmit into our economy. When we open trade with other countries the price volatility or the global economic situation can affect our economy as well.

The estimated coefficient calculated through Principal Component Analysis is 0.15 which means that an increase in trade openness will also increase the exposure of Pakistan to external shocks. The coefficient yielded through Johansen Co-integration is 0.307. So, both techniques have given similar results which indicate that the increase in trade openness increases the external vulnerability of Pakistan.

Cotton prices play an important role in assessing external vulnerability of Pakistan. Almost 60 percent of Pakistan's exports are from the textile sector, which directly or indirectly relates to cotton prices and its trends. Although the share of textile and cotton-related items is significant for Pakistan's overall exports, Pakistan's share in the overall global textile market is only 1 percent. This low share in the global market makes Pakistan a price taker for cotton prices. Pakistan doesn't

have the ability to influence the international cotton prices and hence is subject to price shock for cotton and its related exports. International cotton prices have been volatile off-late and have been a source of higher vulnerabilities of countries involved in cotton specific trade. However even the higher cotton prices contribute a lot in the volatility of cotton specific trade. Higher volatility reduces country's ability to pursue a longer-term trade policy. In the circumstances of changing cotton prices, it is always difficult for the country to set trade targets consistent with its overall economic framework.

Estimated coefficient for cotton price index is -0.0411 which explains that increase in cotton price index generally reduces the external vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is -0.0798 if the model is solved through Johansen co-integration. Both techniques yielded similar results and argues that any increase in international cotton prices generally reduces external vulnerability of Pakistan.

Import concentration by product is another indicator that has been identified in this study as a potential source of external vulnerability of Pakistan. The product concentration to few products is considered bad for the long-term perspective of any country's import potential. If there is any change in product or ban on product happens in the other country it is or if the taste and preferences of the customers of home country changes, it effects the imports negatively so the products should be diversified. Any change in the regulations regarding those products can also harm the imports of country.

The estimated coefficient for index of import concentration by product is 0.019 which shows that when the import concentration by product increases the vulnerability related to import also increases. This coefficient has been yielded through principal component analysis approach. While the value of coefficient is 0.038 when solved through the Johansen co-integration approach. Both

techniques yielded similar results and argues that any increase in index of import concentration by product generally increases external vulnerability of Pakistan.

Pattern of export earnings is another important source of external vulnerability. Export earnings generally have two-fold impact on the economy. It provides the much-needed foreign exchange inflows to the country and motivates and incentivizes the local producers to become an exporter. Lesser volatility in export earnings are more helpful in reducing country's external vulnerabilities. Less volatility also helps the country to achieve the longer-term goals. Even with low level of exports the muted volatility helps. Pakistan is one of the country's which has relatively low volatility for its export earnings. However, Pakistan is stuck low export zone for years.

Estimated coefficient for index of export earnings instability is 0.0641 which explains that increase in export earnings instability generally increases external vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is 0.1243 if the model is solved through Johansen co-integration. Both techniques yielded similar results and argues that any increase in index of export earning instability generally increases external vulnerability of Pakistan.

Real effective exchange rate is another important source of potential external vulnerability of Pakistan. REER is the reflection of country's competitiveness in the global market. Countries with better competitiveness normally wins most of the demands of the global buyers – as they offer better quality products at a lesser price. Index of REER is defined in a way that increase in the value of the index shows the loss of competitiveness. Any increase in the value of REER will put the country's exports at a disadvantage and hence potentially increase the vulnerability.

Estimated coefficient for index of REER is 0.0694 which explains that increase in REER generally increases external vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is 0.1348 if the model is solved through Johansen co-integration. Both techniques yielded similar results and argues that any increase in index of REER generally increases external vulnerability of Pakistan.

International rice prices play an important role regarding external vulnerability of Pakistan. A substantial share of Pakistan's exports relied on the rice. Although share of rice is significant for Pakistan's overall exports, Pakistan's share in overall global rice market is only 0.02 percent. This low share in the global market makes Pakistan a price taker for rice prices. Pakistan doesn't have the ability to influence the international rice prices and hence is subject to price shock. International rice prices have been volatile off-late and have been a source of higher vulnerabilities of countries involved in trade.

Estimated coefficient for rice price index is -0.2081 which explains that increase in rice price index generally reduces external vulnerability. This coefficient has been yielded from principal component analysis approach. Coefficient for the same variable is -0.4642 if the model is solved through Johansen co-integration. Both techniques yielded similar results and argues that any increase in international rice prices generally reduces external vulnerability of Pakistan.

Import concentration by product is another indicator that has been identified in this study as a potential source of import related external vulnerability. The product concentration to few products is considered bad for the long-term perspective of any country's import potential. If there is any change in product or ban on product happens in the other country it is or if the taste and preferences of the customers of home country changes, it effects the imports negatively so the products should be diversified. Any change in the regulations regarding those products can also harm the imports

of country. The top five imports of Pakistan are Refined Petroleum, Crude Petroleum, Palm oil, Petroleum gas and cars. Mostly imports of Pakistan are related to Petroleum so when the prices of oil get high in the international markets Pakistan suffers because of it a lot.

The estimated coefficient for index of import concentration by product is 0.094 which shows that when the import concentration by product increases the vulnerability related to import also increases. This coefficient has been yielded through principal component analysis approach. While the value of coefficient is 0.1830 when solved through the Johansen co-integration approach. Both techniques yielded similar results and argues that any increase in index of import concentration by product generally increases external vulnerability of Pakistan.

Oil is the major import of Pakistan so oil prices play a vital role regarding the import related vulnerabilities of Pakistan. Pakistan is a price taker country so when the international prices increase it affects the imports of Pakistan negatively. High volatility in prices reduce the country's ability to pursue long term trade policy. When the prices are volatile it is difficult for a country to set trade targets consistent with its overall economic framework.

The estimated coefficient for oil prices is 0.0156 that is calculated through principal component analysis. The figure shows that any increase in the oil prices increases the import related vulnerabilities of Pakistan. Coefficient for that variable is -0.0302 when the model is solved through Johansen co-integration approach. Both models yielded similar results that any increase in international oil prices increase external vulnerability of Pakistan.

Figure 5.3 1 Overall External Vulnerability Index by using Principal Component Analysis

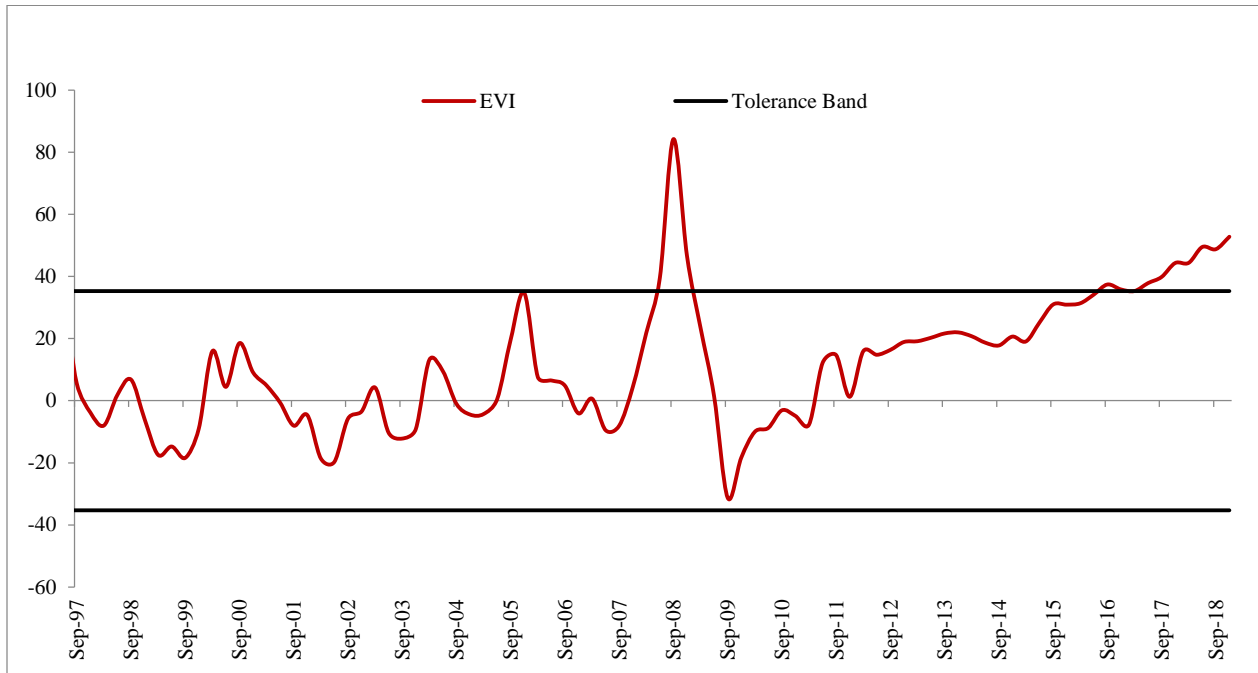


Figure 5.3 1 depicts that the constructed overall external vulnerability index for Pakistan through Principal Component Analysis the Red line depicts the constructed EVI, while the black lines indicate the tolerance band. The argument is that within the tolerance band the vulnerabilities are not causing any serious concern for the country. While when the red line breaches the tolerance band it indicates about the serious concerns for the country. As the EVI breaching the tolerance band indicated that urgent attention by policy makers is needed and they should take some necessary steps to keep the country from the materialization of risk. The inspection of EVI constructed through Principal Component Analysis reveals that constructed EVI is a good Early Warning indicator for the Balance of Payment crisis of Pakistan. Every time the EVI was heading towards the upper band Pakistan ended up which approaching IMF or other International Financial Institutions for the bailout. As we can see that EVI approached upper band in 2008, 2013 and 2018. All these years Pakistan approached IMF for bailout package.

Figure 5.3 2 Overall External Vulnerability Index by using Johansen Co-integration

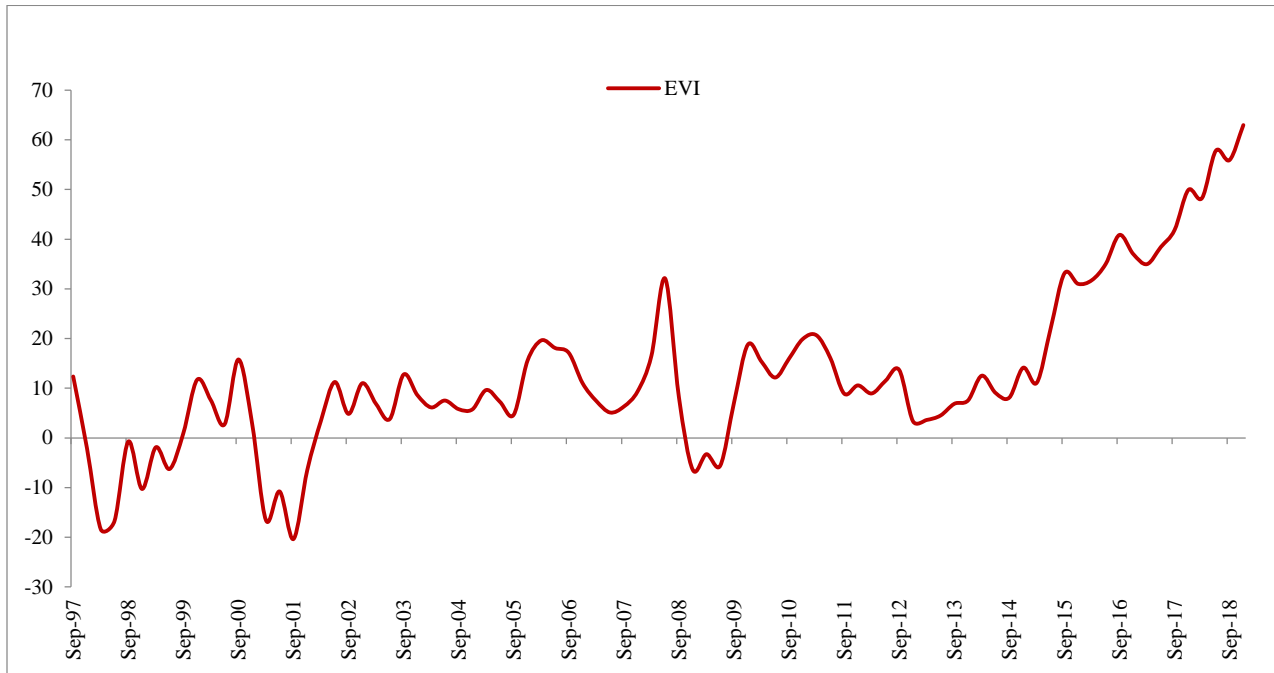


Figure 5.3 2 depicts the constructed External Vulnerability Index for Pakistan by using Johansen Co-integration. The shape of EVI is quite similar to the EVI constructed through PCA. However, the introduction of tolerance band is a bit hard in the dynamic models. Similar to precious EVI, there is an upward trend in EVI that was followed by bailout packages form IMF or other IFI's. the upward pressures could be seen in 2004, 2008, 2013, 2018 and in each of these years Pakistan approached IMF for bailout package. These constructed EVI make a strong case of using such information as an early warning system for import related vulnerabilities.

Figure 5.4 1 Debt from IMF

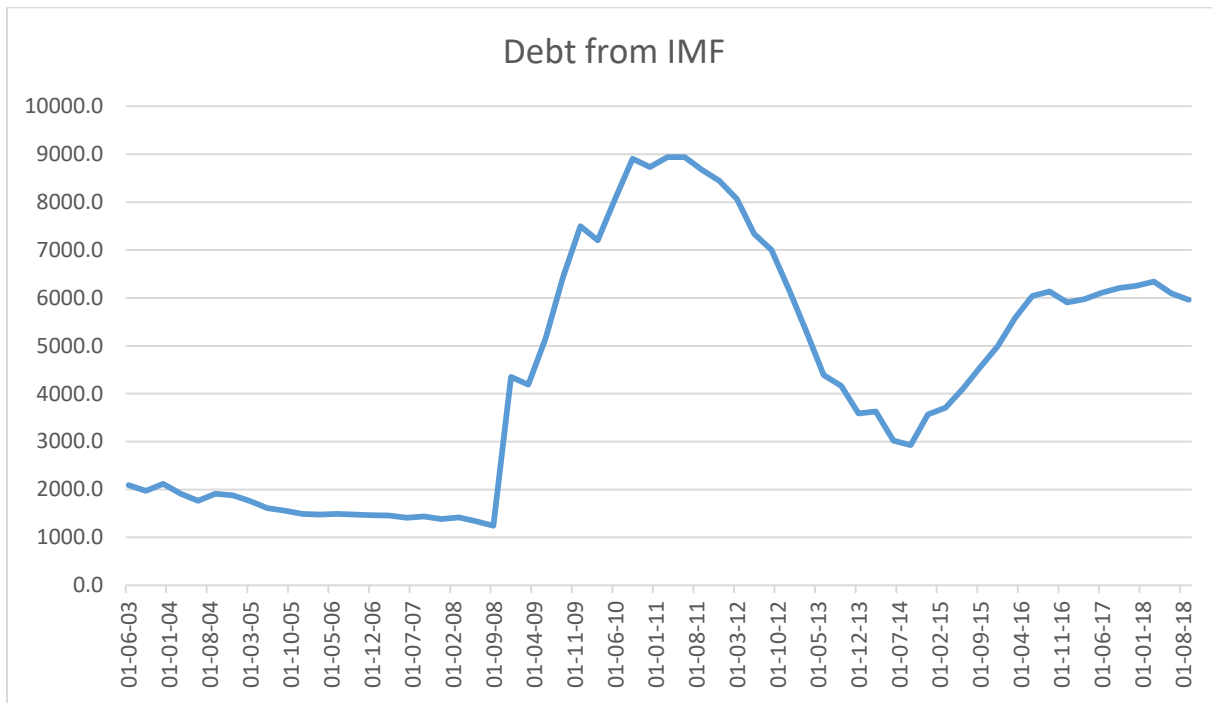


Figure 5.4 1 shows the debt that has been taken from IMF over past two decades. As the figure shows the huge rise after 2008 and 2013, which depicts that government has approached IMF in these years for bailout to overcome the balance of payment crisis. The bailout package taken in 2008 was the largest one consists of \$4.94 billion US. Then in 2013 government again approached IMF for the second largest loan that amounted \$4.399 billion.

Figure 5.4 2 SBP Reserves

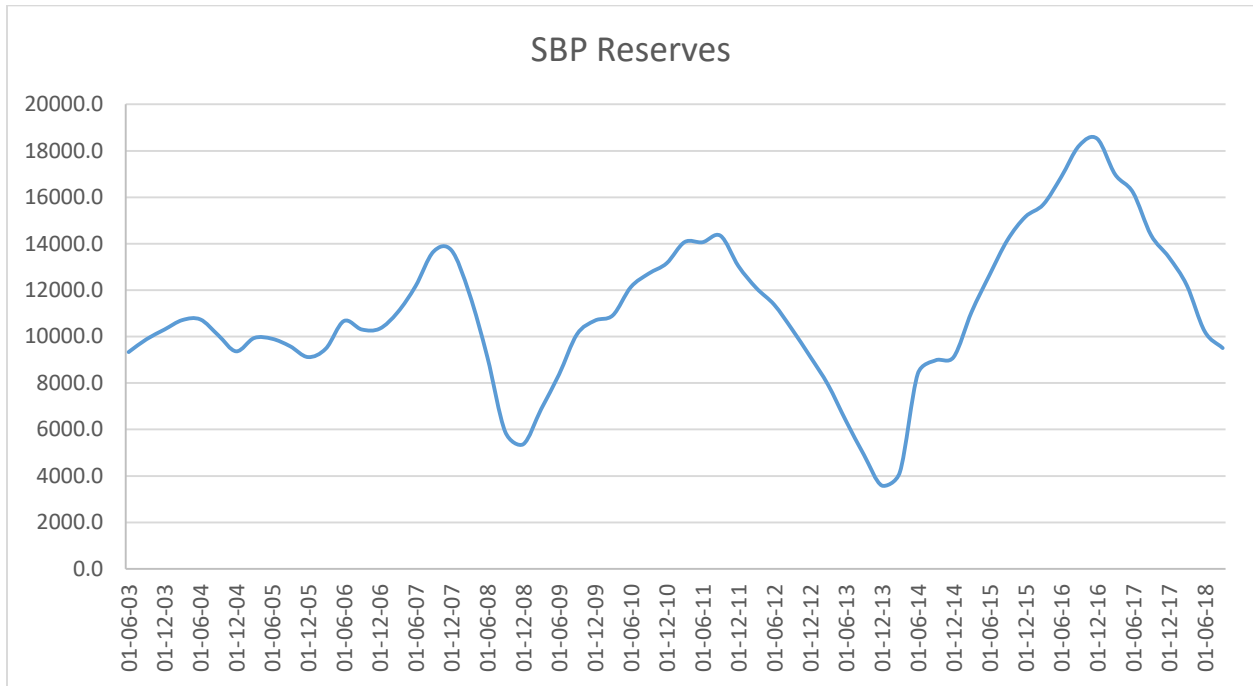


Figure shows the reserves held by State Bank of Pakistan. This figure is also showing upward trend after 2008 and then 2013, so if the reserves amount is seen in isolation it shows that the country has increasing reserves and economy is doing good but on the other hand this fact cannot be forgotten that these reserves contain huge amount of loan taken from IMF. So, these indicators cannot be seen in isolation to show the health of external sector of Pakistan that why a composite indicator was needed which included every variable that was important regarding the external sector of Pakistan.

6 Chapter 6: Conclusion

Pakistan has been facing severe balance of payment crisis, mainly due to the fact that country has not been able to come up with proactive policies to hedge itself against external shocks. This proactive approach remained absent mainly because country has no composite indicator which can correctly reflect the building external vulnerabilities. Most of the governments have taken benefit of this situation and have used variable of their choice to show economic performance of their respective government and take some political mileage. For instance, right now Pakistan has a change in government. The incoming government has been making noise of state of economic affairs handed over to them by the previous government. They have been referring to the level of debt country has to pay in the short to medium run and the declining exports. On the flip side of it, previous government has consistently been claiming that they left office with a prosperous and sustainable growing economy. And they have been supporting their argument with reasonably handsome numbers in the FDI and foreign exchange reserves.

This situation could have been avoided with the help of composite indicator, which should ideally be the aggregated position of all the relevant economic indicators. Such indicator can take away the discretionary power from the political parties and can present the factual position. However, construction of such indicator is not a straightforward task. This study is an attempt to construct such index for Pakistan. While doing the literature review, the research gaps found are the use of dynamic models and disaggregated approach to construct an aggregated index.

This study has approached the aggregate vulnerability index by using multiple sub-indices to mitigate the chances of neutralization of sources of vulnerability. To bridge the research gap, this study has utilized co-integration approach which provided dynamic results for long and short run as well also provide the speed of adjustment from disequilibrium to equilibrium. Although this

study bridge most of the gaps for literature on this topic for Pakistan. However, one of the key limitations of this study is its ability to find out the probabilities of occurrence of such external vulnerabilities.

Results showed the constructed overall external vulnerability index for Pakistan through Principal Component Analysis the Red line depicted the constructed EVI, while the black lines indicated the tolerance band. The argument is that within the tolerance band the vulnerabilities are not causing any serious concern for the country. While when the red line breaches the tolerance band it indicates about the serious concerns for the country. As the EVI breaching the tolerance band indicated that urgent attention by policy makers is needed and they should take some necessary steps to keep the country from the materialization of risk. The inspection of EVI constructed through Principal Component Analysis reveals that constructed EVI is a good Early Warning indicator for the Balance of Payment crisis of Pakistan. Every time the EVI was heading towards the upper band Pakistan ended up which approaching IMF or other International Financial Institutions for the bailout. As we can see that EVI approached upper band in 2008, 2013 and 2018. All these years Pakistan approached IMF for bailout package.

The results of EVI is constructed through Johansen Co-integration is quite similar to the EVI constructed through PCA. However, the introduction of tolerance band is a bit hard in the dynamic models. There is an upward trend in EVI that was followed by bailout packages form IMF or other IFI's. the upward pressures could be seen in 2004, 2008, 2013, 2018 and in each of these years Pakistan approached IMF for bailout package. These constructed EVI make a strong case of using such information as an early warning system for external vulnerability. So, we can conclude that the composite indicator that has been constructed by aggregating trade and non-trade related variable was successful to find the crisis periods.

There is need for vigilant monitoring of external indicators and taking effective policy steps to improve their performances. Therefore, there is a need for prudent management of external sector to stay away from any external or domestic shocks and to keep the economy on growth trajectory. While monitoring the vulnerability index, it should be noted that a vulnerable situation is only a precondition for a crisis to happen; it is the exception of market participants that play a crucial role in igniting an actual external crisis. Nevertheless, the degree of vulnerability can certainly amplify the scale of crisis to take place. This study only shows the indication of crisis but it doesn't tell that whether the risks will materialize or not so in addition to calculating the vulnerability index there is need to measure an index that also covers the materializing or non-materializing of the external shocks.

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