COINTEGRATION ANALYSIS OF TWIN DEFICIT: AN INDICATOR SATURATION APPROACH

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I Aqib, Registration No. PIDE2017FMPHILETS16, student of MPhil Econometrics at Department of Economics and Econometrics at Pakistan Institute of Development Economics Islamabad. I hereby declare that the work embodied in this thesis “Cointegration analysis of triple deficits: An indicator saturation approach”, is the result of original research and has not been submitted for any degree in any other University or Institution.

Aqib

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In the name of Almighty Allah, the most Gracious and the most Merciful who made me capable enough to do field work without being dispirited. I thank Allah for blessing me with the strength and patience.

All respects to the Holly Prophet Muhammad (P.B.U.H) who is the role model for humanity and enabled us to recognize our creator.

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DEDICATION

I dedicate my thesis work to my family and my all teachers. A special feeling of gratitude to my loving parents and cooperative supervisors. My brothers give me all time support to work. I will always appreciate all they have done. Now I achieved this goal with the help of my teachers and parents. My Parents who faced too many difficulties and problems while bringing me on this stage, my father who supported me and elevate me from beginning to the end in every stage of my life and I dedicate to my mother for her resilience in insisting to educate me.

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ABSTRACT

This research aims to examine the econometric methodology of the triple deficit's hypothesis in the existence of multiple structural breaks. Triple deficit theory is a put forward by expanding the twin deficit theory, to recognize the private deficit together with the trade deficit and budget deficit and to investigate the relationship among these under the Keynesian approach. Annual time series data has been used from the period 1975 to 2018. Previous literature is evident with the fact that researchers have employed traditional econometric techniques and did not incorporate multiple structural breaks. To fill the existing gap in previous literature, this study has applied econometric techniques that captured the impact of multiple structural breaks in the series. In this study we used the saturation approach (impulse indicator saturation and step indicator saturation) for multiple structural breaks and equilibrium correction model (Eqcm) for cointegration analysis. Results concluded that in the static equilibrium correction model there has been a positive relationship between fiscal-deficit, private deficit and trade-deficit in the existence of multiple breakpoints (I: 1977, I: 1998, I: 2018, S1: 1987, S1: 2001, S1: 2004 and S1: 2008). In the dynamic equilibrium correction model, there exists a positive relationship both in (short-term and long-term) between budget-deficit, private deficit, and trade deficit in the presence of three-step indicators (S1: 2001, S1: 2004 and S1: 2008).

CHAPTER 1

INTRODUCTION

Macroeconomic problems arise in the economy when a country fails to achieve the goal of full employment, inflation, and economic stability. After the second world war, the major problems faced by countries were unemployment, inflation, and an unstable economy (Keynes, 1936)[1]. To overcome these problems countries had been involved in international trade to decrease the existing huge budget-deficits[2]. But large fiscal deficit and private deficits affects the trade balance hence, twin deficits (fiscal-deficit and trade-deficit) occur together in the economy.

Budget-deficit happens when the total government expenditures of a country exceed its whole revenue and trade-deficit is observed when a country face its imports greater than exports while private deficit occurs When interest rate increases in the economy the private investment decreases which leads to the private deficit (saving and investment ratio imbalance). Keynesian school of thought proposed that there is a causal relation between these three deficits. Keynesian model[3] suggested that budget-deficit and private consumption has a positive impact on trade-deficit. According to Mundell Fleming model, trade balance is equivalent to the budget deficit, private saving, and investment gap. When interest rate increases in the economy the private investment decreases which leads to the private deficit (saving and investment ratio imbalance). While on the other hand, another economist David Ricardo gives Ricardian equivalence theory[4], which states that trade-deficit and budget-deficit both are independent, and no causal relationship exists between them. He argued that when the

[1] John Maynard Keynes in his book "General theory of employment and money" in 1936 address the major problems in the economy after the world war.
[2] Budget deficit is the difference between total receipts and total expenditure. When borrowings and other liabilities are added to the budget deficit, it becomes a Fiscal deficit.
[3] John Maynard Keynes in 1936 proposed the Keynesian proposition of budget-deficit.
[4] David Ricardo (classical Economist) in the 1890s proposed Ricardian equivalence theory.

government increases the money supply in the market by printing money or taking loans from the external or internal resources, the saving ratio increases because of the expected future tax. This additional money has no impact on the balance of payment, as the domestic consumer has the same consumption pattern.

This thesis intends to explore the effect of fiscal deficit, private deficit on current accounts in Pakistan. Previous literature from international as well from Pakistan associated to twin and triple hypothesis, most of the researchers accepts the Keynesians point of view but some of them accept the Ricardian equivalence theory. However previous studies used different econometric models and concluded a causal relationship between these two deficits as proposed in Keynesian theory. Most of the researchers examine the twin and triple deficits hypothesis without capturing breakpoints and used standard econometric techniques to determine the triple deficits hypothesis whether it exists or not.

From the previous literature, it is also observed that some of the researchers included the structural breaks in their studies but the tests they had used for the detection of breaks were not so powerful, to capture the multiple break shifts. This study inspects the effect of budget-deficit and private deficit on trade-deficit to fill the existing gap in previous studies by using indicator saturations approach (for multiple structural breaks detection) and equilibrium correction models (Eqcm) for long-term and short-term relationships.

The indicator saturation approach (Impulse Indicator Saturation and Step Indicator Saturation) has the power to detect multiple break shifts. Indicator saturation has an extra advantage of model selection (both IIS and SIS can be used for model selection). For an unknown number of breaks and outliers, dynamics and non-linearities of independent variables can be selected together with indicators. Whenever the data generating process (DGP) is unknown then such type of break detection approach is important. Most of the break detection

tests rely (up to some extent) on the model, if the said model is specified properly other than breaks but these approaches have a deficiency of the power to identify breaks if a model is not specified correctly.

For the detection of a known number of breaks, there were several studies in the literature, but the saturation method is relevant when data series have unknown breaks and outliers. Impulse indicator saturation is specifically designed for the detection of outliers comparatively to breaks, but the method of split-half can be used to demonstrate the saturation method, when there is a single break (Hendry and Santos, 2010). Impulse indicator saturation's detection power and potency are determined by the length of the break. Which defines how much indicators have required to be found. Castle et al (2012) enhanced the capability of impulse indicator saturation in Auto metrics to identify multiple structural breaks.

Step indicator saturation (SIS) is specifically designed for the detection of multiple location shifts (Hendry et al, 2010). Step shifts are exactly a block of adjacent impulses having the same sign and magnitude. Though impulse indicator saturation has the power to detect these step shifts, and the indicators which are retained were integrated into a dummy variable which takes the average value of break and zeroes otherwise.

To investigate the impact of the fiscal and private deficit on trade imbalance in the existence of multiple location shifts, in this study we have used equilibrium correction models (Eqcm) to explore the long-term and short-term relationship. Equilibrium is a condition from which there has no inherent tendency to transform. While dealing with the stochastic process the equilibrium is the probable value of the variable in appropriate representation since that is the state in which the process would return in the absence of further shocks. Equilibrium correction models have a definite equilibrium and in which changes occur to that equilibrium. Eqcm shows the strength of the relationship and openly stipulates the effect of the changes in

independent variables over the time (short term) and the effect of variables which illustrate an equilibrium relationship (which are long term effects).

The purpose of this research is to examine and analyse the triple deficits hypothesis by considering the multiple breaks shifts in the case of Pakistan. The distinct features of this study are identification of multiple locations shifts through step and impulse indicator saturation. Next, the focus of this study is to examine the empirical short term and long-term relation among fiscal and trade imbalance. After the comprehensive description of the introduction, the remaining portion of this chapter describes the objectives of the study, contribution, and motivation.

1.1 Objectives of the study:

To investigate a long-term relation between fiscal deficit, private deficit, and trade deficit in the existence of multiple location shifts.

1.2 Motivation of the study:

Triple deficits have remained an important problem for the legislators and policymakers of Pakistan for the past several years because of numerous external and internal shocks that badly affected the trade sector and the development of the economy. For this reason, there is need to identify the consequences of these shocks by incorporating the structural breaks, to ensure that in the existence of multiple structural breaks, fiscal and trade imbalances have a significant relation, or we have some estimation errors that give misleading results about the triple deficits. In the existence of multiple location shifts, this study has examined the long-term and short-term relation of triple deficits.

1.3 Contribution to the study:

This study contributes especially to applied econometrics by locating the significant multiple breaks, in the case of triple deficits through indicator saturation approach. As indicator

saturation (IIS and SIS) is till to date the most powerful and modern technique of detection of breaks in macroeconomic data while for long-term relationships this study used the equilibrium correction model to inspect the impact of budget-deficit on trade-deficit in the presence of multiple structural breaks.

CHAPTER 2

LITERATURE REVIEW

To understand the previous literature about triple deficits it is necessary to recognize the connection between fiscal-deficit and trade-deficit according to economic theory.

2.1 Background of the study:

As the Keynesian school of thought proposed that fiscal deficit has a causal relation with trade-deficit. Fiscal-deficit has a positive effect on domestic consumption which leads to trade-deficit. As stated by the Mundell Fleming model[5], there are two sectors in a country, the government sector, and the private sector. The government is sovereign and has the power to finance itself by printing money or by taking a loan, while the private sector allocates its budget according to its income. When the government faces a budget-deficit then the government takes a loan from the external or internal resources or prints money. This additional money transfers from the government sector to the private sector through government expenditures and increases the purchasing power of the domestic consumer. To improve the living standard, the demand for foreign goods increases which means more imports in the country, and the difference between exports and imports increases which leads to the current account imbalance.

While on the other hand, another economist David Ricardo gives Ricardian equivalence theory, which states that these deficits (current account, private and budget) are independent, and no causal relationship exists between them. He said that when the government increases the money supply in the market by printing money or taking loans from the external or internal resources, then the saving ratio increases because of the expected future tax. This additional money has no impact on the balance of payment, as the domestic consumer has the same

[5] Robert Mundell and Marcus Fleming in 1963 proposed the IS-LM BOP model.

consumption pattern experimental study by (Ebrill et al, 1988) confirmed the Ricardian theory that these two deficits are independent of each other.

In Previous literature from international sources as well as from Pakistan related to the triple deficits hypothesis, most of the researchers used econometric methods and did not incorporate the breakpoints and several of them used traditional tests in the detection of location shifts, like Perron (1997), Zivot Andrews (1992) test, etc. We now look in detail a review of existing literature.

2.2 Investigation of Triple deficits without structural breaks:

Analysing the twin deficit without incorporating the structural breaks in the estimation yields invalid outcomes (Sarwar, 2012). However previous studies used different econometric models and showed that there is a causal relationship between budget and private deficits to trade-deficit. Abell (1990) analysed VAR in the case of the USA, he investigated that, budget and trade-deficit have a causal relationship. He did not incorporate the structural breakpoints; hence the estimated outcomes are false. In Pakistan (Aqeel et al, 2000) investigated that, in the long-term, there exists cointegration relation, but no relationship is found in the in short-term. Akbostanci et al, (2001) also investigated the long-term relationship among budget-deficit and trade-deficit in Turkey. However, in India, Johansson, and Juselius (1990) cointegration technique was used and the study showed no long-term connection.

Triple deficits phenomena are still controversial and inconclusive that, it exists only in developed or developing countries. Ahmed (2002) examines the twin deficit in case of Pakistan. Bassu and Datta, (2005) used the HEGY test for unit root and did not incorporate the breakpoints in the series. He used cointegration and error correction mechanisms without incorporating structural breaks. Further (Mukhtar et al, 2007) used Engle-Granger and ECM test and confirmed the long-term relationship between both.

Marinheiro (2008) used VECM for causality and Augmented Dickey Fuller test for stationarity in the case of Egypt and reported long-term relationships among fiscal and trade deficit. Corsetti and Muller (2008) likewise affirmed the long-term relationships in the context of the European Union. Beetsma et al (2008) reported that there exists twin deficit in the Eurozone. He used the panel VAR model and panel unit root test for the stationary process. Another study from Eurozone (Aristovnik and Djuric, 2010) investigated that there was no evidence of twin deficit.

Similarly (Ganchev, 2010) investigated the twin deficit phenomenon and found evidence in the long-term but in the short-term, it doesn't exist. Bluedorn and Leigh (2011) also investigated that there exists a triple deficits phenomenon in OECD countries. He used the Cyclically adjusted primary balance (CAPB) technique for analysis and the Augmented Dickey-Fuller (ADF) test for unit root. Prerra and Liyanage (2012) noted that there was uni-directional causation from fiscal-deficit to current account deficit. He used the Granger causality test for short-term, Engle-Granger for a long-term relation, and the ADF test for unit root. Bagheri, (2012) collected evidence from Iran also reported the unidirectional causation. Another study from Iran by (Zamanzadeh et al, 2011) showed that there exists bidirectional causality among these deficits. He used the Granger causality test and ADF test for unit root without including the shifts. Saeed and Khan (2012) investigated the Feldstein-Horioka puzzle and twin deficits in Pakistan and found no evidence of the Feldstein-Horioka puzzle.

Akdogana and Geldia (2013) founded evidence of the long-term relationship in European economies while in the short-term there was no causal relation. Further research from the Southern Eurozone also provides evidence about the presence of twin deficit (Kosteletou, 2013). Anas (2013) found an inverse association among fiscal imbalance and current account in Morocco. Sobrino (2013) there has a reverse causality in Peru. He used Philips Perron (1988) test for unit root and the Granger causality test for a causal relation. El-Baz (2014) explored

the existence of reverse causation from trade-deficit to budget-deficit. He used VECM and Johansen cointegration for causality without incorporating the breakpoints. Mandishekwa et al. (2014) provided evidence that there exists twin deficit in Zimbabwe. Bolat et al (2014) examines the triple deficits hypothesis and states that there exists a positive relationship among the private deficit, fiscal and trade deficits.

Forte and Magazzino (2015) also investigated that there exists a twin deficit phenomenon in European economies. Yasmin (2015) examined the causality direction travel from fiscal imbalance to trade-imbalance in Pakistan. He used the Granger causality test and impulse response function. At the same time (Hassan et al. 2015) investigated that there was a bidirectional causality. He used the ARDL and VECM model. Ravinthirakumaran et al (2016) identified that there was uni-directional causation from the current account deficit to trade-deficit. Budget-deficit causes trade-imbalance in the case of Pakistan and Sri Lanka, but the converse is correct for India and Nepal. In a case study of Congo (Mahuni, 2016) the two balances diverge before converging, in the long-term through the restoring force.

Coban and Balikçioglu (2016) found the evidence of an interaction between current account deficit and savings-investment deficit. Epaphra (2017) also provides evidence of twin deficit in Tanzania. Bayramoglu and Ozturk (2018) investigated the triple deficits hypothesis in Turkey he argued that in the field of the triple deficits hypothesis, a strong interrelationship between domestic savings and the current account is reached, while a causal relationship between fixed capital investments and the current account balance cannot be determined. Yeniwati (2018) budget deficit and saving-investment gap have one-way relationship and current account deficit and saving-investment gap does not have causality or one-way relationship. While (Gaysset et al, 2019) provided evidence about the existence of twin deficit. Raji (2019) provided the evidence about the triple deficits in case of Nigeria. Magoti et al (2020) triple deficits do not hold in East African countries.

2.3 Investigation of Triple deficits with structural breaks:

As we noticed in previous literature that without incorporating the structural breaks in the estimation gives invalid results about twin deficits phenomena. In previous literature, most of the researchers used traditional tests to detect the breakpoints in the series i.e. Perron (1997), chow test (1960), Zivot and Andrews (1992) test, etc. As these tests cannot capture the multiple breaks shifts in the series both exogenously and endogenously. Kustepeli and Onel (2005) also investigated that there was no evidence of twin deficit in Turkey. Baharumshah et al (2006) provided evidence of the twin hypothesis in ASEAN economies. He used the VAR model for causality and Zivot and Andrews (1992) for structural breaks of breaks.

Bagnai, (2006) investigated the double deficit by incorporating location shifts and reported a long-run relationship among the current account imbalance and its determinants. He used Perron, Zivot and Andrews (1992) test for breakpoint detection. Kim et al (2006) examined that there exists no fundamental link among fiscal imbalance and trade shortfall, but he found the evidence of causality in Korea. He used Zivot and Andrews (1992) for breakpoints. Chowdhury and Saleh (2007) described trade openness has a positive effect on trade imbalance but statistically insignificant in Sri Lanka. He used the Perron test for structural breaks and used ARDL and ECM for a cointegration relationship. Bitzis et al (2008) In the long-term fiscal deficit affects the trade imbalance while no proof was found in the short-term.

Further (Daly and Siddiki, 2009) found a cointegration relation among budget disparity, interest rate, and trade-imbalance in thirteen out of twenty countries. Baharumshah et al (2006) noted that regime shifts significantly effects and twin deficit occurs in 4 South Asian states and while in developed countries it does not exist. He used Zivot and Andrews's (1992) test for the endogenous breakpoint and Gregory and Hansen's model was used for cointegration analysis.

Grier and Yeh (2009) found that cointegrating relations amongst dual deficits in the United States. He used the Perron test for structural breaks and used the VAR, GIRF, ARCH, and GARCH model for analysis. Holmes (2010) examined the existence of a cointegration relation between dual deficits. He used the Perron test for break detection and Gregory and Hansen test for causality, (Lam 2012 and Sakyi, 2013) also provide the evidence of twin deficit.

Another study from OECD economies (Makin and Narayan, 2013) identified the causal relationship between both deficits in Australia. Ahmad and Awordine (2015) reported that dual deficits have a positive relation in eight African countries while residual four countries of Kenya, Ethiopia, Uganda, and South Africa found no evidence of twin deficit. He used the Perron test for break detection and ARDL for cointegration. Sarwar (2012) founded a significant relation among both imbalances in the existence of a single break in 1987. He concluded that examining the relationship of twin deficit, the breakpoints should be incorporated, otherwise, we end up with false outcomes. Gautam (2015) examined the occurrence of twin deficit in short term but in the long-term, no causal relationship was found in India. He used the Perron method for break identification and Gregory and Hansen to check the causality. Ngakosso (2016) used Perron, Zivot and Andrews's (1992) test for break identification and cointegration analysis and founded no evidence of twin deficit in Congo.

2.4 Impulse indicator saturation and step indicator saturation:

In previous literature, we have noted that researchers used time-series data and incorporated the location shifts in the series to capture the volatility of econometric models but the methodology or tests they used to detect the breakpoints in the series i.e. Perron (1997), chow test, Zivot and Andrews (1992) test, etc have low validity if the series data have multiple breakpoints. As these tests were not so powerful to capture the multiple breakpoints both exogenously and endogenously for this reason, in this study we attempt to apply the indicator saturation (IIS and SIS) methodology to capture the multiple mean and location shifts in the

series. As the step indicator saturation was a more powerful technique to capture the mean and location shifts endogenously (Hendry et al, 2013) and it's very important for the validation of an econometric model.

Johansen and Nielsen, (2009) examined that the impulse indicator saturation was robust to outliers and structural breaks, he used one step M-estimator and impulse indicator saturation on time series data for the detection of outliers and breakpoints. Hendry and Santos (2010) reported the potency of impulse indicator is described through the scale of the break (the span of the break interval) which defines that how much indicators were needed to be found. For the detection of multiple structural breaks step indicator saturation is explicitly designed (Hendry, 2010). Castle et al (2012) create the capability of impulse indicator in Auto metrics for multiple break shifts. Another study (Hendry et al, 2013) also revealed that location shifts by SIS seem feasible and IIS has relatively low power for long-term breaks, they investigated the location shifts through the extension of general to a specific approach. Castle et al (2015) investigated that IIS (impulse indicator saturation) has relatively low potency for longer shifts than SIS, he used the indicator saturation approach to apprehend the structural breaks in the framework of the selection of models. IIS delivers a context to analyse the identification of location shifts at any point in time (Pretis et al, 2016). He used the IIS methodology on artificial data to capture the economic recessions to volcanic recessions.

In previous literature, most of the researchers used different econometric models to analyse the relationship among fiscal and trade imbalance. In this research, we are going to apply equilibrium correction models in the existence of multiple location shifts to fill the literature gap. Equilibrium correction models are a special class of proportionate integral and derivative regulator mechanism. Eitrheim et al (1999) used the equilibrium correction model and differenced VAR to investigate the macro-econometric forecasting. Krolzig et al (2002) Markov switching of VEqcm of the UK labour demand, further (Bec and Rahbek, 2004 and

Sarno et al, 2003) used equilibrium correction models and vector equilibrium correction model (VEqcm) with a nonlinear adjustment by considering the stable, stationary linear combinations of P dimensional process. Hendry (2006) examined that equilibrium correction models show the strength of a relationship and openly postulates the effects of the change in independent variables over the period (short term) and the effects of variables that show an equilibrium relationship (which are long term effects).

Pelipas and Chubrik (2008) used Eqcm to investigates the impact of market reform on economic growth, (Dekker et al, 2003) equilibrium correction model gives interpretable parameters in distinction to an unobstructed dynamic model. Equilibrium correction models are frequently used in time series analysis (Hendry et al, 2013). It describes the effects on time-based variations in an explanatory variable. Charfeddine (2017) used equilibrium correction models to identify the relationship between energy consumption and economic development by incorporating structural breaks through Markov shifts. Kripfganz and Schneider, (2019) identified that for the examination of the existing relationship among the variables of interest single equation conditional equilibrium correction models can be used.

In time-series data analysis, the problem of seasonal mean shifts, or structural breaks will lose the information and give spurious results. Most of the researchers did not incorporate the breakpoints in the series and some of them used such traditional tests that cannot capture the multiple breakpoints in the series, hence the problem of triple deficits is still unresolved. That is why we should use standard econometric tests (as this study will use), for the detection of significant multiple breakpoints and use standard econometric models which can capture the breakpoints effects in the estimation.

CHAPTER 3

DATA AND METHODOLOGY

The intend of this chapter is to clarify the econometric methods that are utilized to achieve the purpose of this study. In this thesis, we have elaborated on the short-term and long-term connection among the import/export gap and fiscal imbalance in the existence of multiple breakpoints through indicator saturation methodology. For the short-term and long-term relationships, the equilibrium correction model (Eqcm) has been utilized. We have explored this relationship empirically by using real data. The variables are imports, exports, government expenditures, taxes, private investment, private saving, exchange rate, and interest rate. Time series data have been used on annual bases.

3.1 Theoretical framework:

While understanding the causal relationship among budget-imbalance and trade-imbalance, we first clarify the idea of Keynesian's closed economy and David Ricardo's open economy. Keynesian proposition describes that a closed economy is when a country's revenue is equivalent to the government expenses, total consumption, and investment and if we add the net exports (EX - IM) it becomes an open economy. To capture the relationship of budget-imbalance and trade-imbalance, we will start from the national income identity.

National income identity on the expenditure side,

$$Y = C + I + G + (EX - IM) \quad \textbf{(3.1)}$$

National income identity can be stated as a disposable side,

$$Y = C + S + T \quad \textbf{(3.2)}$$

by putting equation 3.2 into equation 3.1

$$C + S + T = C + I + G + (EX - IM) \quad \textbf{(3.3)}$$

By rearranging 3.3 equation we get,

$$(EX - IM) = (I - S) + (G - T) \quad \textbf{(3.4)}$$

Equation 3.4 shows that import and export balance is equivalent to the gap among private investment, private saving, and government expenditures minus taxes. After the independence Pakistan has been facing the trade-deficit throughout the history therefore equation 3.4 becomes,

$$(IM - EX) = (I - S) + (G - T) \quad \textbf{(3.5)}$$

While investigating the triple deficits, Mundell-Fleming explains the IS-LM model in the context of the unrestricted economy by assuming the free capital movement. When budget-deficit increases it also raises the interest rate and attracts the foreign capital, which leads to a high exchange rate which causes triple deficits. First-time twin deficit was investigated by Abell (1990) he used interest rate and exchange rate as an exogenous variable. Therefore, we analysed the triple deficits hypothesis by incorporating the exchange rate and interest rate Akdogan et al (2013), Bolat et al (2014). According to economic theory and past literature, the economic model of triple deficits becomes,

$$TD_t = f(PD, BD_t, int_t, ex_t) \quad \textbf{(3.6)}$$

The econometric model becomes,

$$TD_t = \propto_0 + \beta_1(PD_t) + \beta_2(BD_t) + \beta_3(int_{t)} + \beta_4(ex_t) + e_t \quad \textbf{(3.7)}$$

TD = trade-deficit (Imports - Exports)

PD = investment saving gap (private deficit)

BD = budget-deficit (G-T)

Int = interest rate

E*x* = real exchange rate

e = error term

3.2 Econometric methodology:

According to previous studies from international sources as well from Pakistan, related to the triple and twin deficit hypothesis, most of the researchers used different conventional econometric models techniques and showed that there exists a causation relationship amongst the fiscal-imbalance and current account-imbalance as stated in Keynesian theory. This research aims to discover the cointegration relation among the trade-deficit, private and budget-deficits as proposed under the Keynesian theorists in the presence of multiple breakpoints.

3.2.1 Stationarity:

In time series the stationarity is, when the statistical properties (mean and variance) are consistent over the period. In time-series data there exists a problem of non-stationarity or a random walk. To check the stationarity, we applied KPSS (Kwiatkowski Phillips Schmidt Shin) test in the detection of unit root because the null hypothesis of the test is, data is stationary. KPSS test has a drawback of type one error as it rejects the null hypothesis, to control this error we have applied ADF (Augmented Dicky Fuller) test if both tests results show the stationarity in time series then it probably is. We applied ADF and KPSS tests for stationarity of the variables. If the variables are non-stationarity it means that non-stationarity is due to the accumulation of past shocks. So, there is a need to identify the breakpoints in the series.

3.2.2 Impulse indicator saturation:

The methodology of IIS is general to specific wherein an indicator is introduced for every observation in the set of explanatory variables, it means if "T" is the number of observations then "T" several variables will be created. In this study, we are using two kinds of saturation methods impulse indicator saturation and step indicator saturation.

Impulse indicator generates a complete set of indicators, for every variable an indicator takes the value one for each observation and zero otherwise. The number of observations is created according to the number of indicators; each observation has a cross ponding value one. Hence for the sample of "T" observations, "T" indicators are added in the set of aspirant variables. By adding an impulse indicator for a certain observation in a statistic regression delivers the same estimate of the model's parameter. If an observation is left out the coefficient of that indicator becomes equal to the residual of the associated observation when predicted from a model, based on the other observation. In dynamic relations, by omitting an observation can distort autocorrelations, but an impulse indicator will simply deliver a zero residual at that observation.

If I_t (T) denotes an indicator variable, then in the case of impulse indicator saturation I_t (T) is a pulse dummy taking values 1 for T and zero otherwise. Santos (2008), analyze the distribution properties of impulse indicator saturation when the observations are generated according to the model.

$$Y = \mu + \varepsilon_t \qquad \text{t = 1, ……., T}$$

and

$$\varepsilon_t \sim IID\ (0, \delta^2)$$

For the model selection, impulse indicator saturation is considered as split-half approach T/2. For the first half sample added to the model.

$$Y_t = \mu + \sum_{k=1}^{T/2} \delta_{1k}\, I_t(k) + \varepsilon_t \qquad \text{t = 1, ……., T} \qquad \textbf{(3.8)}$$

Form the first half an indicator has been chosen at α (significance level) then the selection procedure is repeated in the second half (T-T/2). Then significant dummies from both halves are combined to determine the final model. Impulse indicators average retaining rate under the null is αT, when all individual test's significance level is set at α. Hendry et al (2008) investigated that splitting like m splits of size T/m or different, does not affect the indicators.

Impulse indicator saturation is considered to detect outliers rather than breaks, but the split-half method can also use to exemplify indicator saturation when there is a single location shift (Hendry and Santos, 2010). The detection power and potency of IIS are determined by the magnitude of the shift (the length of the break interval) which describes how many indicators need to be found. Castle et al (2012) create the ability of IIS in Auto metrics to detect multiple location shifts.

3.2.3 Step indicator saturation:

Step indicator saturation (SIS) is specifically designed for the detection of multiple location shifts (Hendry et al, 2010). Step shifts are exactly a block of adjacent impulses having the same sign and magnitude. Though impulse indicator saturation has the power to detect these step shifts, and the indicators which are retained were integrated with a dummy variable which takes the average value of break and zeroes otherwise. Castle et al (2015) generate the null retention frequency of step indicator saturation and describes the enhanced potency for longer location shifts rather than impulse indicator saturation.

The step indicator method is the extension of impulse indicator to the case when It (T) represents a step or intercept dummy. Johansen and Neilsen (2009) generalized the integrated dynamic model analysis (probably with unit roots) that for small α like i.e. $\alpha \leq 0.01$. The inadequacy of conducting impulse indicator saturation is small even with testing T impulse indicators.

$$y_t = \beta_o + \beta'_1 z_t + \sum_{i=1}^{m} \varphi_i 1_{\{t=ti\}} + v_t \qquad \textbf{(3.9)}$$

Where $v_t \sim IID\ (0, \delta_v^2)$

φ_i is a significant impulse indicator when the significance level α is used in testing their retention. Hendry et al (2013) examined that regressors could be retained without selection.

$$y_t = \sum_{J=1}^{T} \delta_j\, 1_{\{t \leq j\}} + \mu_t \qquad \textbf{(3.10)}$$

Where $\mu_t \sim$ IID $(0, \delta^2{}_\mu)$

Step indicators are the cumulation of impulse indicators up to each next observation. When a complete set of step indicators are added to a model,

$$S_1 = \{1_{\{t \le j\}}, j = 1, \ldots\ldots, T\}$$

Step indicators takes the form from whole sample vectors,

$$t_1 = (1,0,0,\ldots.,0), \quad t_2 = (1,1,0,0,0,\ldots 0) \ldots\ldots\ldots\ldots t_T = (1,1,1,1,\ldots.,1)$$

As a step indicator saturation follows the split-half approach T/2. Choose a significance level α for T indicators and add the first half T/2. Record the indicators which have significant coefficients, eliminate them, and add the second block of T/2 to the original model. Again, selecting the indicators which have significant coefficients. Finally, combine the recorded variables from the two splits and select a significance level α under the null α = 1/T, on average at both sub-steps αT/2 will be retained by chance. Hence on average αT indicators will be retained from the combined stage and one degree of freedom is lost on average. When there are more regressors plus indicators than T the procedure can be extended by dividing the total set of N aspirant variables into smaller sub-blocks setting α = 1/N.

3.2.4 Equilibrium correction model (Eqcm):

After the breakpoints identification, this study applies equilibrium correction models (Eqcm) for long-term and short-term analysis. As equilibrium correction models incorporate the multiple breaks points (see Hendry, D. F. (2015). Introductory macro-econometrics, page # 97). Equilibrium correction models can give unit root tests based on the pc-give t-test (see Hendry, D. F. (2015). Introductory macro-econometrics task # 18, page # 99).

Equilibrium correction models (Eqcm) have a special class of proportional derivative and integral control mechanisms, so they have a long pedigree in that arena. Often it is not realized that the model being used is a member of the equilibrium class model. Equilibrium correction models are a very broad class comprising all regressions, autoregressions, ARDL models, linear simultaneous equations, VARs, VEqcms, DSGEs, and all types of ARCH and GARCH

models. Their formulation determines the equilibrium to which they converge (level or steady state). For example, a random walk without drift is a non-stationary process in levels but is stationary in differences and has an expectation of zero. So, the differences equilibrium corrects to zero.

$$Y_t = \beta_o + \sum_{i=1}^{k} \beta_i z_{i,t} + \varepsilon_t \quad \textbf{(3.11)}$$

$$= \beta_o + \beta' z_t + \varepsilon_t$$

Where $\varepsilon_t \sim IN\ (0,\ \delta^2)$

ε_t is normal and independent from the past and present of the k regressors (Z_t) then,

$$E\ [\ Y_t\ -\ \beta_o\ -\ \beta' z_t]\ =\ 0 \quad \textbf{(3.12)}$$

Where eq (3.12) shows the conditional equilibrium and adjustment to that equilibrium is instantaneous as in eq (3.11), by taking differencing from eq (3.12) delivers isomorphic Eqcm formulation.

$$\Delta Y_t\ =\ \beta' \Delta z_t\ -\ (Y_{t-1}\ -\ \beta_o\ -\ \beta' z_{t-1})\ +\varepsilon_t \quad \textbf{(3.13)}$$

$(Y_{t-1}\ -\ \beta_o\ -\ \beta' z_{t-1})$ is an equilibrium correction term and its coefficient is (-1). Notice that a differencing is a linear transformation and not an operator in any setting beyond a scalar time-series. The existence of eq (3.12) does not require that Y_t and Z_t are stationary.

3.2.5 From error correction to equilibrium correction:

In economics, explicit examples of equilibrium correction models are called error correction mechanisms (ECMs). The major developments in cointegration analysis by Engle and Granger (1987) established its isomorphism with equilibrium correction for integrated processes, leading to an explosion in the application of equilibrium correction models and the development of a formal analysis of vector Eqcm systems in Johansen (1988; 1995).

$$\Delta Y_t = \beta_o + \beta_1 \Delta X_t + \beta_2 \Delta Y_{t-1} + \varepsilon_t \quad \textbf{(3.14)}$$

When E [ε_t] = 0 and the differenced variables are stationary with means $E\ [\Delta Y_t]\ =\ Y'$ and $E\ [\Delta X_t]\ =\ X'$ then the long-term steady state solution to eq (3.14) is,

$$Y' = \frac{\beta_o + \beta_1 X'}{1-\beta_2}$$

As formulated in eq (3.14) does not establish any relationship between the levels Y_t and X_t, hence these could drift apart.

$$(Y - X)_{e,t} = \delta_o + \delta_1 \Delta X_t + \delta'_2 z_t \quad \textbf{(3.15)}$$

Where z_t denotes a vector of additional variables.

The disequilibrium is,

$$v_t = Y_t - X_t - \delta_o - \delta_1 \Delta X_t - \delta'_2 z_t \quad \textbf{(3.16)}$$

To re-establish the equilibrium whenever level drifts apart (Sargan, 1964) used the explicit adjustment equation.

$$\Delta Y_t = \alpha(Y_{t-1} - X_{t-1} - (Y - X)_{e,t-1}) = \alpha v_{t-1} \quad \textbf{(3.17)}$$

In equation (3.16) if a relation is well defined like v_t is I (0), when the levels are I (1) and the difference are I (0), then Y_t forms a non-integrated combination with Xt and Zt. So, these variables are cointegrated (Engle and Granger, 1987) (Phillips and Loretan, 1991).

3.3 Data:

For the analysis of the triple deficits in the case of Pakistan, this research has used annual data from 1970 to 2018. The explanation of data is described under.

Variables	**Measurements**	**Source**
Trade-deficit (TD)	Difference between imports and exports (IM-EX)	IFS
Budget-deficit (BD)	Difference between receipts and taxes (G-T)	Pakistan Bureau of Statistics (PBS)
Private deficit (I-S)	Difference between gross total investment and national saving	Yearbook of Pakistan Bureau of Statistics (PBS)
Interest rate (i)	Call money rate	Yearbook of Pakistan Bureau of Statistics (PBS)
Real Exchange rate (e)	$RS/CPIPAK$ $\$/CPIUS$	IFS

CHAPTER 4
ESTIMATION AND EMPIRICAL RESULTS

Empirical outcomes of the triple deficit's hypothesis have been discussed in this chapter by employing the econometric methodology, as described in the preceding section. For the identification of multiple location shifts, we have used the methodology of impulse indicator saturation and step indicator saturation. For the cointegration relationship, this study used equilibrium correction models (Eqcm). For the identification of unit root Augmented Dickey-Fuller (ADF) test and Kwiatkowski Phillips Schmidt Shin (KPSS) are done in section 4.1.1. In time series analysis existence of structural breaks in the series produces spurious results therefore, we applied impulse indicator saturation and step indicator saturation in section 4.1.2. In section 4.1.4 we performed a cointegration analysis thorough the equilibrium correction model to check the static and dynamic long-term and short-term relationship between dependent and explanatory variables.

4.1.1 Stationarity:

We have applied Augmented Dickey-Fuller (ADF) and Kwiatkowski Phillips Schmidt Shin (KPSS) to check the stationarity of variables whether our variables were stationary at the level or not, at 5% significance level. If the variables are non-stationarity it means that non-stationarity is due to the accumulation of past shocks.

The hypothesis of Kwiatkowski Phillips Schmidt Shin (KPSS):

Ho: data is stationary.

$H_{A:}$ data is not stationary.

If the LM statistics are greater than the critical value at 5% then the null hypothesis is rejected, the series are non-stationary.

Hypothesis of Augmented Dickey-Fuller (ADF):

Ho: Series have a unit root.

$H_{A:}$ Series has no unit root.

If the probability value of the ADF test is less than 0.05 then we reject the null hypothesis which means that series have a unit root.

Table 4.1 Unit root tests

Variables	**ADF at level**	**ADF at 1st diff**	**KPSS at level**	**KPSS at 1st diff**
	P value		LM statistics value	
Trade-deficit	0.77	0.000	LM stat = 0.19 C.V at 5%= 0.14	LM stat = 0.07 C.V at 5%= 0.14
Budget-deficit	0.69	0.006	LM stat = 0.17 C.V at 5%= 0.14	LM stat = 0.07 C.V at 5%= 0.14
Interest rate	0.365	0.0001	LM stat =0.2 C.V at 5%=0.14	LM stat =0.04 C.V at 5%=0.14
Exchange rate	0.7794	0.0357	LM stat =0.15 C.V at 5%=0.14	LM stat =0.05 C.V at 5%=0.14
Private deficit	0.1060	0.0000	LM stat =0.15 C.V at 5%=0,14	LM stat =0.03 C.V at 5%=0.14

As shown in table 4.1 both test (ADF and KPSS) results showed that our variables are non-stationary at level. Now we have to detect structural breaks by using indicator saturation approach.

4.1.2 Impulse and step indicator saturation:

For the analysis of multiple structural breaks, we used impulse indicator saturation and step indicator saturation. First, we applied impulse indicator saturation on our data to realize

that how many impulse indicators have been identified in the series. Then we applied step indicators saturation for step indicators. Secondly, we applied both techniques (IIS + SIS) jointly for the identification of significant breaks in the series (impulse and step).

Table 4.2 Impulse and step indicator saturation:

Indicators	Coefficients	T- Value	T- Prob.
I:1977	-5.81568	-4.52	0.0001
I:1998	2.43047	3.22	0.0033
I:2018	-5.30593	-6.14	0.0000
S1:2004	2.13441	3.27	0.0023
S1:2001	3.73929	6.27	0.0000
S1:2008	-2.26332	-3.46	0.0018
S1:1987	-3.21655	-3.08	0.0039
budget-deficit U	-0.00258029	-0.352	0.00727
budget-deficit_1 U	-0.00275084	-3.38	0.0022
Interest rate U	-0.356075	-4.05	0.0004
Interest rate_1 U	-0.191087	-2.05	0.0507
exchange rate U	-0.154774	-2.79	0.0096
exchange rate_1 U	0.237552	3.81	0.0007
private deficit U	-0.373063	-5.93	0.0000
private deficit_1U	0.418150	6.43	0.0000
Sigma	0.703795	13.3738421	
log-likelihood	35.9045		
no. of observations	43	No of parameters 15	
mean (trade-deficit)	-6.5552	3.85142	

Table 4.2 shows the Indicator saturation (IIS + SIS) model for triple deficits and generates significant impulse and step indicators with their magnitudes in their parentheses: 1977 (-58%) an impulse indicator captures the impact on trade-deficit due to the military

dictatorship (dismissal of civil government by the military). 1998 (24%) captures the impact after the nuclear test, Pakistan was banned all aid and financial supports due to UN sanctions (Sarwar, 2012). In 2018 (-53%) Pakistan trade deficit has been increased from $2.7 billion in 2015 to $18.2 billion in 2018 (Pakistan economic survey 2018-2019). In 2001 (37%) a step indicator captures the impact on trade-deficit (due to the incident of September-9-2001, resulting in an American attack on Afghanistan) (Khanna, 2010). In 2004 (-21%) Pakistan entered the era of terrorism after the invasion of NATO on Afghanistan (Khanna, 2010). 2008 (-22%) Pakistan also suffered from the financial crises of 2007-08 and internal political instability (Rehman et al, 2015) and in 1987 (-32%) Pakistan's economy experienced public debt of Rs 521 billion. All independent variables are un-restricted (fixed) so, that all significant indicators have been retained by IIS and SIS. Sigma is 0.7 which is lower than previous models of IIS and SIS. All these indicators affect the trade-deficit during the time. Previous models could not capture all these effects.

Table 4.3 Diagnostic Test:

AR 1-2 test:	F (2,25) = 0.29949 [0.7438]
ARCH 1-1 test:	F (1,41) = 0.60554 [0.4409]
Normality test:	Chi^2(2) = 2.0173 [0.3647]
Hetero test:	F (21,17) = 1.4109 [0.2376]
RESET23 test:	F (2,25) = 0.42856 [0.6561]

The diagnostic check misspecification or diagnostic tests are used to guide the selection of congruent models, where the residuals which are not normally distributed at 5% level of significance but if we are wider the interval at 1% then they appear normally distributed. Fit vs

actual much better than all other previous models used for trade-deficit. All effects are removed in this new indicator saturation model (IIS + SIS) model.

4.1.3 Graphical presentation of breakpoints:

Figure 4.1

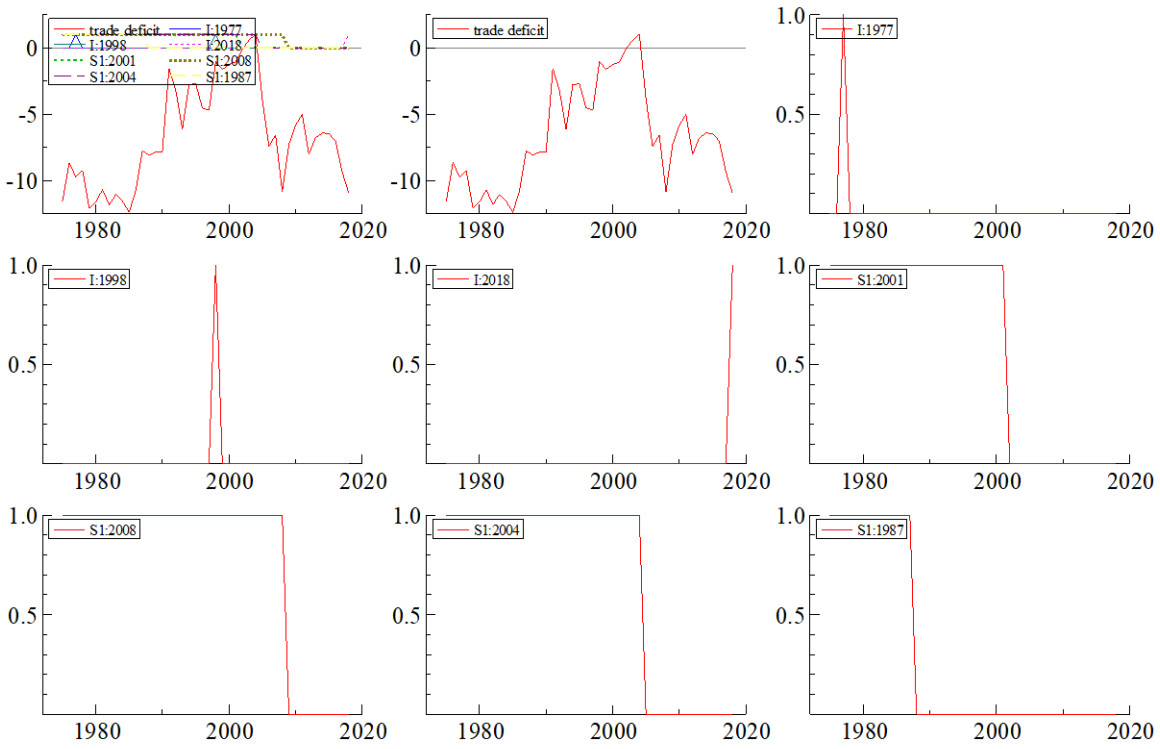


Figure 4.1 shows the significant impulse and step indicators of the triple deficits model graphically. The first two figures labeled with trade deficit showed a trade deficit graph with structural breaks. Three impulse indicators (I: 1977, I:1998, I:2018) and four-step indicators (S:1987, S:2001, S:2008, S:2004). These steps and impulse indicators significantly affect trade-deficit over time.

4.1.4 Cointegration:

For cointegration analysis, we have applied the equilibrium correction model (Eqcm) for short-run and long-run relationships. First, we employed a static equilibrium correction model for long-term cointegration to check whether the cointegration relationship among explained and explanatory variables exist or not. Secondly, we applied a dynamic equilibrium correction model for short-term and long-term analysis.

4.1.5 Static equilibrium correction model:

In cointegration analysis, we apply the static long-term equilibrium correction (Eqcm) to check the cointegrating relationship among trade-deficit and its determinants in the existence of multiple breakpoints. A long-term relationship established between the fiscal and trade imbalance, private deficit, and other economic variables like exchange rate and interest rate.

Table 4.4 Static equilibrium correction model:

Indicators	**Coefficients**	**T- Value**	**T- Prob.**
budget-deficit	-2.162523	-3.59	0.0011
Interest rate	-2.261998	-1.01	0.0098
exchange rate	-1.288218	-1.66	0.0065
private deficit	-3.393476	-0.685	0.0080
I:1977	1.14963	0.560	0.0092
I:1998	3.34197	1.67	0.0047
I:2018	-1.54185	-0.692	0.0037
S1:2004	3.43389	1.83	0.0000
S1:2001	-2.43992	-1.37	0.0000
S1:2008	-2.37988	-1.70	0.0076
S1:1987	-7.07223	-6.46	0.0000
Long-run sigma		1.91508	
WALD test		Chi^2(11) = 676.981[0.0000] **	

The underlying equation shows static long-term results.

$$TD_t = 2.16\, bd_t + 2.26\, Int_t + 1.28\, ex_t + 3.39\, pd_t - 1.14\, I{:}1977 - 3.34\, I{:}1998 + 1.54\, I{:}2018 - 3.43\, S1{:}2004 + 2.43\, S1{:}2001 + 2.37\, S1{:}2008 + 7.07\, S1{:}1987 \quad (\mathbf{4.1})$$

Table 4.4 shows that in the presence of multiple structural breaks the Keynesian theory of triple deficits is significant in the case of Pakistan as the static equation in equation 4.1 showed that the long-term relationship exists between the said variables. It has been observed that budget-deficit and private deficit have a significant and positive relation with trade-deficit in Pakistan, in a way that budget deficit influenced the trade imbalance by 2.16 percent. After the incorporation of multiple location shifts, we rejected the twin deviation. The private deficit also shows a significant and positive relationship with trade-imbalance, that the trade-imbalance will rise by 3.39 percent in the long run. Similarly, in the case of interest rate and exchange rate, the situation appears significant with current account-deficit as both interest rate and exchange rate enhances the trade-deficit by 2.26 and 1.28 percent respectively in the long run. In the static long run equilibrium correction model, multiple structural breaks significantly influenced the trade deficit.

4.1.6 Analysis of Lag Structure Coefficients:

Long-term equation results have been shown in the underlying table 4.5. Unit-root t-test = -2.33 for trade-deficit, -3.5914 for budget-deficit and -1.01 for interest rate, -1.65 and -0.68 for the exchange rate and private deficit respectively, which suggests that trade-deficit and all independent variables were non- stationary series at level, integrated of order I(1) as the dynamic ARDL model suggest so, better to estimate the equation with equilibrium correction model (Eqcm) to capture both short-term and long-term dynamics.

Table 4.5 Lag structure and significance test:

Analysis of Lag Structure Coefficients:			
Indicators	**Lag 0**	**Sum**	**SE (Sum)**
trade-deficit	-1	-1	0
budget-deficit	-2.163	-1.0163	0.00453
Interest rate	-2.262	-1.162	0.16
exchange rate	-1.288	-0.0288	0.0174
private deficit	-3.39103	-0.103	0.151
Tests on the Significance of each Variables			
Variables	**F- Test**	**Prob. Value**	**Unit Root, T- Test**
trade-deficit	F (1,26)	12.407 [0.0016] **	-2.3303
budget-deficit	F (1,33)	12.898 [0.0011] **	-3.5914
Interest rate	F (1,33)	1.0204 [0.3198]	-1.0102
exchange rate	F (1,33)	2.7539 [0.1065]	-1.6595
private deficit	F (1,33)	0.46944 [0.4980]	-0.68515

4.1.7 Dynamic long-term cointegration:

To capture the long-term and short-term dynamic relationship among the trade imbalance, fiscal deficit, saving investment gape (private deficit), interest rate, and exchange rate in the

occurrence of multiple structural breaks we have analyzed the dynamic equilibrium correction model.

Table 4.6 Dynamic long-term cointegration:

Modeling Trade Deficit by OLS			
Indicators	**Coefficients**	**T- Value**	**T-Prob.**
trade-deficit_1	0.782923	11.0	0.0000
budget-deficit	0.4104397	-3.18	0.0030
private deficit_1	0.342117	4.56	0.0001
Eqcm_1	-0.306710	-2.23	0.0324
S1:2004	4.20885	3.45	0.0014
S1:2001	-2.28069	-2.24	0.0316
S1:2008	-4.52093	-5.54	0.0000
Sigma		1.5119	
log-likelihood		-74.969	
RSS		82.2904203	
no. of observations		43	
no. of parameters		7	
Mean (TD)		-6.5552	
SE (TD)		3.85142	
AR 1-2 test:	F (2,33)	5.4200	[0.0092] **
ARCH 1-1 test	F (1,41)	0.80639	[0.3744]
Normality test	Chi^2 (2)	5.8968	[0.0524]
Hetero test	F (13,29)	1.1025	[0.3952]
Hetero-X test	F (23,19)	0.83111	[0.6671]
RESET23 test	F (2,33)	0.64514	[0.5311]

The following equation shows dynamic long-term coefficients.

$$TD_{\ t} = 0.78\ td_{\ t-1} + 0.41\ bd_{\ t} + 0.34\ pd_{\ t-1} - 0.306\ eqcm_{\ t-1} + 4.2\ S1{:}2001 - 2.2\ S1{:}2004 - 4.5\ S1{:}2008 \quad (\mathbf{4.2})$$

In the previous table 4.5 dependent and all explanatory variables are non-stationary at level, so we regress trade-deficit on the lagged, current, and differenced values of dependent and independent variables. The dynamic equilibrium correction model (Eqcm) in table 4.6 shows the significant variables i.e. 1st lag of trade-deficit td_{t-1}, budget-deficit (BD), 1st lag

of private deficit (PD_{t-1}) and three-step indicators 2001, 2002, and 2008 which influence the current account imbalance in the long-term and short-term. While the exchange rate, interest rate, and lagged values are insignificant with trade-deficit and hence removed from the model, but the triple deficits hypothesis is still significant in the dynamic equilibrium correction model. The effect of the lag value of trade deficit (td_{t-1}) increases the inertia in trade-deficit, adding to rises as trade-deficit increases. Current account imbalance rises by 0.41 percent in the short run.

The trade-deficit has been influenced by 0.34 percent, due to changes occurred in private deficit. These variables have a significant and positive effect on trade-deficit both in the long-term and short-term. The equation (4.1) ($Eqcm = 2.16\ bd_t + 2.26\ int_t + 1.28\ ex_t + 3.39\ pd_t$) the coefficient of this equation is -0.30, which is statistically significant, and it means 30% of that deviation from equilibrium is remove from each period. In the presence of three-step indicators S1:2001, S1:2004, and S1:2008, budget-deficit shows a significant relationship with trade-deficit. In 2001 Pakistan suffered political crises after the military takeover in 1999 (Khanna, 2010). As the military seized the civilian government.

After the incident of September-9-2001 war started in Afghanistan and the influx of Afghan refugees destabilized the economy of Pakistan. In 2004 Pakistan's economy faced energy, financial crises, and armed conflicts. Armed conflicts began in 2004 when tensions started in Waziristan (Khanna, 2010). In 2008 Pakistan also suffered from world financial crises (Rehman et al, 2015). The sigma is the same as the previous model, but the fit is better as all previous models do not capture all these effects in both short-term and long-term dynamics.

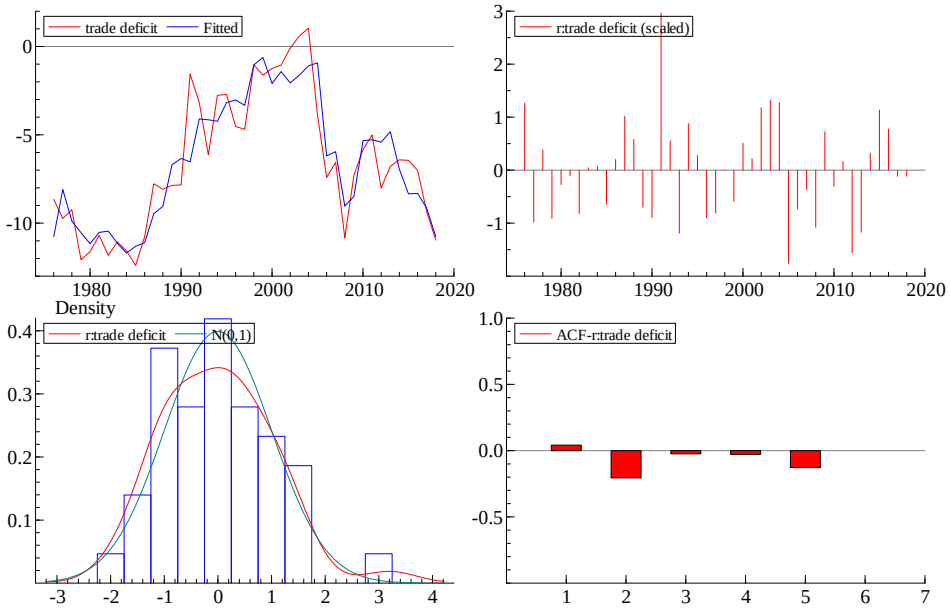
In previous studies, only twin deficit hypothesis was reported in the Pakistan economy i.e. (Aqeel et al, 2000), (Saeed et al, 2012) and (Sarwar, 2012), etc. These studies also analyzed

that budget-deficit on trade-deficit and showed a positive impact, but their studies either incorporated one or two breaks or considered no breaks. Sarwar (2012) analyzed the trade-deficit hypothesis by incorporating two breaks in 1987 and 1998 and concluded that the 1987 break significantly affect the trade-deficit in the long-term. After the inclusion of multiple structural breaks in the triple deficits model hence the interpretation is quite different from the previous studies. This research considered the presence of multiple breaks points in 2001, 2004, and 2008 and concluded that in Pakistan trade-imbalance has a positive relation with budget-imbalance and private deficit.

4.1.8 Graphical statistics for the equilibrium correction trade-deficit model:

The graphical statistics of the model in underlying figure 4.2 shows that although the match of trade imbalance and budget imbalance seems best from the previous models. The fitted values track the outcomes least well for the changes in trade-deficit over that period. However, in the case of Pakistan trade-deficit and budget-deficit exist throughout history due to several external and internal shocks. As a result, graphical analysis shows that the residuals are non-normal and no autocorrelation.

Figure 4.2 Graphical presentation of Equilibrium correction model



4.2 Stability tests:

In time series analysis there exists a problem of structural change in parameters therefore, it is necessary to check the stability diagnostic of parameters. For the diagnostic check, we have applied the ARCH effect, normality, and heteroscedasticity test.

4.2.1 ARCH effect:

In time series analysis the variance of the error term is stochastic (non-uniform over the time) and effected by the variance of one or more variables, that is the problem of autoregressive conditional heteroscedasticity (ARCH). Therefore, the ARCH effect is used to analyze the effects which are unexplained by econometric models.

Hypothesis:

H_0: Model has no ARCH effect.

H_A: Model has an ARCH effect.

Table 4.7 ARCH effect:

Lag	**Coefficient**	**Standard Error**
1	0.10813	0.1543
RSS = 455.247	Sigma = 3.3322	
Testing for error ARCH from lags 1 to 1		
ARCH 1-1 test	F (1,41) = 0.49096 [0.4875]	

The ARCH test is used to check for the autoregressive conditional heteroscedasticity in time series data. Results show that the probability value of the F-test is 0.4 that is why we cannot reject our null hypothesis that there exists no ARCH effect.

4.2.2 Normality test:

In econometrics, normality tests are used to describe the data either it is well modeled by a normal distribution or not. To check the normality of the data we have applied the Jarque Bera test. Jarque Bera test is a goodness of fit test to examine whether the skewness and kurtosis of sample data are according to the normal distribution or not.

Hypothesis:

H_0: Residuals are not normal.

H_A: Residuals are normal.

Table 4.8 Normality test for residuals

Observation	43
Mean	-0.060576
Std.Dev	1.3820
Skewness	0.68705
Excess Kurtosis	1.0949
Minimum	-2.5179
Maximum	4.5314
Median	0.061561
Asymptotic test	**Chi^2(2) =** 5.5306 [0.0630]
Normality test	**Chi^2(2) =** 4.8090 [0.0903**]**

Results of Jacque Bera show that the values of skewness and excess kurtosis are not reliable because in Pakistan trade and budget deficits exist throughout history and the chi-square probability value is greater than 0.05 therefore, we cannot reject our null hypothesis.

4.2.3 Heteroscedasticity test:

Heteroscedasticity means unequal scatter of variance. In econometrics, the vector of stochastic variables is heteroscedastic if the consistency of a variable is unequal across the range of values of a second variable that predicts it.

Hypothesis:

H_0: Data is homoscedastic.

There is no heteroscedasticity in the model.

H_A: There is heteroscedasticity in the model.

Table 4.9 Heteroscedasticity coefficients:

Variables	Coefficients	t-value
trade-deficit_1	-1.8396	-0.93869
budget-deficit	-0.021667	-0.52815
private deficit_1	-0.30852	-0.37411
Eqcm_1	0.073399	0.047164
S1:2004	-0.41530	-0.12638
S1:2001	1.9712	0.63642
S1:2008	1.0488	0.25815
trade-deficit_1^2	-0.16710	-1.0286
budget-deficit^2	-1.8231e-005	-0.14388
private deficit_1^2	-0.027420	-0.47138
Eqcm_1^2	0.066034	0.25891
trade-deficit_1*budget-deficit	-0.0028483	-0.33026
budget-deficit*private deficit_1	9.4441e-005	0.042532
private deficit_1*Eqcm_1	0.0019731	0.010449
trade-deficit_1*private deficit_1	-0.059998	-0.65401
budget-deficit*Eqcm_1	0.0063498	1.0633
trade-deficit_1*Eqcm_1	0.11969	0.46438
RSS = 289.018 **sigma** = 3.4001 **effective no. of parameters** = 18		
Chi^2(17) = 16.435 [0.4932] **F (17,25)** = 0.90981 [0.5718]		

For heteroscedasticity in table 4.9 white test was used to check the heteroscedasticity in the model. It obtains squared residuals from original and auxiliary regression on the set of explanatory variables, the square of the independent variable and their cross terms. Chi^2 probability test value is 0.49 so, we cannot reject the null hypothesis.

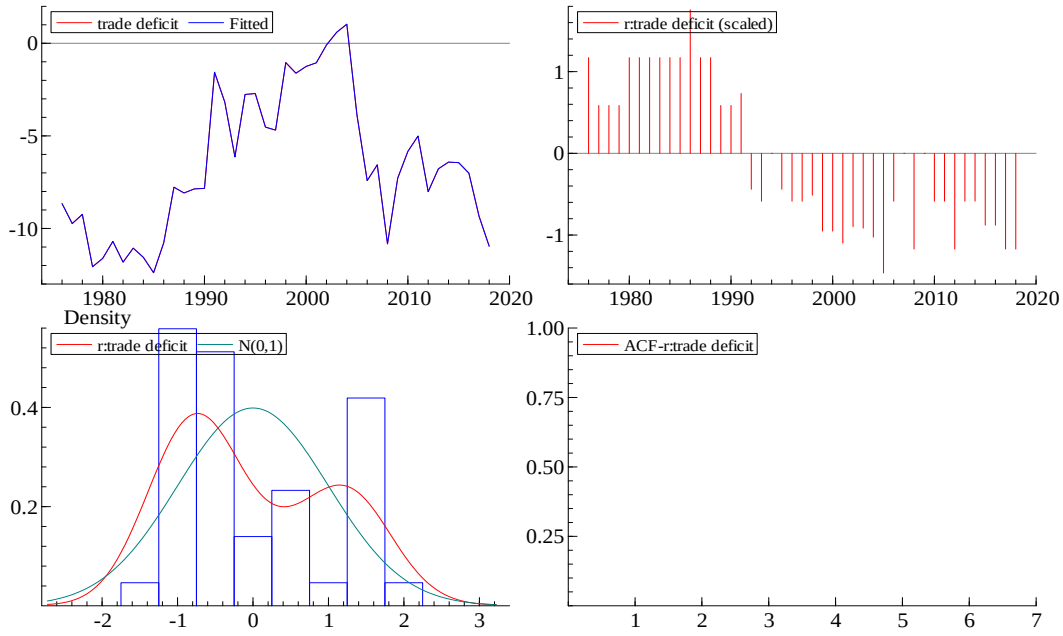
4.10 Equilibrium correction model without structural breaks:

We applied the equilibrium correction model (Eqcm) on trade-deficit without incorporating the structural breaks. The results show that budget-deficit, interest rate, and private deficit are insignificant and the value of the eqcm term was -7.08 which is insignificant. As the graphical analysis also shows that model is insignificant and not normal.

Table 4.11 Equilibrium correction model without structural breaks

Variables	Coefficient	t-value	t-probability
Trade deicit_1	1.00000	5.579e+015	0.0000
Budget deficit	-0.000000	-0.00	1.0000
Interest rate	1.33625e-016	0.799	0.4297
Exchange rate	4.43192e-017	2.67	0.0114
Eqcm	-7.08358e-017	-0.488	0.6282
D (trade deficit)	1.00000	3.505e+015	0.0000
Sigma	3.03152e-015	RSS	3.3084395e-028
Log Likelihood	+ infinity		
No of Obs	43	no. of parameters	7
Mean	-6.5552	S.E	3.85142
AR 1-2 test	F (2,34) = 0.42900 [0.6546]		
ARCH 1-1 test	F (1,41) = 0.00000 [1.0000]		
Normality test	Chi^2 (2) = [0.0000] **		
Hetero test	F (13,26) = 6.6689 [0.0000] **		
RESET 23 tests	F (2,34) = 0.099940 [0.9052]		

Figure 4.3 Graphical presentation of Equilibrium correction model without break points



CHAPTER 5

CONCLUSION

In previous literature, researchers postulated different results about the twin deficit hypothesis in the short term as well in long term, but these studies were based upon one or two structural breaks. Hence this research covers the literature gap by analyzing three deficits in the existence of multiple location shifts in case of Pakistan. Triple deficit theory is a put forward by expanding the twin deficit theory, to recognize the private deficit together with the trade deficit and budget deficit and to investigate the relationship among these under the Keynesian approach. Triple deficit describes the existence of an equilibrium condition within the disequilibrium where internal and external disequilibrium do coexist that puts forward the necessity of producing alternative policies.

Since there exists a positive relationship among trade-deficit and budget-deficit under the equilibrium correction model with multiple structural breaks. For structural breaks, this study used step indicator saturation method and impulse indicator saturation to get the significant impulse and step indicators. The standard Indicator saturation method shows significant multiple indicators (I:1977, I:1998, I:2018, S:1987, S:2001, S:2004, and S:2008). These breaks are globally and domestically significant. We used annual data from 1975 to 2018. This study applied the equilibrium correction model (Eqcm) on the triple deficits hypothesis as the standard Johansen cointegration and ECM did not capture the multiple breakpoints.

First, we analyze the Keynesian triple deficits hypothesis with a static equilibrium correction model in the presence of multiple breakpoints and concludes that in the long-term there exists a positive relationship between trade-deficit and budget-deficit. While other financial variables also show a positive and significant relationship with trade-deficit. Then we

applied a dynamic equilibrium correction model in the presence of multiple breakpoints. we examine that in dynamic long-term and short-term budget-deficit, the private deficit has a positive relationship in the presence of three-step indicators (S1:2001, S1:2004, and S1:2008). In 2001 Pakistan suffered political crises after the military takeover in 1999. After the incident of September 11, 2009, the war started in Afghanistan and the influx of Afghan refugees destabilized the economy of Pakistan. In 2004 Pakistan's economy faced an energy crisis. Armed conflicts began in 2004 when tensions started in Waziristan. In 2008 Pakistan also suffered from world financial crises. This research determines that while analyzing the triple deficits hypothesis, multiple breakpoints should be considered in the series otherwise we may end up with false results. Trade-deficit occurs when there exist structural breaks in the economy. Therefore, to control the deficits government should make such type of policies that mitigates the effects of structural breaks and this will atomically reduce the adverse effects of shocks to the trade sector and financial sector.

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