Oil Price Shocks and Global Imbalances: Exploring the Channels, Role of Moderators in Adjustments and Asymmetries to Industrial Production

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"Oil Price Shocks and Global Imbalances: Exploring the Channels, Role of Moderators in Adjustment and Asymmetries to Industrial Production"

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Dated: September 9, 2022

In the name of Allah, the most compassionate, the most merciful, kind and benevolent

DEDICATION

To my loving Husband

And my Children Husnain, Farhan and Maham

With out whom this work would not have been completed

Abstract

Current-account imbalances are one of the critical issues in the international policy debate as its threats the stability of the world economy from the last two decades. Oil being an important internationally traded commodity shocks to its price can well delineate the emergence of large trade imbalances across the global economies. The study is an attempt to empirically estimate the effects of oil price shocks on current account imbalances. The financial integration depicting the magnitude of international linkages and policy variable that is trade openness either speeds up the the process of adjustments or make it slow when dealing the adjustment of the country's balances .

The mediation analysis for trade valuation and wealth effect is carried out on the panel of 160 countries divided into three different groups on basis of oil imports. Firstly, the seemingly unrelated regression models are used to estimate the effects of oil price shocks on current account imbalances with transmission channels namely trade, valuation, and wealth. Secondly, the mediation effect (indirect effects) and direct effects of the shocks to oil price has been estimated empirically. To inspect the query of asymmetry the data of 40 oil-importing economies for the period of 1990-2019 has been used in the analysis. All of the oil-importing economies are divided into 3 categories consisting of the low, medium, and high oil-importing economies. The shocks to oil price can cause the cross-section to be correlated particularly oil-importing panels for this purpose technique of dynamic common correlated effects (DCCE) used for analysis. To analyze the role of the moderators' regression with interaction variables has been estimated for OPEC, developing, and developed economies with 1990-2020 data.

The findings of the study report that for all three groups of countries the oil price shock has a positive effect on the current account through the trade channel. However , the current account of all three groups is negatively associated with oil price shock with the wealth channel. The valuation channel holds mixed results across country groups about the effect of oil price shock on the current account balances. In the case of low and major oil importer countries, oil price shock is negatively linked with the current account, whereas the current account of medium oil importer countries is improving with an

increase in oil prices. The mediation analysis holds mixed results across groups of countries. The results contributed the evidence of asymmetries for the lowest and highest oil-importing economies in long run. Further, an absence of asymmetry in the short-run for whole three groups of oil-importing nations. The role of both moderators is found to decelerating the process of adjustment in OPEC economies and no role for developing and developed economies.

JEL classification: F4; F41, F43,

-*Keywords:* Current-account imbalances; oil-importing economies; Seemingly unrelated regression; mediation effects, Moderators

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LIST OF ABRIVIATION

CADF	Cross Section Augmented Dickey Fuller Test
CIPS	Cross Section IPS
CSD	Cross Sectional Dependency Test
CS ARDL	Cross Sectional Auto Regressive Disrtibutive Lag
CPI	Consumer Price Index
DCCE	Dynamic Common Correlated Effect
GDP	Gross Domestic Product
GLS	Generalized Least Square
IFS	International Financial Statistics
MG	Mean Group
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square
OPEC	Organization of Petrolium Exorting Countries
PMG	Pooled Mean Group
SUR	Seemingly Unrelated Regression
US	United States
UK	United Kingdom
WDI	World Development Indicator
WTI	West Texas Intermediate

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The current-account imbalances[1] set threats to the stability of the global economy, and are one of the hot debatable subjects among the international trade issues from the right beginning of the twenty-first century Rebucci and Spatafora (2006). The related literature Baas and Belke (2019) on the subject reaches a result that the volatile and highly unpredictable nature of oil price is the driving force behind this issue. Besides, studies on the subject also reach a consensus that oil price shocks affect the current-account of oil importers and exporters countries in variant ways. In the case of oil importer, fluctuation in oil price causes an imbalance in the adjustment of these imbalances. For instance, on the supply side, the increase in oil price worsens the trade balance and therefore increases the current account deficit that in turn deteriorates the net foreign asset position of the oil-importing countries. While on the demand side, an increase in oil price tends to decline private disposable income and corporate profitability that decreases domestic demand. Besides, an increase in the deficit in current account tends to depreciate the exchange rate. Hence a reduction in domestic demand and exchange rate depreciation drive the

[1] Technically global imbalances are defined as "external positions (refers not only to current account flows, but also the net foreign assets of countries) of systemically important economies that reflect distortions or entail risks (it considers both the causes (distortions) and possible consequences (risks) of the imbalances) for the global economy". Systemically important economies: these are the economic blocks running the imbalances, relevant to the world market operations, e.g. China, the Euro area or the United States).

current account toward equilibrium agian. However, the speed and output cost of the adjustment are based on the transmission channels.

In this context, the related literature Sen (1994) on the subject highlighted several transmission channels that play their role in the adjustment of imbalance. However, among these, three channels namely the trade channel (Kilian, Rebucci et al. (2009), Allegret, Mignon et al. (2015)), financial or valuation channel (Lane and Milesi-Ferretti (2006), Gourinchas and Rey (2007), Kilian *et al.* (2009), Bodenstein, Ereeg et al. (2011), Allegret *et al.* (2015)) and wealth channel (Czudaj and Beckmann (2013)) are the most prominent channels presented in the literature. As far as trade channel is a concerned, Kilian *et al.* (2009) argued that the trade channel plays its role in the adjustment of imbalance, as generally the price and quantity of traded goods mostly change with oil price fluctuation. Besides, some others Rebucci *et al.* (2006), Kilian *et al.* (2009), Bodenstein *et al.* (2011), and Le and Chang (2013) argued that oil price shocks have both effects (direct and indirect effects) on the current-account imbalances of both oil importer and exporter countries.

The direct effect of positive shock to oil price poses a positive effects due to an increase in revenue particularly for the oil-exporting economy termed as revenue effect. However, the indirect effects of a positive shock should be negative for an oil-exporting economy on the basis of (i) global inflation caused by increase in oil price (ii) the emergence of supply shocks in oil importing economies. To curb the inflation the monetary authorties are constrained to increase the interest rate that reduces consumption, investment, and hence the economic growth of trading partners. Further the emergence of the "supply

Shocks" decrease the production and consequently decrease the oil imports, this effect is transmitted to oil exporting economies trade balance.

For oil-importing country, a positive shock to oil price is considered as a negative terms of trade shock by their effect on decision about production. The mechanism presented in existing studies is the increase in the input prices. For instance, Backus and Crucini (2000) argued that input cost directly increase by raise in oil prices that in turn affects firms' investment decisions and thus cause a productivity shock. However, the effects of oil fluctuation through a trade shock on aggregate output are still uncertain. Firstly, imported oil is input for the production function, which is segregated in imported energy and value-added, but not produces as domestic value-added. Hence, keeping other inputs constant, oil price shocks do not change value-added and consequently can not generate productivity shocks for the real GDP of oil-importing countries. Secondly, as Kilian (2010) explained that if oil price shock is treated as cost shock, the effect on domestic production should be captured through the cost share of imported oil, which is not capable to explain large fluctuations in real GDP.

The second transmission channel of oil price shock recognized in the literature is the valuation channel. According to Lane *et al.* (2006) and Gourinchas *et al.* (2007), the valuation channel is the transmission channel of oil price shocks that changes the net foreign asset value. Numerous empirical insights are present on the association of oil price shock to asset value. However, the empirical literature is still away from consensus. Some studies argued for the positive response of oil price shock on asset value, whereas, others found a negative relationsip between the shock to price of oil and asset values. However, the positive and negative effects of oil price shock are mainly allied with

changes in aggregate demand and aggregate supply. Gogineni (2008) found a positive association of oil price with stock prices in the case of G-7 countries. The effect is potive if the shocks to price of oil represent fluctuation in demand and negative if they depict the supply changes. Similarly, Bai and Koong (2018) investigated the impact of oil prices on the stock market capitalization through its effects on supply and demand of oil. They found that oil price response to supply shocks is negative and positive to the demand shocks.

Dividing the oil shocks into global-demand shocks, oil-supply shocks and idiosyncratic demand shocks (specific to oil market), Apergis and Miller (2009) through their research work reveal that in all sample countries, oil shocks have negative effects on stock market returns. Further, they concluded that the idiosyncratic demand shocks hold a stronger effect on stock market returns. Bastianin, Conti et al. (2016) argued that demand-side shocks have a relatively stronger effect on the volatility of stock prices. Further, the responses of the stock prices are asymmetric to movement in price of oil. Similarly, estimating the conditional volatility Boldanov, Degiannakis et al. (2016) found heterogeneous nature of oil price to financial markets in different periods. For instance, the correlation is found positive during events that trigger the demand and negative during events that affect the supply. Some studies have a pessimistic view of the impact of the oil price shock and asset values. Jones and Kaul (1996), for instance, explore the effect of fluctuation in oil prices on the stock returns of the four stronger economies (the US, the UK, Japan, and Canada). According to their findings oil price movement has a inverse effect on the stock returns.

The third channel is the wealth channel. The studies e.g. Beckmann and Czudaj (2013) captured transmission channel with the exchange rate. The received studies termed this transmission channel the wealth channel under the hypothesis that with a rise in price of oil, the wealth transfers to oil-exporting economies and vice versa for oil-importers. Beckmann *et al.* (2013) argued that a positive shock to oil price appreciated the currency of oil exporter, whereas, the oil-importers' exchange rate depreciated. Many others (Amano and Van Norden (1998) 1998a); Coudert, Mignon et al. (2008); Bénassy-Quéré, Mignon et al. (2007) and Beckmann *et al.* (2013),came with the same findings. However, some studies (Taylor, Peel et al. (2001); Kilian and Taylor (2003); Sarno (2005) casts doubt to argue that the impact of oil price shock not always positive/negative on the exchange rate of oil-exporting/importing countries but differ remarkably across countries. Kim, Kim et al. (2019) analyzed the exchange rate movement of Korea being a high oil-importing economy and found a significant effect of oil price on the exchange rate in high volatility regime.

Having played a vital role in the determination of both supply (production), and demand (consumption) sides determination, a large segment of empirical literature cover the impact of oil prices on macro variables see Rahman and Serletis (2012), Elder and Serletis (2010); Hamilton (2003, 2009); Kilian (2008): Jones *et al.* (1996); Jones, Leiby et al. (2004) ; and Brown and Yücel (2002) among others. However, the oil price shock

and the current account is less ventured avenue of research in general and for oil-importing economies in particular.[2]

Fluctuation in prices of oil affects the macroeconomic indicators of the economies, constructed on the fact whether the economy is a net oil importer or exporter of energy. The oil price increases are considered a benefit for oil-producing economies. The increase in oil price increases the purchasing power, disposable income, and the current account position of the oil-producing economy. The revenue by positive shocks further makes it possible to spend on social security and investment spending Moshiri and Banihashem (2012). However, if the boom persists the blessing can be turned into a curse by initializing Dutch Disease[3].

Economies dependent on imported oil bear adverse effects of rising oil prices more prominently. The positive shocks to its price will reduce output and generates inflation and deficit; see Rasche and Tatom (1977a), Hamilton (1983) Burbidge and Harrison (1984), Mork (1989), Lee, Ni et al. (1995),and Hamilton (1996). The aggregate demand curve shape and the nature of shocks (transitory or permanent) plays a significant role to determine the magnitude of individuals' response to oil price increases Berument, Ceylan et al. (2010). If the shock is permanent, disposable income and consumption declines, and oil is moderately replaced in production as the cost effect rules. The decrease in productivity of capital and labor lowers potential output accordingly.

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[2]The theoretical evidence is limited to Bodenstein *et al.* (2011), Backus *et al.* (2000) however, on the empirical side Ozlale and Pekkurnaz (2010); Kilian *et al.* (2009) ; Huntington (2015); Le *et al.* (2013); Raheem (2017) has focused issue partially.

[3] The increase in the price of oil increases revenue and investment in oil- exporting economy. The appreciation of exchange rate takes place and which deteriorates in the external position of oil exporting economies. This unfavorable consequence of positive oil price shocks is explicated by the Dutch Disease in the literature.

Heightened uncertainty is a factor having a central role in expectations about oil price changes. This can increase precautionary saving and decrease consumption in the short-run Bredin, Elder et al. (2011). The inelasticity of demand in the short-run can create an intensive effect of positive oil price shocks on to exchange rate. A rise in the price of oil increases the domestic price and passes through to the exchange rate causes depreciation and increases input costs Kamin and Rogers (2000).

The rising deficits in the US and Eurozone and surpluses in the other counterpart China and Asian tiger has been a center of attention in recent years. The emerging economies including Argentina Brazil and specifically oil-exporting economies are increasing their competence to surpluses since 1990. The surpluses of the oil-exporting economies are confidently related to the oil price hikes. The imbalance raises issues on the sustainability of the current account deficits. The most widely accepted fact is that deficit rising above 5% of GDP causes doubts related to long-term sustainability. Some factors play a role in the value of current account deficits in future, some of these are macroeconomic conditions and global economic outlook, the composition of deficits, methods to finance deficits, and the exchange rate policy.

A change in energy or oil price has influenced the global current account imbalances and hence, the net foreign asset positions of the countries Allegret *et al.* (2015). This is because energy prices movement can be regarded as the transfer of wealth from oil-importers to oil-exporters. The windfall revenue allocation in oil-exporting countries, in particular, has main effect for the current balances of country and then for the pattern of current account imbalances at global level. Dealing with the adjustment of the countries balances, monetary policy stances, degree of trade openness, financial integration, the

persistence of shocks, and structural flexibility of that particular economy (the moderators) play the role of cushioning or exacerbating the process of adjustments. These moderators are either the policy variables (monetary policy stances, degree of trade openness), and exogenous that is international linkages (financial integration), or subjective to economy that is the persistence of shocks, and structural flexibility of that particular economy. Rebucci *et al.* (2006).

The reconciliation of imbalances caused due to the oil price fluctuation is as described by Rebucci *et al.* (2006). The process of adjustment in the broader sense is an increase in oil price decreases the disposable income which decreases the domestic demand in the oil-importing economies and depreciates the exchange rate. The downward movement of exchange rate value causes the current account back to equilibrium. The adjustment of oil price shocks broadly takes place as reported by Rebucci *et al.* (2006), where the magnitude of the moderators either smoothen or exacerbate the process of adjustments.

The saving pattern of the oil producers(raise in the price of oil creates revenue for oil exporters) due to fluctuation in oil price and their consequences on the current account pattern has been discussed by Bems and de Carvalho Filho (2011). The second strand focuses on the reason for the shifting of the accumulated saving into asset accumulation abroad. Three mediums are involved here. The first is related to the discouraging impact of inefficiencies of investment and constraint related to capacity and capital accumulation in these countries Van der Ploeg and Venables (2011) and Araujo, Li et al. (2016). The second channel is concerned with the role of the state for a distribution between investment and savings however the preferences of the private sector are vastly different

from the state's, Basher and Fachin (2013). The last channel is the intensity of financial development and its effect on the distribution of resources which has been quite on the side from the eyes of literature. The countries with a strong financial system will invest a larger part from savings in their domestic market.

1.2 Research Gap

A well-established segment of economic literature investigated the impact of shock to price of oil on economic performance of oil exporting and importing economies. However , the studies on the interlinkages between prices of oil and the current account is quite scarce, particularly for developing countries being oil importers. Existing literature on the subject has mostly examined the association in the price of oil and economic activities, for instance, Rahman *et al.* (2012); Elder *et al.* (2010); Hamilton (2003, 2008); Kilian (2008a); Jones *et al.* (1996); Jones *et al.* (2004); and Brown *et al.* (2002) among others.

Besides, in the literature, the link of oil prices to stock markets has also been investigated for instance Bai *et al.* (2018); Donoso (2009), regarding the pioneering studies Jones *et al.* (1996), Sakellaris (1997), Sadorsky (1999) and the effect of movements of the price of oil share prices have particularly been examined by Jones *et al.* (1996), Sadorsky (1999) and El-Sharif, Brown et al. (2005). The oil price fluctuation has been examined as a key cause of business cycle movement. With such a perspective, a wide range of studies has been carried out to highlight the mechanism by which shocks to oil price impact macroeconomic stability.

Regardless of the significant, research on financial and the economic effects of movement in the price of oil, the literature is still away from agreement about the

transmission channels. Although the dynamics of the current account have been comprehensively examined in the literature, there are only a few analyses that examine the effect of oil prices on current account balances Killian *et al.* (2009), Raheem (2017). Furthermore, the studies that investigate the link between the two variables have ignored, the repercussion for the economies that are dependent heavily on imported oil.

The positive shock to oil price causes a raise in the cost of production for oil-importing economy, generates inflationary pressure cause deficits, and decreases the national income tbe evidence of such movement is observable by Rasche and Tatom (1977b), Burbidge *et al.* (1984), Mork (1989), Hamilton (1996), and Lee *et al.* (1995). Later the asymmetric specification was considered more appropriate pioneered by Loungani (1986), Davis (1987a), and Mork (1989). Considering the behavior of industrial production to shocks to oil price a number of studies have been carried out using data of U.S. economy, however recently reported have been for oil-exporting countries, e.g., Eltony and Al-Awadi (2001), El-Anashasy (2006), Berument *et al.* (2010), Olomola and Adejumo (2006). Cuñado and de Gracia (2003), Huang, Hwang et al. (2005), Jiménez-Rodríguez and Sánchez (2005), Tazhibayeva, Husain et al. (2008), Ayadi (2005), Lescaroux and Mignon (2008), Korhonen and Mebrotra (2009), Mendoza and Vera (2010). However, our contribution to the literature on the asymmetric specifications of oil price sbocks is particularly for the net oil-importing economies over the globe. The degree of dependence is considered by dividing the whole set of countries by the percentage of oil imports over the sample period.

The discussion of moderators that appeared in the literature takes the contribution of financial development and financial deregulation in the adjustment of imbalances and

energy consumption Sadorsky (2010); Allegret, Couharde et al. (2014); Moral-Benito and Roehn (2016). Another strand of the literature has considered the role of the financial market moderators that is financial bubble and risk and uncertainty in the oil market Fantazzini (2016); Demirer, Jategaonkar et al. (2015); and Kang and Ratti (2013),. The financial integration and trade openness can accelerate or decelerate the adjustment process of imbalances however the role of these moderators is absent from the eyes of the literature. This study is unique in the prospect of taking the role of moderator on OPEC, developed, and developing economies for the adjustment of balances after shocks to oil price. The analysis of moderators is quite interesting and precise to incorporate the interaction terms of the moderator with the oil price. Further the results are more precise and accurate on the account of the introduction of categories for the moderators estimated.

To the best of our knowledge literature lacks such analysis considering the role of categorizing the moderators for the adjustment of current account balances of oil-importers and exporters. To analyse the role of trade openness and financial integration the data for developing developed and OPEC (oil and Petroleum Exporting Countries) have been taken from 1999 to 2020.

1.3 Objectives of the Study:

This study aims to explore the channels for examining the impact of oil price shocks on global imbalances considering the oil-importing countries. Besides the nature of oil price fluctuations its impact on output have been investigated whether it asymmetric and symmetric. Further the role of trade openness and financial integration has been determined empirically for adjustment of balances.

The study aims to extend the literature on the following in this association,

i. To explore the channel, that is more effective in the transmission of shock of oil price on global imbalances. To explore the mediation effects of the variables, being more effective in determining the effects of oil price movements on global imbalances in the oil-importing economies.

ii. To analyze the asymmetric effects of oil price shocks on industrial production of oil-importing countreies.

iii. To explore the role of financial integration and global openness of economies that whether the adjustment mechanism of the oil shocks to current account balances is accelerated or decelerated by different levels of these moderators.

1.4 Research Questions

The study will try to respond to the following questions;

i. Which channel does play a more effective role in the oil prices and global imbalances relationship among the channels of transmission with varying levels of oil imports?

ii. Does trade composition play a role to cushion the effect of oil price shocks on current accounts for highly oil-importing economies?

iii. Do moderators play their role in the adjustments of balances post-oil price shock?

iv. What is the role of financial integration in the adjustment of balances after oil price shocks?

v. How the financial openness of different groups of countries cushions or amplify the adverse effects of oil price shocks?

vi. Does a different forms of moderators accelerate or decelerate the process of adjustments of current account balances after oil price shocks?

vii. Does an oil price shock have an asymmetric response to industrial production for oil-importing economies with industrial production being the dependent variable?

1.5 Significance of the Study

In every economy, oil is the important ingredient of the production process and economic activities. However, due to the diversity of natural resources among global economies, a large number of economies are deprived of this important natural resource. The deprivation of important ingredients to production leads to its imports from resource-abundant economies, so making them vulnerable to oil price shocks. The study bears much significance on the grounds for the analysis of current account balances with fluctuation in oil price of oil-importing incorporating the degree of dependence (dividing the economies into group on basis of oil imports).

Keeping in view the literature on the link between oil price and current account the focus of this study is to explore the transmission channels for importing countries by using seemingly unrelated regression not used in earlier studies on the subject. The use of seemingly unrelated regression will make the analysis precise and rich. The following reasons may justify why? Firstly using the Seemingly Unrelated Regression directly takes into account the heterogeneity of the estimated parameters. Further the use of SUR modeling allows the dependent variable to have a set of different independent variables. The additional benefits of the SUR method is that it estimates the parameters of all equations simultaneously, so that the parameters of each single equation also take the

information provided by the other equations into account. This results in greater efficiency of the parameter estimates, because additional information is used to describe the system. The mentioned properties are required in the empirical model of our study making SUR an efficient and suitable choice.

Secondly, the analysis can be completed by using a lesser number of observations at the country-level in comparison to the analysis done for a single country[4] Cusolito and Nedeljkovic (2013). The analysis is unique in the sense that all the economies have been categorized according to their import of oil from abroad. The study is more comprehensive because it comprises the larger data set of countries over the globe (including 160 countries for transmission channel analysis).

The significance of our asymmteries analysis is on many grounds. First, we have shifted the focus from the US data (e.g.; Kilian and Vigfusson (2011a) Kilian and Vigfusson (2011b), Hamilton (2011); Herrera, Lagalo et al. (2011) and OECD data Herrera, Lagalo et al. (2015) to a large sample of oil-importing nations over the globe. Second, we have categorized the oil-importing economies into three different categories which enable us to estimate the amplitude of asymmetry to particular oil imports magnitude (the magnitude of reliance on imported oil). Third, we use the state of art technique considering the problem of correlation among cross sections and homogeneity to test the symmetry in the oil price response. Further using the industrial production index instead of gross domestic product in analysis will be more informative as it is main parameter of the economic

[4] The SURE requires more observations as compared to panel data techniques. Further, the numbers of countries to be included need to be less than the observation. As the data period is 1980-2019 so both considerations have been taken care in conducting the analysis.

activity. Industrial production index of any country provides information about the changes in production where gross domestic product provides the value of said production. [5]

Third, by using the broad set of moderators, international linkages (i.e. financial integration) and policy variables (degree of openness of economies) the study has presented the complete picture of the effects and actions needed to lessen the responses of oil price shocks. Fourth using different levels of moderators make the empirical analysis more comprehensive.

1.6 Contribution of the Study

In every economy, oil is the important ingredient of the production process and economic activities. However, diversity of the resurces over the globe make some resource deficient economies vulnerable to oil price shocks. The need of the hour is to provide suggestions to the policymakers for requisite tools to design policy responses that lessen the adverse consequences of a shock price of oil. For the development of policy for moderating, the adverse impact of oil price shocks he prerequisite is to analyze the transmission channel, the adjustment mechanism, and the role of moderators in the adjustment of balances.

The dynamics of the current account have been considered extensively in the literature, however; there is limited number of studies that investigate the effects of oil prices on current account balances. This study directs to add value to the scarce litcrature as the

[5] Industrial production index is published on a monthly basis by the Central Statistics Organization (CSO). It consists of eight core industries (Steel, Electricity, Cement, Petroleum, Coal, Crude oil, Natural Gas and Fertilizer). It gives details on the productivity, growth, slowdown, viability of these industries.
GDP growth provides information about goods and services that is produced within the territory of country in a fiscal year.

studies that have analyzed Backus *et al.* (2000); Kilian *et al.* (2009) and Allegret *et al.* (2015) the relationship between the two have not taken such perspective addressed in our study. The study will provide a rich analysis of oil price shocks by taking a broader perspective. The following are some basic important issues that have not been covered potentially in the recieved studies literature on the subject. Firstly, the received literature on the current account dynamics does not take in the impact of oil prices on current account balances with its full-length. Secondly, the inconclusiveness in the related literature about the role of different transmission channels in the adjustment of current account imbalances demands a rigorous analysis.

Thirdly, the findings of the study will provide the policymaker with requisite tools to develop policy responses that lessen the unfavorable effects of shocks to the price of oil. The examination of the variability of the current account balances to the fluctuation in oil prices will provide the role of terms of trade, asset prices, and exchange rates of the oil-importing economy.

The U.S. Energy Information Administration (2017) forewarns that between 2015 and 2040 world consumption of energy to expand by 28%. The foretold increase in worldwide consumption growth and increasing energy prices will position net-importing economies, in a taut position Gershon, Ezenwa et al. (2019). The oil-importing economies are more vulnerable to the oil price shocks and increase in energy use in coming years with fluctuation in oil price can have impact on output in these economies. Fourth, economies dependent on imported oil bears adverse effects of rising oil prices which reduces output and increases inflation Hamilton (1996). The study have tried to

bring to light the impact of oil price on industrial production of oil-importing economies that whether it shows any asymmetries or not.

Fifth, oil has a prominent role in the growth and development process of an economy. However, countries being resource deficient are more vulnerable to its price shocks. In this context, the oil-importing countries are divided into three different groups, to examine how much the current account imbalances of oil-importing countries are volatile with a change in oil price. The contribution of this study is threefold. Firstly, unlike existing studies, we have taken a broad sample of oil-importing countries that are divided into three sub-groups based on their oil import bill as appearing in the trade balance. The countries are divided into groups to focus on the oil price current account relatioship with degree of dependence of economy on imported oil. Secondly, the mediation effects of all channel variables are estimated.

The contribution of our asymmetry analysis is on basis that, we have categorized the oil-importing economies into three different categories which enable us to estimate the amplitude of asymmetry to particular oil imports magnitude. The insignificance of the oil price for all groups in the long run is evident for use of asymmetric model. The result provide evidence of symmetry in the response of industrial production in the short run. However, our analysis suggests asymmetry in long run for the lowest and highest oil-importing economies.

The present study analyzes the role of trade openness and international financial integration (international linkage) of the economy facing the oil shock. The introduction of the qualitative variable for both moderator's magnitude makes the analysis quite

interesting. Our main contribution is to bridge the gap by providing a thorough empirical analysis focusing on the role of moderator through interaction term categorizing it into low and high magnitude. The results suggest that both financial integration and trade openness play a significant and enhancing role in the surpluses of oil-exporting economies. Further, moderators decelerates the process of adjustment of balances for oil-exporting economies and does not show significant impact for developing and developed economies. By using such information a vigorous regulatory structure of national and global financial markets can be designed. It provides knowledge on how to keep an eye on and avoid global or regional imbalances.

1.7 Structure of the Thesis

The rest of the study is organized as follows. Chapter 2 prsents the review of existing literature focusing on macroeconomic effect of oil price discussed in detail sectionwise . Chapter 3 presents the theoretical framework of the empirical analyses. Chapter 4 comprises of four section with eacb section comprises of futher sub scctions. The methodology chapter presents a detailed discussion of the empirical models, data and variables, sample countries, and econometric technique used for the analysis respectively. The last section of chapter 4 discusses the descriptive statics of data used for analysis. Chapter 5 discusses the empirical findings and its interpretation. The study concludes with chapter 6, which gives out the summary of the key findings, and policy commendations dependent on the findings from the study.

CHAPTER 2

LITERATURE REVIEW

The literature on the subject has been structured according to different themes of study. Hence the chapter is structured in six different sections . In this context section 2.1 presents the review of the studies on oil price shock and their macroeconomic impacts. The section 2.2 presents the investigation of the effects of shocks to oil price on channels of transmission of oil price shocks and its related impact on the current account of a country or cross section of countries. The section 2.3 discusses the oil price shocks effect on the stock market and asset prices however the section 2.4 cotains the empirical literature on the oil price movement and exchange rate. The section 2.5 presents the asymmetries of the industrial productivity related to oil price. Finally section 2.6 analyses the empirical literature on the adjustment of current accounts and role of moderators in adjustment speed.

2.1 Oil Price Shocks and their Macroeconomic Impacts

The first strand of the study concentrates on the effects of shocks to oil price on the macroeconomic activities of countries under consideration. The oil price shock in 1973 and the following recession initiated a scholarly debate of investigation of the effects of oil price incraeses on the macroeconomic variables of the economies. The early literature on the topic include (Pierce, Enzler et al., 1974), (Rasche *et al.*, 1977a, 1977b), Mork and Hall (1980), Bruno and Sachs (1982), and Burbidge *et al.* (1984), Hamilton (1983)

Hamilton (1996) and Mork (1989), all of which reported the converse reationship between oil price raises and economic activity.

The prior agenda in oil price literature confronts the shock impact on GDP considering the non-US economies, obtained different results. For instance, Papapetrou (2001) and De Miguel, Manzano et al. (2003) reported negative effects of oil price fluctuation on industrial production employment and latter on the country's welfare. However, the former study was conducted for Greece and the latter for Spain. Cuñado *et al.* (2003) dealing with 15 European countries was unable to find a long-run relationship for oil price and output excluding Ireland and the United Kingdom. Levin and Loungani (1996) analyzing the data of G7 countries reported significant differences in the response of the GDP to fluctuation in oil price.

Cuñado *et al.* (2003), Jiménez-Rodríguez *et al.* (2005), and Mork, Olsen et al. (1994) investigated the impacts of shocks to oil prices on economic activity for oil-exporting economies (Canada, Denmark, the UK, and Norway). Cuñado *et al.* (2003) obtained a positive correlation coefficient for Denmark but not for the UK. Jiménez-Rodríguez *et al.* (2005) reported a negative effect for the UK but a positive effect for the Norwegian output. Mork *et al.* (1994) also obtained results similar to Jiménez-Rodríguez *et al.* (2005), which is a negative correlation (oil price fluctuation and GDP movements) for UK and Canada and positive for Norway.

The size of oil import is the reason for the difference in the impact of oil price as Rasmussen and Roitman (2011) found that a positive shock to oil price affects the oil importers negligibly as an increase of 25% results in a decline in GDP by about 0.5% or less. The variation over the countries is dependent on the magnitude of imports of oil,

where, the negative effects are partly settled by increases in external receipts. Narayan, Sharma et al. (2014) explored that economic growth for developing (16 countries) and developed (21 countries) countries is predicted by the nominal price of oil and greater evidence found for in-sample predictability.

The sources of shocks play a role in the determination of the magnitude of the effect of a shock on the oil price. Berument *et al.* (2010) suggested that focusing the type of oil shocks (supply versus demand) is more important for policymakers, particularly for the policymakers of importers of oil as the economic growth is significantly and positively affected by oil price shocks effects in case of oil-exporting economies. Lippi and Nobili (2012) found that there is a large, negative, and highly persistent impact on US production due to negative supply shocks. Further, the presence of supply shock over the globe and the US explain most of the variance of oil price fluctuations. The study suggests gauging the impact of the world business cycle on the US economy the shocks be distinguished into global supply and global demand shocks, as both have different implications. Baumeister, Peersman et al. (2010) analyzed the volatility puzzle and reason induced, that both demand and supply are inelastic so even small disturbances generate higher price jumps but smaller quantity adjustment[6]. Backus *et al.* (2000) found that shocks to price of oil has significant role in unstable relations in quantities and prices, once the sources of shocks are controlled the resilience of the terms of trade, trade balance, and the output is less mystified. Further, the high volatility in the terms of trade appears due to the higher instability in the relative oil price rather than the resilience of exchange rates since Bretton Woods. Baumeister *et al.* (2010) found that the results of oil

[6] The volatility puzzle refers to shocks of oil price creating higher price jumps and moderate quantity adjustments.

price increase depend mainly on the cause of oil price shock taking demand shock due to economic activity output and CPI increases, in contrast to oil particular demand shocks that decreases output and does not affect CPI. Cashin, Mohaddes et al. (2014) results indicated that demand disturbance in oil creates an increase in real output and faces inflationary pressures for all countries of the sample where supply-driven increase affects the economic activity of the oil importers. For energy-exporting countries, the impact is positive.

The effects shocks to price of oil on macro variables have been captured by Choi, Furceri et al. (2018) found that a rise in global oil inflation by 10%, on average, increases domestic inflation by 0.4%, however, the effect becoming insignificant two years after the shock. Mohaddes and Pesaran (2017) found that a decline in oil price decreases inflation and interest rates in the majority economies, and raises world real equity prices. The repercussions on real output are optimistic but take more time to materialize. Olaide (2016) investigated the impacts of the fluctuations in oil price on certain macroeconomic parameters in Nigeria and found an absence of causality in any direction in the price of oil and each of these macroeconomic variables (interest rate, real GDP, the exchange rate, the inflation rate, and the unemployment rate). Gokmenoglu, Azin et al. (2015) found support for the long-run relation in the price of oil and industrial production, inflation, and gross domestic product of Turkey. Hamilton and Herrera (2004) concluded that the prospect of monetary policy to avoid the contractionary results of shocks to the price of oil is not as huge as proposed by Bernanke, Gertler et al. (1997). Segal (2011) argued that the important route by which the price of oil influences output is monetary policy. The

reason that the oil price hike has not slowed the growth seems that they do pass through to core inflation.

Hamilton (2003) analyzed whether linear or nonlinear functions are better suited to forecast Gross domestic product growth in case of a fluctuation in oil price and found strong evidence in the favor of using a nonlinear function.

Kaul and Seyhun (1990) investigated the effect of the buoyancy (volatility) of the price of oil on rates of return to assets and found an insignificant coefficient on inflation variable, the oil price coefficient as negative and significant, and that on industrial production as positive and significant.

2.2 Oil Prices and Current Account and Channels of Transmission

To analyze the transmission channel for oil price shock to an economy much fewer studies have been conducted. However, the notable studies are Backus *et al.* (2000), Kilian *et al.* (2009), and Bodenstein *et al.* (2011); among all, Kilian *et al.* (2009) advances the most inclusive analysis of the impact of shocks to oil price on external balances of the economy. The most recent studies include Allegret *et al.* (2015), Rafiq, Sgro et al. (2016), Raheem (2017) and Baas *et al.* (2019).

Considering the shocks to the price of oil and their transmission channels the literature has analyzed oil price impacts by taking into account the types of the shocks Kilian *et al.* (2009) divided oil shocks into three types is finding the result that oil price increase will have an impact on external balances of oil importer differently based on whether they show high demand or less supply of oil[7]. Further, non-oil trade balance performs a central

[7] Aggregate demand shocks, oil specific demand shocks and supply shocks.

role there is the presence of valuation effects of shocks to oil price with capital gains and losses balancing trade imbalances. The nature of transmission of the rise in oil price mainly depends on the source of an increase in the price of oil. Cashin *et al.* (2014) results show that sources of shocks to the price of oil are important in determining its macro impacts on both the oil-importing and exporting economy. A supply-driven positive shocks in oil price results in decline in the economic activity of oil imports and vice versa for the exporter. However, increases in output and inflationary pressure results due to oil demand disturbance. Allegret *et al.* (2015) argued that the type of shock (supply-driven or demand-driven) significant factor to understand the effects of a shock to oil price on global imbalances where, the central adjustment system to oil shocks is formed on the trade channel, the valuation channel be at work in the short run only.

The oil price impact of on trade balance and its components oil and non-oil have been examined in literature Le *et al.* (2013) finding revealed positive impact for oil exporter to overall and oil trade balance resulting in trade surplus. For oil importer, the impact is being negative for oil trade balance and positive for non-oil trade balance canceling each other.

Splitting the shocks of oil price into negative and positive shocks Rafiq *et al.* (2016) showed the presence of revenue effect expenditure effect, and Demand effect invariably benefits oil-exporting countries[8]. Further, the oil-importing economies were protected from positive oil price shocks as the non-oil trade balance rose due to a negative shock to the oil price.

[8] As the price of product decreases its demand expands same taking place here as price of oil declines the importing economies expand its demand regarded as *demand effect* in the literature

Taghizadeh-Hesary (2017)'s findings revealed that oil-exporting (the Russian Federation, Iran) countries completely benefit from raises to oil price with significant direct effect (increase in the Gross domestic product). The evidence for the indirect effect is observed as negative and statistically significant, excluding Kazakhstan and Indonesia. In the case of oil importer (China, Korea, and Japan), the effects are more diverse, these bear a negative supply shock, whereas the coefficient of indirect effect was positive for all countries.

Oil price shocks' effect on current account investigated by Huntington (2015) provided an empirical examination of the relation between oil trade and a countries' current account for 91 economies. The results showed that the exports of oil are a significant cause to explaine current account surpluses whereas the oil imports do not appear to be the source of the deficit.Ozlale *et al.* (2010) results showed that the sensitivity of the ratio of the current account to raise at the price of oil price raises steadily for the first three months, and then decreasing, which shows a significant effect of a shock to oil price in the short-run for the Turkish economy. Ostry and Reinhart (1992) suggested that an important channel by which trade shocks are transmitted to private saving and the current account is substitution between tradable and non-tradable.

Elekdag, Lalonde et al. (2008) developed a Global Economy Model (GEM) to explore the international transmission mechanism of disturbances that move prices of oil. The incidence of real rigidities simulations causes significant wealth transmission in states. This is particularly accurate where a sustained rise in productivity growth is considered as emerging Asia. Bodenstein *et al.* (2011) by using a two-country DSGE model examined the effect of the movement of oil price is determined endogenously. A shock

related to the oil market that raises oil prices and shifts wealth to exporters of oil declines consumption of oil importer and depreciates their real exchange rate under incomplete financial markets. While the worsening of the oil trade balance of oil importer takes place, whereas improvement in the nonoil balance gradually lessens the impact on the overall trade balance.

2.3 Oil Price, Stock Market, and Asset Price

The relationship in the price of oil and stock market explored by Bai *et al.* (2018) findings were that the unanticipated rise in the supply of oil is negatively affected by oil price movement, however unanticipated rise in oil demands are positively affected. Furthermore, the Chinese and U.S. stock markets' response to shocks of oil price has different magnitude but same direction. Arouri and Rault (2013) by using SUR methodology using monthly and weekly dataset finds the evidence of cointgration in oil price and stock market of Gulf cooperation countries (GCC- exporter of the oil).

Naser and Ahmed (2016) examined tbe repose of stock prices to shocks of oil price by using FAVAR approach. The results suggested persistent and asymmetric response in case of all four economies.[9] Further the findings suggested positive response of stock of China and negative in other countries for oil price shocks. Apergis *et al.* (2009) provided the multi-country examination by dividing oil shocks into oil-market specific demand shocks, oil-supply shocks, and aggregate global-demand shocks all play a significant role in illustrating stock-inarket returns in the majority of countries[10]. The results of Granger

[9] The analysis used data for Brazil, China,India and Russia

[10] Sample of 8 countries, comprising of countries- the United Kingdom, the United States, Italy , Japan, France , Germany, Canada, and Australia.

causality tests suggested a significant role for idiosyncratic[11] demand shocks guiding the stock market returns. Donoso (2009) analyzed the relationship between oil prices and stock markets of the United States, United Kingdom, and Japan where findings suggest U.S. economy be most responsive to the oil price fluctuations further, the stock markets of the U.S. and U.K. are affected more by negative oil price movement than from positive shocks to oil price.

Impact of oil price variation on stock returns examined by Jones *et al.* (1996) for Canada, Japan, the United States, and the United Kingdom, explored that that fluctuation in the price of oil has an unfavorable effect on real stock returns and output during the postwar period. Further, the evidence suggested that Canadian and U.S. stock markets are rational[12]. Sakellaris (1997) studied stock prices and excess returns of individual firms, where excess returns to firms over the OPEC shocks to oil price varied from -80% - 100%, with the group average around -13 %.[13]

Sadorsky (1999) estimated VARs of real oil prices, interest rates, industrial production, and an index of real stock returns on the S&P 500. The results showed that stock returns have asymmetric responses to shocks to the price of oil.

Pollet (2002) and Driesprong, Jacobsen et al. (2008) found that on an international level movement of oil-price forecast stock market returns. Sawyer and Nandha (2006) reported conversely, the insignificance of oil prices for stock returns at the aggregate level. Park and Ratti (2008) argued that shocks to the price of oil have a significant effect on real stock returns in the same month. Further, allowing for the spillover effects, all three

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[11] demand shocks which are country specific.

[12] The reaction of stock prices to shocks to oil price can be considered completely by their effect on current and anticipated future real cash flows only.

[13] Stock prices less "fundamental" values-essentially discounted cash flows.

shocks measures show significant inverse effects for stock prices in the U.K. Chang and Yu (2013) found the results that oil price shocks immediately affect the stock returns. Nandha and Faff (2008) investigated the effect of shocks to the price of oil on 35 industry sectors and found that equity returns from all industries are inversely affected by fluctuation in the price of oil except for mining, oil, and gas, xfurthermore, the analysis shows the asymmetric impact on equity price of oil price change.

For the oil price impact on stock prices Huang, Masulis et al. (1996) provided support for the causality effects from oil futures prices to stock prices. Faff and Brailsford (2000) reported that oil-price risk is a significant factor for market risk, in the stock market of Australia. Hong, Torous et al. (2002) also identified an inverse relationship between oil-price returns and stock-market returns. Hammoudeh and Li (2004) and Hammoudeh and Aleisa (2004) also discovered the significance of the oil factor for stock prices in some oil-exporters. Bittlingmayer (2005) documented that fluctuation in the price of oil is linked with war risk and that linked with other reasons show an asymmetric effect on the stock price behavior. Gogineni (2008) provided evidence that the relationship of oil price to stock prices is positive, if shocks are due to changes to aggregate demand, and have a negative association with stock prices when shocks are due to movement in supply.

Fang and You (2014) investigated the association between oil price and stock prices of newly industrialized countries (India, China, and Russia) and found mixed evidence. Henriques and Sadorsky (2011) examined oil price volatility and strategic investment behavior for US companies find U-shape relationship between the two after controlling the effects of Tobin's q and cash flows. Bastianin *et al.* (2016) explored that demand-side shocks play a prominent role than supply-side shocks and influence volatility in long run.

The co-movement in the response of volatility is observed in G7 countries except for Italy and Japan, as they emerge as more erratic.

Boldanov *et al.* (2016) estimated the conditional volatility by GARCH (1,1) model found that the relation between oil price and financial markets behaves heterogeneously over a different period while correlations are found positive during events that trigger the demand and negative during events that affect the supply.

Oil prices and currency relationship examined by Yang, Cai et al. (2018) explored that raises at the price of oil in Canada and Europe are associated with the depreciation of currencies. The intensity of co-movements is different in different currencies being more intense for oil exporters like the UK and Canada and less intense for oil-importing countries like Japan. Beckmann and Czudaj (2012) interrogates the direction of causality of price of oil to exchange rate and explored the presence of reverse causality in some cases, further the study observed an appreciation for an increase in oil price for exporting countries and depreciation for importing economy. Buetzer, Habib et al. (2012) showed that currencies of the oil-exporting countries do not appreciate after oil price shocks where it is partly determined by the fact that oil exporters actively offset appreciation pressures by gathering forex reserves.

Ready (2018) developed an asset pricing model to study oil price risk where the results from the model suggest that oil shocks persistence is a key driver of riskiness further provides evidence that shocks to the price of oil affect future productivity growth and point up the prominence of asset prices. Morana (2017) found strong asymmetric impacts of oil price, as raises in prices of oil causes contraction in industrial production for Euro

Area where decrease has some expansionary effects early and mid-2000s further real effects of shocks to oil price appear to increase with their magnitude.

2.4 Oil Price Shocks and Exchange Rates

The trade channel considered in the earlier Sections motivated many authors to emphasize on effective exchange rates of oil-importing and oil-exporting economies. The conclusions however, differed remarkably over studies and economies (Taylor *et al.* (2001); Kilian *et al.* (2003); Sarno (2005).

Beckmann *et al.* (2013) analyzed a group of 10 countries and explored that the results to be different across oil-exporters and oil-importers not only between, but also within the group. Huang and Feng (2007) showed that China experiences an appreciation of the real exchange rate to shocks of real oil price employing a SVAR model. Conversely, the results of two current studies depict the absence of association of real oil price to real effective exchange rates of oil exporting and oil-importing countries. Habib, Bützer et al. (2016) by SVAR identified different shocks to real oil price and unable to find evidence of appreciation of exchange rate of oil exporter against of oil importers for set of 43 countries. Yousefi and Wirjanto (2004) empirically examined five OPEC countries and presented evidence that there is positive response of oil export prices to depreciations of US dollar.

Basher, Haug et al. (2016) by applying a Markov-switching approach and identified that after oil demand shocks the exchange rate appreciates in oil exporting countries, but unable to observe the similar effect for oil supply shocks. Akram (2004) identified a nonlinear inverse relation in currency of Norway and oil prices based on a threshold

model. De Schryder and Peersman (2015) offered an interesting perspective by identifying a significant decrease in the demand for in 65 oil-importing economies as a consequence of US dollar appreciation.

The relation in oil price and exchange rate focused by Clostermann and Schnatz (2000) who found a long-term relationship in oil price and the dollar-euro exchange rate.Chaudhuri and Daniel (1998) assessed real dollar exchange rates for OECD countries and detected a cointegrating relation in the most. Chen and Chen (2007) by using a G7 panel countries found that movement in real echange rate are due to real oil prices.

Habib and Kalamova (2007) did not find evidence of a conintegration in real effective exchange rates and the oil price for Saudi Arabia and Norway, but reported evidence for a real appreciation of Russian currency in long-run as a result of oil price increase. However, Al-mulali (2010) provided evidence for appreciation of a real effective due to increase in the real oil price. Schneider, Van Robays et al. (2014) identified bi-directional causality in oil price and US dollar using daily data between January (2001 and 2012) established that a 10% rise in oil price depreciates US dollar by 0.28%, whereas a 1% dollar depreciation increases oil prices by 0.73%. Ghosh (2011) found that the Indian rupee depreciate due to positive shock to oil price using daily data. Jiang and Gu (2016) analyzed 13 currencies, and found correlations between prices of oil and exchange rates to be asymmetric. Zhang (2013) concluded that movement in oil price and exchange rate dynamics conditional on structural break. As a long-run relationship between both is detected and it depends on allowing for structural breaks. Basher, Haug et al. (2012) provided evidence for short-run impact of oil price shocks on exchange rates by analyzing emerging markets.

Despite of quite rich literature oil price impacts to macroeconomic variable. The oil price current account relationship is yet to be discovered with specific focus on the role of different mediators in oil price and current account relationship. The present study is an attempt to that focusing specifically on oil importing economies.

2.5 Literature on Oil Price Asymmetric Behavior

The process where retail prices respond to increase in wholesale prices but not to the reduction in the wholesale prices is termed as asymmetric price impacts. Asymmetric impact is termed as *"Rocket and Feather Effect"* firstly used Bohi (1991) in the literature. The concept of price asymmetries is not just incarcerated to the gasoline market, but it has been broadened to agricultural goods and financial markets. Peltzman (2000) examined 242 diverse product markets and verify rockets and feathers effect to be a regular pricing scheme in beyond two thirds of the markets.

The empirical analysis of responses of industrial production to shocks of oil price, Mork (1989) conclude that increase and decreases does not have the same implication for growth in US gross domestic product. Other studies that have reported a confirmation for nonlinear forecasting equation perform better comprise Lee *et al.* (1995), Balke, Brown et al. (1998), and Hamilton (1996, 2003). Carlton (2010) and Ravazzolo and Rothman (2013) both confirmed these analytical improvements using real-time data. Frederer (1996) and Elder *et al.* (2010) confirmed that oil-price variation anticipates slow growth in GDP, implying that delines in oil price causes contractationary effects. Herrera *et al.* (2011) discovered a robust nonlinear response industrial production to oil prices for U.S., with the sizeable effects for energy intensive industries. a nonlinear relation between real

gross domestic product growth and oil prices has also been reported for some OECD countries by Cuñado *et al.* (2003), Jiménez-Rodríguez *et al.* (2005), Kim (2012), and Engemann, Kliesen et al. (2010).

In contrast to previous anlyses Kilian *et al.* (2011a) and Kilian *et al.* (2011b) found a little evidence for presence of nonlinearity (evidence of asymmetry) in response of gross domestic product growth of US to oil price. The reason stated for such contrasting results is use of methodology for evaluation of presence of asymmetry between oil price and output is based on modeling the oil price variable. Herrera *et al.* (2015) using simultaneous equation modeling finding presence of asymmetry for the economies either large oil exporter or oil importer further testing the null of joint symmetry provides little evidence of asymmetry.

Overall the above literature encompasses the relationship and reaction of different macroeconomic variables to oil prices by analyzing the oil importing and exporting countries with help of various economic techniques. However asymmetries dealt using US data (see e.g. Hamilton (2011), Kilian *et al.* (2011a, 2011b) , Herrera *et al.* (2011) and OECD data Herrera *et al.* (2015) only. The negative relation between oil price hike and gross domestic product has been an established fact. The asymmetric response of gross domestic price to change in price of oil is not clear from literature with specific focus on oil importing economies. The present study will analyze the behavior of industrial production to oil price shocks by using dynamic common correlated estimates by Chudik and Pesaran (2015) for oil importing economies. However, oil importing economies are being classified into low medium and high oil importing economies.

2.6 Moderator Analysis Literature

The literature on the role of moderators for adjustment is quite scarce. The role monetary policy, nature of shocks (transitory or permanent), financial integration and trade openness has been analyzed in the literature. Below section discusses the financial integration and trade openness for sustainability of current account balances of the economy.

2.6.1 Financial Integration Literature

The literature on the causes and sustainability of current accounts deficit is available but the number of studies focusing on the role of financial integration of the adjustment speed of financial integration is more limited. The literature on the role of moderators for adjustment has utilized the coefficient of net foreign asset as a measure of integration or sustainability. The sustainability is defined from fiscal policy literature Bohn (1998) presented theoretical model presenting that conditional on temporary disturbance; the negative response of the deficit on public debt is condition for solvency. Taking it from sustainability perspective insensitivity of trade balance to net foreign asset is matter of concern, as it almost violates the sustainability condition. The presented theoretical model provides a new avenue for weak response as a sign of high integration. There are a number of studies that have analyzed the sustainability by using reaction function (see e.g Galí and Perotti (2003);Mendoza and Ostry (2008); Wyplosz (2005), some have focused on United states (Engel and Rogers (2006); Wickens and Uctum (1993) and Towbin (2008) estimated the reaction function to a broader sample of seventy countries and argues that in integrated economies the adjustment is slower.

There is a strand of literature built on Feldstein and Horioka (1979) stronger correlation of investment and saving is interpreted as presence of low capital mobility. The literature focusing on the investment saving dynamics in an error correction model argued that adjustment is slow when there are periods of high capital mobility (Hoffmann (2004); Pelgrin and Schich (2008); Taylor (2002). These studies have concentrated on industrial countries only.

The above discussed literature is concerned with current account adjustment not considering the role of oil price shocks. However, analyzing oil price effects the current account of oil exporting economies is complicated by two issues, the stabilization purpose and role of precautionary saving due to oil revenues. The nature of the effect of the oil price varies as referred to use of the revenues are in consumption or precautionary saving.

The literature related to the management of revenue has dealt the issue in different ways. The permanent income hypothesis argues that economies abundance in the natural resource should save the major part of the revenue to smooth the consumption and to ensure intergenerational equity. Parallel to above is precautionary saving motive built on hypothesis that oil producers considers the positive shock as temporary. The building of the precautionary saving to meet the uncertainty in future has been discussed by Bems *et al.* (2011). A large part of literature is devoted to Herberger-Laursen-Metzler effect that

argues that windfall gains in income will be saved and permanent will be a part of consumption.[14]

The revenues of oil can also expand sources of investment as Solow (1986) termed as "rule of thumb" for sustainability. However oil producers with low income face inefficiencies in investment (Van der Ploeg *et al.* (2011); Araujo *et al.* (2016).

According to empirical literature the countries with more bulky oil producing sector have higher current account balances as higher revenues increases saving more than its other counterpart (investment) Cheung, Furceri et al. (2010). The results has been confirmed by the spending trend of oil producers increasing less than oil revenues, this result is confirmed by many in the literature (Higgins, Klitgaard et al. (2006) Cheung *et al.* (2010); Arezki and Hasanov (2013).

In the analysis of current accounts patterns a factor that gained increasing attention is level of financial development. The emerging economies and oil producers have bypassed their inefficient financial markets and transferred their capital to the countries with more efficient financial markets and have made a contribution toward global saving glut.

Mendoza, Quadrini et al. (2009) explored that international financial integration can lead to large and unrelenting global imbalances whem there is difference in financial

[14] This effect examined by Harberger (1950) and Laursen and Metzler (1950) justified the Keynesian consumption framework that is marginal propensity to consume be less than one following an iinprovement in terms of trade of country.

development domestically [15]. Financial integration causes to decreases savings and add up a stock of net foreign liabilities for countries with deep financial markets. The countries with deep financial markets borrow heavily from abroad and invest foreign risky assets with high-return.

Vermeulen and de Haan (2014) tested the Mendoza (2009)'s implication for a cross section of 50 developing and industrialized countries. They found results consistent with Mendoza *et al.* (2009) implication that financial development plays a role for net foreign asset and it reduces the asset position of the economy in long run. Caballero, Farhi et al. (2008) focused on the countries with division into two regions, the region with deficit in current account and higher financial development and other savers with less financial development.[16] The author conclude that deficit in US is due to inflows from savers. The implication from saving glut thesis is that improved financial development will reduce the current account imbalances.

Chinn and Ito (2008) focused on the East Asian economies and provided the evidence against the theory stated. Arezki *et al.* (2013) estimated the dynamics of the current accounts of oil exporting for financial development and found significant negative impact on former. However they used restrictive assumption of use of oil revenues by oil abundant economies independent of their economic environment, where the oil abundant groups includes economies with differences in level of financial development. Another important issue related to financial development in oil abundant economies can be their

[15] Financial integration is situation where financial markets of neighboring countries are associated with one another.

[16] Current account deficit region includes Australia , United Kingdom, and United States the savers includes oil producing, emerging markets and newly industrialized countries.

role to allow the resource distribution during changes in the resource price. So the financial development effect can be non linear as well, Allegret *et al.* (2014) by analyzing the data of 27 oil exporting economies found the current account to be positively affected by oil price fluctuation, however the effect of non linear and depends on the level of financial development.

2.6.2 The Role of Trade Openness in Current Account Oil Price Relationship

Degree of trade openness plays a significant role for current account and literature received presents mixed evidence. The negative effect of trade openness on the current accounts of the economy observed by Edwards (2004) and Chinn and Prasad (2003) both analyzed the panel data, where data set contained both developed and developing countries in the latter finding the developing countries negative relation between openness to trade and current account balances. However, Selçuk, Karaçor et al. (2017) result for Turkey showed that trade liberalization played a role to increase the trade deficit where, same result does not hold for current account deficit.

In the literature for trade openness two proxies are used Santos-Paulino (2002) by using changes in custom duties on imports and export as proxy found that trade liberalization worsen the trade balance and balance of payment because due to liberalization import respond faster than exports[17]. Ostry and Rose (1992) by choosing a second measure of trade openness found a significant relation of change in tariff on trade balance. Parikh (2002) determined that by increasing imports liberalization in short term lead to trade and

[17] The literature on trade openness comprised of two proxies first is ratio of export plus imports to GDP , the second is change in custom duties on imports and exports.

current account deficits and economic growth due to liberalization can increase imports than exports.

Summary

Summarizing the literature on oil price shocks and current accounts it can be concluded that degree of dependence in oil imports has not been focused while analyzing the both variables relation. The present study estimated the role of mediation keeping in view the dependence of economy on imported input . the asymmetry of industrial prpduction has also been analyzed by magnitude of dependence on imported input. The focus of the present study is to estimate the effects of different moderator focusing on the dgee of dependence of the economy over the globe. Despite the substantial debate on the role of policy variable (trade openness) and international linkages (financial integration) to best of our knowledge there is no study analyzing the role of the degree of the both variables on the adjustments of current account due to oil price sbocks.

CHAPTER 3

THEORETICAL FRAMEWORK

3.1 Introduction

This chapter presents the theoretical background conceptual framework of oil price shocks and global imbalances. In this context, the theoretical background of mediation analysis followed by theoretical underpinning of asymmetries of economic activity. The last part of the chapter focuses on the theoretical background for moderator analysis. This chapter comprises of four sections presenting theoretical framework for impacts of change in imported oil on macroeconomic parameters of the economy followed by mediation analysis. The theoretical underpinning of asymmetries of industrial production to oil price shocks is presented in third subsection and role of moderators for adjustment of balances in last subsection.

3.1 Theoretical Background

The following sub-section presents theoretical framework that explicate the relationship between oil price and macroeconomic performance through which oil price affects economic activities.

3.1.1 Macroeconomic Impacts on Oil-Reliant Economy

In order to examine that how oil price affect macroeconomic performance both static and dynamic models have been presented. The static models incorporating the role of

imported input are reported by Corden (1986), Benavie (1978), Findlay and Rodriguez (1977). Whereas the dynamic models on the theme is even scarcer. Buiter (1978) presented an integrated macro dynamic model, while a pure currency substitution approach followed by Obstfeld (1980).

As far as dynamic approach is concern, Bhandari (1981) presented a dynamic macroeconomic model that captures a small open economy that is completely dependent on imported oil.[18] In addition to imports of oil, the economy in discussion also imports final commodity from abroad.

The model has examined the response and dynamic behavior of macroeconomic variables in response to an unexpected increase in oil prices. The model considers the specific focus on implications for balance of payments due to the disturbance.

3.1.1a *The Model*

Bhandari (1981) model comprise of a 'small' open economy that imports oil from OPEC economies and final commodity from the U.S. due to its size oil price, foreign good price and interest rate are all exogenous for the economy. Domestic production is accomplished by using three factors capital, labor and oil. The capital stock is assumed fixed for the duration of the model. The substitution of oil with other factors is not possible so the oil and labor both are used in fixed proportions.

[18] This assumption is not unrealistic for some West European economies.

The supply of domestic labor and oil is entirely elastic at world price of oil and the current wage rate (nominal) respectively. Domestic demand determines the domestic income and also oil imports and employment level of the economy. [19]

The macroeconomic dynamics of the model discusses the oil price shocks effect. The model is explained by the set of following instantaneous relations. [20]

$$m - q = \lambda i + \phi y \tag{3.1}$$

$$q = \beta p + (1 - \beta)(e + p^*) \tag{3.2}$$

$$i = i^* + \dot{e}^E \tag{3.3}$$

$$y = a + \delta(e + p^* - p) \tag{3.4}$$

$$\dot{p} = \alpha\dot{w} + (1 - \alpha)\dot{e}^E \tag{3.5}$$

$$\dot{w} = -\mu(w - q) \tag{3.6}$$

$$\dot{e}^E = -\theta_1(e - \bar{e}) - \theta_2(w - \bar{w}) \tag{3.7}$$

Where m: *log of domestic nominal money supply,*

q: *log of domestic price index,*

y: *log of domestic real income,*

i: *domestic nominal interest rate,*

$i*$: *foreign (U.S.) nominal interest rate,*

e: *log domestic exchange rate vis − a − vis U.S. dollar,*

w: *log of domestic nominal wage rate.*

p: *log of domestic price of domestic output,*

$\dot{e}^E$: rate of expected depreciation of domestic currency vis − a − vis the U.S.,

$p*$: *U.S. dollar price of foreign final good,*

n: *U.S. dollar price of imported oil,*

[19] Dots denote derivatives with respect to time and over bars show values at steady state. Lower case letters depict the logarithm of variable, and upper case letters used to refer to the natural variables.

[20] The detail of the macroeconomic dynamics of the model is provided in Appendix C.

a: $shift\ term$,

$\lambda, \phi, \theta_1, \theta_2, \delta, \alpha, \beta, \mu$: Parameters of the model, each defined positively.

Here in Eq. (3.5) α represents part of unit cost attributed to labor, so the first term depicts the rise in labor costs. Assume that oil price is denominated in dollars, the raise in oil costs as input is $(1 - \alpha)(n + e)$, recognized by local firms is to be $(1 - \alpha)\dot{e}^E$. The rise in cost of labor is observed by wage contracts; however the rise in oil costs can not be measured but must be evaluated. It is assumed that oil price increase unanticipated, i.e., $\dot{n}^E = 0$[21].

The trade balance of the domestic economy is supposed to be managed by the real exchange rate. The real exchange rate also determines the income, as in Eq. (3.4) and is supposed that the clear effect of a rise in the exchange rate causes to riase the trade surplus,

$$b = b_0 + b_1(e + p^* - p) \tag{3.8}$$

Eq. 3.9 the trade balances with reference to OPEC, is given as following in terms of domestic output.

$$B_p = \bar{X}_p - (KY)^{NE}/_P \tag{3.9}$$

$\bar{X}_p$, denotes domestic exports and (KY)depicts oil imports (in number of barrels) of, K is fixed by the assumption of technology to be constant. The real trade balance (logarithmic form) is shown to be correlated to the last term in the Eq.(3.9).

$$b_p = (a_0 - \acute{k}) - y - (e + n - p) \tag{3.9a}$$

where a_0 and $\acute{k}$ both are constants. A decrease in $\acute{k}$ however symbolizes cost effective use of imported oil. Equation (3.9a) also supposes oil to be in dollars. If the price was

[21] Such assumption is not realistic in recent time as schemes are now initiated in OPEC to effect the oil price positive regularly by a announced proportion.

regarded in the domestic currency, in that case equation (3.9a) would not had the exchange rate term.

The steady-state equilibrium is given by $\dot{e}^E = \dot{e} = 0$ and $\dot{p} = \dot{w} = 0$ for economy.

The price index depicts the wage level at steady-state in Eq. (3.6), whereas the implications of the unit cost mark-up rule provides domestic price level at the steady state as following

$$\bar{p} = \alpha\bar{w} - (1-\alpha)(\bar{e} + n) \tag{3.10}$$

given oil denominated in dollar. So, it is evident that in the present economy, the movement in the oil price primarily changes price at steady-state that domestic firms want to impose. Simultaneously, the price index at equilibrium levels, the wage rate, income and the exchange rate are strained and the economy set about a new steady state, except domestic system try to prevent this by developing a policy.

3.1.2 Impact of a Rise of the Price of Imported Oil

Suppose now the impact of an unanticipated rise in the oil price measured in dollar (OPEC oil), n. Then the effects of the shock at steady-state can be acquired from the expression of equations (3.1), (3.2), (3.4), (3.6) and Eq. (3.10) and are as follows;

$$\frac{d\bar{e}}{dn} = \frac{(1-\alpha)(\phi\delta-\beta)}{1-\alpha\beta} > 0, \tag{3.11a}$$

$$\frac{d\bar{p}}{dn} = \frac{(1-\alpha)(1+\phi\delta-\beta)}{1-\alpha\beta} > 0, \tag{3.11b}$$

$$\frac{d\bar{e}}{dn} - \frac{d\bar{p}}{dn} = -\frac{(1-\alpha)}{1-\alpha\beta} < 0, \tag{3.11c}$$

$$\frac{d\bar{y}}{dn} = -\frac{\delta(1-\alpha)}{1-\alpha\beta} < 0, \tag{3.11d}$$

$$\frac{d\bar{w}}{dn} = \frac{\phi\delta(1-\alpha)}{1-\alpha\beta} > 0 \tag{3.11e}$$

$$\frac{d\bar{w}}{dn} - \frac{d\bar{p}}{dn} = -\frac{(1-\beta)(1-\alpha)}{1-\alpha\beta} < 0, \tag{3.11f}$$

The stability of Eq.(3.11a) depends on the assumption ($\phi\delta>\beta$). Under this assumption, the impact of the increase in the oil price involve depreciation of exchange rate along with wage inflation and price. The impact on the domestic price level is harsher than the depreciation of domestic exchange; hence there is deterioration of terms of trade domestically as compared with the United States. The last has its complement in the decrease in real income at equilibrium, which resultantly, is shown in a decline in oil imports quantity along with decrease in domestic employment. Finally, Eq. (3.11f) shows that the real wage at equilibrium also decreases with increase in oil price. Then, the home economy can not be protected against the external interruption.

Approaching to the trade balance impacts now, it is obvious from (3.8) that the real trade balance at equilibrium adjacent to the U.S. is deteriorated. This result continues to dominate even if U.S. prices are also augmented by the raise of oil-price, being the last raise is not a important part of the raise in domestic price. If conversely, the imported oil has an important impact on price level at the U.S. and so the trade balance repercussion would retrogress.

The impact on the trade balance at equilibrium with reference to OPEC is not clear and is given below as

$$\frac{db_p}{dn} = \frac{\delta(1-\alpha)-\alpha(1-\beta)}{(1-\alpha\beta)} \gtrless 0 \qquad (3.12)$$

With reference to Eq.(3.9) bp, shows the real trade balance and gives a magnitude of the real transmit to OPEC. While the real transfer increases by the rise in oil price n and the linked depreciation of exchange rate. The depreciation can lead to inflation which results in the decrease in real income at equilibrium, which in real terms decreases the transfer.

The effects of different parameters on above mentioned results, as the extent of openness can be investigated conveniently. As β decreases, indicating a high influence to U.S. commodities prices in the CPI, the income decreasing impact is lessened and simultaneously the probability of real trade deficit with reference to OPEC is high. Nevertheless, the impact of depreciation on equilibrium is not apparent and hinges on either $\phi\delta \gtreqless 1$. All else being equal a raise in δ, the extent of substitution among household and U.S. commodities, is noticed to aggravate the stagflationary effects for increase in price of oil unequivocally, though decreasing the real relocate to OPEC.

The elasticity of the exchange rate with reference to increase in oil price n can be shown as following

$$\frac{de}{dn} = \left(\frac{1-\alpha}{1-\alpha\beta}\right)\left[\frac{\{\theta_1(\phi\delta-\beta)+\theta_2\phi\delta\}\lambda}{\phi\delta+1-\beta+\lambda\theta_1}\right] > 0 \qquad (3.13)$$

However the variation in the impact and effect on exchange rate at steady-state is as follows

$$\frac{de}{dn} - \frac{d\bar{e}}{dn} = \frac{(1-\alpha)[\lambda\theta_2\phi\delta-(\phi\delta-\beta)(1-\beta+\phi\delta)]}{(1-\alpha\beta)[\phi\delta-\beta+1+\lambda\theta_1]} \qquad (3.14)$$

Visibly , (3.14) is steady with 'undershooting' or 'overshooting' of the exchange rate, depending on estimates measure. Such as, θ_2 (which estimates the rate of sensitivity of exchange rate predictions to the nominal wage divergence) declines the probability of 'undershooting' raises monotonically. The raise in spot exchange rates involves a temporary enhancement in the terms of trade domestically regarding the U.S. and is hence increase real domestic income. This feature of our investigation is based on the condition of aggregate demand in (3.4). If oil were used partially as a ultimate consumption good, then the raise in price of oil would involve a depressing effect on

aggregate demand. Furthermore, it can be revealed that the nominal interest rate increases at domestic level subsequent the increase in oil price (n) and to the degree to this indicates an increase in real interest rate, that would be an additional effect working to decrease aggregate demand at domestic level.

Although these provision, the truth that exchange rates react more rapidly to domestic prices, involves an inclination to correction in terms of trade domestically with reference to the U.S. and thus a trend to high domestic real income, as compared to new equilibrium point. In the background of this straightforward structure, this predisposition interprets a real raise in real income.

The proposition of the momentary enhancement in the terms of trade with reference to the U.S. is a transitory trade surplus alongside the U.S. conversely, the trade balance initially as compared to OPEC clearly decreases, i.e.,

$$\frac{db_p}{dn} = \frac{de}{dn}(1+\delta) - 1 < 0 \qquad (3.15)$$

Ultimately, the real income decreases and the trade balance with refrence to OPEC may have a positive effect, whereas, with reference to the U.S. deteriorates.

Having investigated the primary and steady-state effects results can be modified by OPEC price hike effecting the US inflation. The variation in the equilibrium results can be investigated by taking $\bar{p}^*$ to have a positive relation to price of oil and by allowing that the steady state nominal interest rate (U.S.) is not influenced. This will be so, if Fisher's hypothesis holds for the U.S. The OPEC prices will not affect the determination of equilibrium real rate of interest of the U.S. so is presummed that it is set by real consideration. By following such modification, the results obtained will be following:

$$\left.\frac{d\bar{e}}{dn}\right|_{\gamma>0} = \frac{(\phi\delta-\beta)(1-\alpha)+\alpha\gamma(1-\beta)(\phi\delta-\beta)-\gamma(1-\alpha\beta)(1+\phi\delta-\beta)}{1-\alpha\beta} \quad (3.16)$$

where γ is the elasticity of the price level of U.S. at equilibrium with reference to increase in oil price (n) i.e., $d\vec{p}^{*}/_{dn} = \gamma$,On comparing (3.16) with (3.11a) it is easy to show 'that

$$\left.\frac{d\bar{e}}{dn}\right|_{\gamma>0} - \frac{d\bar{e}}{dn} = -\frac{\gamma(1-\alpha)(\phi\delta-\beta)}{1-\alpha\beta} - \gamma < 0$$

the impact on the equilibrium exchange rate is obviously diminished, if bank account is of U.S inflation. Actually, this is not sure that depreciation of exchange rate of domestic economy will take place, as (3.16) can be reworded as

$$\left.\frac{d\bar{e}}{dn}\right|_{\gamma>0} = \frac{(1-\alpha)(\phi\delta-\beta)}{1-\alpha\beta}[1-\gamma] - \gamma \quad (3.16a')$$

Although for reasonable estimate measure, such an impact may be anticipated. Further find

$$\left.\frac{d\bar{e}}{dn}\right|_{\gamma>0} = \frac{(1-\gamma)(1+\phi\delta-\beta)(1-\alpha)}{1-\alpha\beta} \quad (3.17)$$

Therefore as (1-γ)>0 (which seems highly rational for a huge economy as U.S.) a evaluation of (3.17) with (3.11b) illustrates that domestic equilibrium prices are less effected by inflationary effect. Moreover

$$\left.\frac{d\bar{e}}{dn}\right|_{\gamma>0} - \left.\frac{d\bar{e}}{dn}\right|_{\gamma>0} = -\frac{\gamma(1-\alpha)(\phi\delta-\beta)}{1-\alpha\beta} - \gamma < 0 \quad (3.18)$$

An examination of (3.18) and (3.11d) depicts that

$$\left[\left.\frac{d\bar{e}}{dn}\right|_{\gamma>0} - \left.\frac{d\bar{p}}{dn}\right|_{\gamma>0}\right] - \left[\frac{d\bar{e}}{dn} - \frac{d\bar{p}}{dn}\right] = \gamma\left[\frac{(1-\alpha)}{1-\alpha\beta} - 1\right] > 0 \quad (3.18a)$$

Since α and β are both <1 . So the deterioration of terms of trade is less when U.S prices are also high flown; thus the decrease in real income domestically is lessen. The afore mentioned findings thus demonstrate that , to the degree U.S prices are also impacted by

the increase of oil price by OPEC price, the stagflationary effects on domestic economy are rather reduced.

The models results can be summarized as it suggests the exchange rate depreciation of for the countries importing oil. The real trade balances of the oil importing economies is worsened is clear from equation (3.8). The results of oil price impact on trade balances are found quite ambiguous when oil shocks effects the U.S economy. Further the model also suggests that terms of trade of oil importing economy will deteriorate. The deterioration of trade balance suggests the implication for the current account balances of the oil importing and exporting economy. The matter thus becomes more of empirical nature, so the model is providing the basis for trade and wealth channel working for communication of shocks to oil price to the current account balances.

3.2 Conceptual Framework for the Channels of Transmission of Oil shocks

Importance of oil cannot be denied by any economy as oil being an important ingredient in production process. As far as the theoretical considerations are concerned the existing literature on the subject explore a number of channels through which oil price shocks affects the performance of macroeconomic variables. For instance, Brown *et al.* (2002) explore six transmission channels through which the effects of oil price transmit to an economy. The present study is an attempt to examine the mediation role of the terms of trade, asset prices and exchange rate from oil price to current accounts of oil importing nations. The presence of supply side and demand side channels for the effect of the oil

price on economic activity provides the potential reasoning for effect of former on current account of economy[22].

For example, the deterioration of terms of trade, trade balances, exchange rate and impact on foreign assets of the oil importing economy provide a potential role of these effecting current account balances of oil importing economy Backus *et al.* (2000), Kilian *et al.* (2009), Olaide (2016), Ratti and Vespignani (2016).

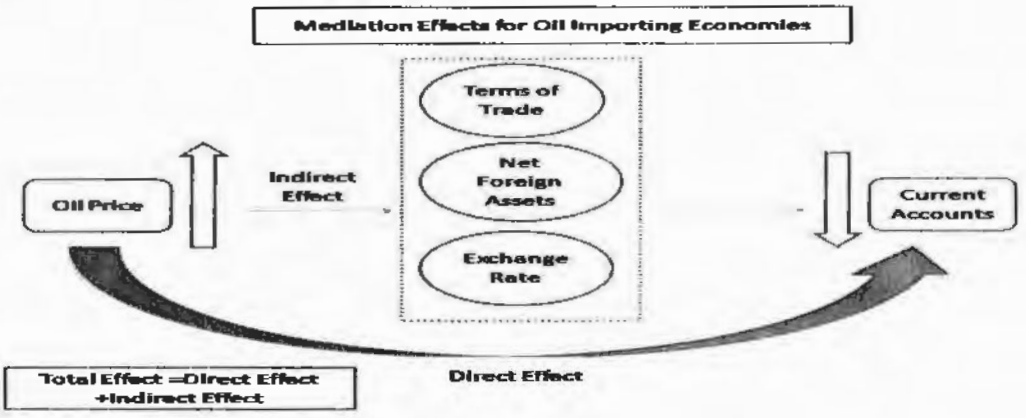
3.2.1 Trade Valuation and Wealth Channels

The oil price shocks effects the external accounts of the economy by two main channels. The first one is the trade channel the second is the financial channel and third prominent transmission channel is the wealth channel. The trade channel is where quantities and prices of tradable goods alter by oil price movement. However, the financial channel operates by changes in asset prices positions of external portfolio Kilian *et al.* (2009). The shocks to oil price effects oil-importing economies and oil-exporting economies both directly and indirectly.

The effects of oil price shock on economy's current balances through three different mediating variables as to be estimated empirically are given in figure 3.1. The mediation effect by terms of trade is referred to as trade channel; the mediation effects of net foreign assets denominated as valuation channel and mediation effects of exchange rate is wealth channel.

[22] The supply-side effects are where increase of price of oil indicates the decrease in quantity of a basic input for output production. The demand effect is the movement of purchasing power which causes a decrease in consumer demand of economies importing oil and expansion of consumer demand in economies exporting oil.

Figure 3.1: Trade Valuation and Wealth Channel



Author Own Illustration

3.2.2 Mediated and Unmediated Effects on oil Exporters

For the trade channel the direct effect for oil exporters can be denominated as revenue effect, which argue that increase in price of oil are plausible to raise the terms of trade that in turn increases investment and consumption Korhonen and Ledyaeva (2010). The immediate (direct) positive shock can be rejoined by two indirect (mediated) effects Le *et al.* (2013).The indirect effect is the channeling of the shock by the international trade. The immediate effect of increase prices of oil over world is often viewed as to create inflationary pressure and increase prices in countries trading mutually. This successively will increase the import prices domestically for oil- exporting and oil- importing countries. The response of monetary authorities in an attempt to control inflation in trading-partner countries may lead to increase interest rates, will cause to decrease the consumption, investment and thus GDP growth for the trading-partner countries. This will decrease the oil demand and finally, initiate decrease in oil exports, while the trade balance of oil exporting economies will be effected (the demand effect).

For an oil-exporting country, the direct effect of positive shock to oil price over world is anticipated to be positive, as its export revenues increases. The indirect effects (mediated effect) are, predicted to arise negative. There are two reason for such effect. First, as endorsed above, increase in world oil prices increases prices of domestic import for both oil importers and oil exporters. Second, a positive shock to the global oil price accounts for a negative supply shock to oil importers output, which can initiate recession in these economies, such situation negative effect on imports and decreases the trade balance of the oil exporting nation that is the supply effect. The proceeds of an oil-exporting country is thus not enormous as assumed. The overall effect of shocks to oil price for an oil-exporting country trade balance hangs on the interaction between the size of three effects discussed. For oil exporters, further fiscal challenges are generated due to increase in oil revenue management. The positive shock to oil price can generate heightened uncertainty, mainly for the economies recognized to be risky. The capital account can also be negatively affected due to a decrease in direct investments and foreign portfolios into the economy, or capital flight can take place. Thus, even though increase in world oil prices simply is thought as positive to countries exporters of oil and negative to oil importers, however the actual situation is quite intricate.

3.2.3 The Impact on oil Importing and Exporting Economies

For the net oil-importers, a rise in the price of imported oil is presumed as a negative shock to term-of-trade by effecting the output production decisions see, e.g., Backus *et al.* (2000); Kim and Loungani (1992). The imported oil is regarded as intermediate input for domestic production and shocks to its price will increase the input cost and ultimately

decrease the real gross domestic product. The households and firms will cut down their expenditure and investment strategies. For oil importers real output declines at least provisionaliy.

For oil importing economy decrease in production and export will take place, but they are not able to decrease the imported produce correspondingly. The effect of an exogenous increase in prices of is expected to be deterioration of overall trade balance. This argument is, however, contentious in two grounds. First, by assumptions, imported oil used as input to domestic production is divisible in imported energy and value added, but not for domestic value added. The oil price shocks do not change the value added where capital and labor are held fixed, thus, by definition, real GDP cannot be affected. Instead, the shock effect is limited to change in capital and labor at domestic level. Second, if shocks to oil price are considered as cost shocks for oil importing economy, the effect is restricted share of imported oil in cost of output, which is considered to be small. Thus, the shocks to oil price are unable to explain movements in real GDP and then in the real trade.

It is predisposed that positive shocks to oil price are a negative shocks to terms of- trade of economies importing oil, these oil importers are presumed to be affected adversely by the shock Kim *et al.* (1992); Backus *et al.* (2000). Hence, this effect on term-of-trade, oil importers are supposed with negative effect on exports and production, which will have a downward pressure for trade balances as well. However, the literature as Kilian (2010) cross examined the negative effect not to so high , as oil share in cost can be small in the output production of the domestic economy for some of the oil importers. This effect can be termed as cost share effect.

Oil importers can decrease the cost share effect by using energy resources available alternate to oil. Furthermore, they can also avoid the adverse effect of shocks by expanding their non-oil exports to oil-exporting economies, thus enhancing trade balance. This effect is termed as trade composition effect. Hence, the size and sign of the comprehensive effect arising due to positive shocks for not oil importers are ultimately based on the interaction of these effects. The trade composition effect has been empirically estimated by the present study for highest oil importing economies measured by non oil balance.

The direct effect of positive oil price shocks through current account for oil importing economy is negative, such argument cannot be rejected. As increase of oil prices will increase import bill of oil that may be multiplied by decrease in export revenues for oil-centered commodities. The current account will be affected negatively instantly. The decrease in trade deficit will takes place as overtime, as the non-oil trade balance will improve. The policy responses however can cushion or exacerbate the magnitude of effects, for the time being. The importers of oil can reap benefit of positive shocks if they increase export to oil exporting nations.

The divergence of wealth effects in net oil importer and oil-exporter plays a role for the effect of increase in oil price on non-oil trade and overall balances of the economy as real world is with financial markets with imperfections. The deterioration in the oil trade balance of the oil importing country can be offset by enhancing its non oil trade balance with sizeable amount. However, this can demand either worsening of its non-oil terms of trade initially or real exchange rate as the last adjusts analogously. The situation however would be quite different under markets working perfectly.

For increase in price of oil if the oil importer obtain an insurance transfer to be able to adjust its inter temporal current account balance constraint instead of increasing non-oil trade balance In such a scenario, the effect of shocks to oil price will be minimal on the non-oil trade balance of the economy. The discussion above strengthens a usual consideration that fluctuations in the global oil prices not only creates negative effects for oil importing nations but also creates challenges for the policy makers of oil exporting nations.

The theoretical interconnections of the oil market to currency market are well recognized. It has been admitted that exchange rates has potential impact on movements of oil price, which is build on the law of one price for tradable commodities Blomberg and Harris (1995). Since oil is a uniform and a good traded internationally and priced in US dollars, a depreciation of dollar decreases the oil price for foreigners as compared to the price of their own goods in foreign currencies, so expanding the purchasing power and demand for oil, in turn, increasing the oil price in US dollars. Since the US dollar is the main invoicing currency in oil markets internationally, the major channel by which shock to oil price is transferred is the exchange rate of domestic currency with the US dollar and the impacts are based on nature of economy either oil exporting or importing the oil Reboredo (2012).

A firm domestic currency in comparison to the US dollar expands the purchasing power of net oil importing economies (excluding the USA) however adversely influencing oil exporting economies. On the contrary, a crappy local currency compared to US dollar may impact negatively net oil-importers and bring about demand shock in the long term that resultantly affects oil-exporters. Oil prices are though about to play the role in

defining for exchange rate fluctuations (Golub (1983); Krugman (1980) and Krugman, (1983). The idea of the wealth channel was initially developed by Krugman (1980) and Golub (1983) is constructed by including three country in framework and has been reviewed by Bodenstein *et al.* (2011). The basic point is that with increase in oil price the transfer of wealth takes place to the net oil-exporters Bénassy-Quéré *et al.* (2007).

The wealth channel depicts the short-run effect emerging as a rise in oil prices transfers wealth to net oil exporters and is has positive effect on exports and ultimately on the current account balance. The currency of net oil exporters are expected to appreciate and depreciation of currency of net oil importer will take place in effective terms due to positive shocks to oil prices Beckmann *et al.* (2013). It is the possibility for appreciation of US dollar in short-run, the reason can be reinvestment of the revenues by net oil exporters in US dollar.

According to protfolio effect the shrort run and medium run effect on US dollar with reference to oil exporter currency will hang on two factors. The first factor is the dependence of the United States on imported oil as compared to its share of exports to oil-producing economies. However the second factor is preference of oil exporter for US dollar assets Bénassy-Quéré *et al.* (2007); Coudert *et al.* (2008); Beckmann, Czudaj et al. (2017).

The oil-exporters (oil-importers) may encounter appreciation (depreciation) in exchange rate when there is increase in oil prices and depreciation (appreciation) when there is negative shock to price of oil. It is manifested that the US dollar, around the decade, has often appreciated when price of oil were lower and depreciated when price of oil prices were higher and proposed that more is exchange rate flexibility would facilitate oil

exporting countries to handle the volatility in export and government revenues linked with world oil price movement .

3.3 Theoretical Justification for Asymmetric Impacts of Oil Prices

This section discusses the theoretical rationale on the response of economic activity to oil price movements. The fluctuation in price of imported oil has been the primary focus of theoretical models for channeling the oil price shocks. There takes a decrease in purchasing power of household of the economy due to an unanticipated raise in the price of imported oil. The stated effect is the direct effect in case increase takes place in price of imported oil and not domestically produced oil. Such effect is symmetric in both increase and decrease in real price of oil.

The justification for asymmetric responses of real gross domestic product to oil price is linked to the existence of supplemental indirect effects of unanticipated changes in the real price of oil. The literature describes three main explanations for asymmetric responses. First, is suggested to be *sector reallocation* Davis (1987a, 1987b), Bresnahan and Ramey (1993) and Davis and Haltiwanger (2001). According to this literature movement in the price of oil will produce capital and labor reallocation in a way to minimize costs. So for oil importing economies costly reallocation can cause recessionary effects to be amplified in case of positive shocks (negative) and can diminish the expansionary effects of a negative (positive) shock. So sector reallocation will guide to asymmetric effect of both positive and negative shocks on aggregate economic activity.

Another justification for asymmetric impact is *precautionary saving* (see Edelstein and Kilian (2009). Increase in price of oil in importing economies will raise concerns in

consumer related to decrease in employment and real income in future, increasing the precautionary savings. Such increase in saving can lead to decrease in demand driven production. As reduction in oil price will not be related to future uncertainty so this channel asserts asymmetry. On the same lines, the argument can be built for oil exporting economy.[23]

Another justification is based on asymmetric response of monetary policy to the fluctuation in price of oil. The asymmetry arises due the fact that Federal Reserve does not respond so actively to declines in price of oil as it responds to the positive shocks to the oil price Bernanke *et al.* (1997). However, the empirical evidence related to role of monetary policy to magnify the recessionary impact due to oil price is weaker (Hamilton *et al.* (2004) , Herrera and Pesavento (2009) and Kilian *et al.* (2011a).

Recent studies have revealed that high levels of uncertainty can produce asymmetric effects under general equilibrium. Plante and Traum (2012) examined DSGE model in which output initially is reduced due to oil price fluctuation. So high uncertainty sharpens the negative effect of an increase in price of oil and lessens the impact of reduction in price of oil in short run. The models of general equilibrium that heightened the asymmetry but do not results asymmetry have been proposed by Rotemberg and Woodford (1996) and Leduc and Sill (2004). Rotemberg *et al.* (1996) proclaimed that elasticity of labor utilization in the presence of markup price amplifies the shock impact.

Summarizing the theoretical model of asymmetry, these can be categorized into two groups on the basis of empirical effects.

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[23] The composition of the economy will play a role to determine the magnitude of the effects the factors are energy intensity in consumption , assumption that uncertainty in future level of employment.

- Models implying symmetry concentrate on direct transmission channels, however these have the view that indirect transmission can be through change in utilization of capital and markup price. These model analyze the precautionary saving assuming that household take the price changes symmetrical.

Models implying asymmetry highlight the significance of reallocation disturbance. These models again examine precautionary saving considering employment to be uncertain in future. In other words, these models examine the oil price changes in heightened uncertainty.

3.4 Theoretical Underpinnings for Adjustment of Account Balances and Role of Moderators

The theoretical underpinnings of the adjustment of current account to oil shocks a model for determination of current account by Schmitt-Grohé, Uribe et al. (2008) is presented. The model is based on an open economy, which trades with the rest of the world in goods as well as with financial assets. The model can be used to investigate the factors influencing the current account and trade balance. In particular, it can be utilized to determine effects of different economic shocks, such as fluctuation in income and the world interest rate on consumption, the current account, and the trade balance. The shocks can be policy shocks as well.

3.4.1 The Model: A Two-Period Economy

Consider economy where people live for two periods, period 1 and period 2, and are having supply of Q_1 quantity of goods in period 1 and Q_2 quantity in period 2. Goods are

perishable so cannot be stored from period 1 to period 2. Alongside, households are supposed to be supplied with B_0^* amount of a bond. These bonds provide interest income of the amount $r_0 B_0^*$ in period 1, where r_0 is the interest rate on bonds carried in periods 0 and 1. So in period 1, the household's income is given by the addition of interest income on its bond carried and its quantity of goods endowment, $r_0 B_0^* + Q_1$. The household can devote its income in alternative uses of expenditure on of consumption goods that is C_1, and buying bonds, $B_1^* - B_0^*$, where B_1^* shows bond quantity at the end of period 1.

Therefore, the budget constraint of the household in period 1 is following:

$$C_1 + B_1^* - B_0^* = r_0 B_0^* + Q_1 \tag{3.19}$$

Taking log-linear utility function:

$$U(C_1, C_2) = lnC_1 + lnC_2 \tag{3.20}$$

The marginal utility of consumption in the first period, is as following

$$U_1(C_1, C_2) = \frac{\partial U(C_1, C_2)}{\partial C_1} = \frac{\partial (lnC_1 + lnC_2)}{\partial C_1} = \frac{1}{C_1} \tag{3.21}$$

On the same lines marginal utility of period 2 consumption is given,

$$U_2(C_1, C_2) = \frac{\partial U(C_1, C_2)}{\partial C_2} = \frac{\partial (lnC_1 + lnC_2)}{\partial C_2} = \frac{1}{C_2} \tag{3.21a}$$

The first-order condition for maximization of utility requires the satisfaction of following condition for the optimal consumption allocation.

$$U_1(C_1, C_2) = (1 + r_1) U_2(C_1, C_2) \tag{3.22}$$

For the particular functional form (two period considerations) for the utility function encountered, the optimality condition is

$$\frac{1}{C_1} = (1 + r_1) \frac{1}{C_2} \tag{3.23}$$

Now, considering the inter temporal budget constraint

$$C_1 + \frac{C_2}{1+r_1} = (1 + r_0)B_0^* + Q_1 + \frac{Q_2}{1+r_1} \tag{3.24}$$

Define $\bar{Y} = (1 + r_0)B_0^* + Q_1 + \frac{Q_2}{1+r_1}$ The variable $\bar{Y}$ is the present discounted value total wealth of the household, which comprises of income stream (Q_1,Q_2) and the initial assets. The household takes $\bar{Y}$ as given. The above expression can be rewritten as

$$C_1 = \bar{Y} - \frac{C_2}{1+r_1} \tag{3.25}$$

By combining (3.23) with (3.25), gives

$$C_2 = \frac{1}{2}\bar{Y} \tag{3.26}$$

The result conveys that it is optimal for households to spend half of lifetime wealth in the first half of the life. The trade balance is the difference in output and domestic spending in period 1, or $TB_1 = Q_1 - C_1$, where the current account is the addition of the trade balance and interests received on net foreign assets held, or $CA_1 = r_0B_0^* + TB_1$. By using the description of $\bar{Y}$ and the fact that the domestic interest rate and the world interest rate are both equal, in other words $r_1 = r^*$ under free capital mobility the, thus C_1, C_2, TB_1, and CA_1 are as given by Eqs.(3.25a) (3.25b), (3.27), and (3.28)

$$C_1 = \frac{1}{2}[(1 + r_0)B_0^* + Q_1 + \frac{Q_2}{1+r^*}] \tag{3.25a}$$

$$C_2 = \frac{1}{2}(1 + r^*)\left[(1 + r_0)B_0^* + Q_1 + \frac{Q_2}{1+r^*}\right] \tag{3.25b}$$

$$TB_1 = \frac{1}{2}\left[Q_1 - (1 + r_0)B_0^* + Q_1 - \frac{Q_2}{1+r^*}\right] \tag{3.27}$$

$$CA_1 = r_0B_0^* + \frac{1}{2}\left[Q_1 - (1 + r_0)B_0^* + Q_1 - \frac{Q_2}{1+r^*}\right] \tag{3.28}$$

Examine the impacts of temporary and permanent shocks to output on the trade balance and the current account. Suppose that income declines by one unit temporarily, that is,

decreases in Q_1 takes place by one and Q_2 does not changes. From Eq. (3.27) and (3.28) it follows that the trade balance and the current account both decline by half a unit. The reason is consumption in period 1 decreases by only half a unit.

If there is a decline in income by one unit permanently, so, both Q_1 and Q_2 falls by one. Therefore the trade balance and the current account decrease by $\frac{1}{2}\frac{r^*}{1+r^*}$. In period 1 the consumption decreases by $\frac{1}{2}\frac{2+r^*}{1+r^*}$. For realistic values of world interest rate $r*$, the anticipated deterioration of the current account and trade balances in reaction to the assumed permanent negative income shock is near zero and specifically of lesser magnitude than the deterioration due to the temporary negative shock to income. For example, suppose that is, r^*= 0.1. Both the current account and the trade balance in period 1 decline by 0.5 due to the temporary shock by 0.046 due to the output shock which is permanent. That is, the deterioration in the current account is 10 times more under a shock which is temporary than one which is permanent.

Finally, consider the impact of a raise in the $r*$(world interest rate). The decrease in period 1consumption takes place and improvement in both the current account and the trade balance takes place. However the decrease in consumption is independent of status of the country in period 1 being a net borrower or a net lender. The reason is specific preference specification considered her, as the substitution effect always overcomes the income effect.

As the price of oil increases trade balance of oil importing economy is worsened showing a current account deficit that in turn deteriorates net foreign asset. As the oil price increase trade balance of oil importing economy will decrease as higher oil price will

require higher expenditure. The economy dependent on imported oil will face deficit in its current account and in turn net foreign asset of the economy will also deteriorate. The adjustment process taking place post oil price shocks will be as reported by Rebucci *et al.* (2006). The occurrence of deficits in current account decreases disposable income and corporate Profitability. The decrease in corporate profitability leads to decrease in domestic demand and depreciation of exchange rate will take place bringing the current account into equilibrium again Rebucci *et al.* (2006).

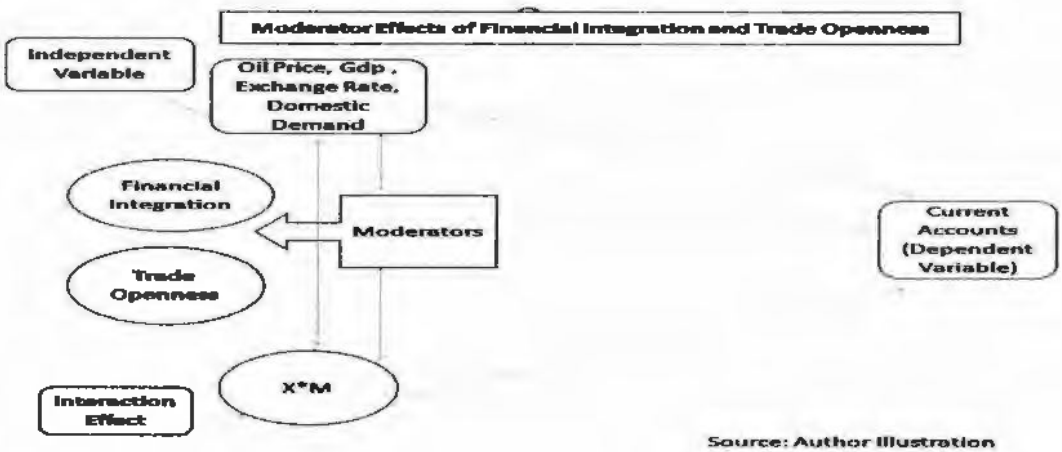
The above stated process works broadly in reverse where exporting economies enjoys surpluses and stronger growth by appreciation of real exchange rate where major difference is there that importers of fuel can take more time to regulate to oil price positive shocks their saving rate may remain high for extended time period Rebucci *et al.* (2006).

The output cost and adjustment speed depends on policy variable such as extent of openness of trade and international linkages that is financial integration, credibility of central bank as well as the expected persistence of shock and speed with which it affects the prices domestically. Along with other factors, these determine the degree to which increase in oil prices raises inflation, which necessitates a tight monetary policy that could bring decline in growth rate Rebucci *et al.* (2006).

Income of the economy can change due to any policy variable (monetary policy stances, trade openness). Further international linkage that is financial integration also can increase or decrease income. The structural flexibility of the economy and persistence of the shocks also play the role in adjustments of current account balances. The different degree of these variables can accelerate or decelerate the process of adjustment. The

present study will attempt to analyze the role of the different moderators by categorizing these variables.

Figure 3.2: Role of Moderators in Adjustment of Current Account Balances



The model discussed for dterminition of currents accounts is taken from Schmitt-Grohé *et al.* (2008) where shocks to income can effect current accunts of the economy. The policy variable and internation links of the economy can causes change in income and current account of the economy analogously. The focus of our analysis will be to explore the role of the above given moderators that whether these enhance or buffer the effect of oil price shocks on the process of adjustment of current account balances of economy.

CHAPTER 4

METHODOLOGY

The methodology chapter includes four sections; the first section presents empirical models that have been estimated. Section 4.2 describes the definition and construction of variables under consideration. Section 4.3 states sample, data, and data sources, where Section 4.4 presents the estimation techniques.

4.1 Empirical Models

As discussed in the opening part that the study is devoted to examining the effects of different transmission channels in the current-account imbalances adjustment. In this context, three different empirical models have been presented. Section 4.1.1 presents the specification of empirical models for the trade channel, whereas Sections 4.1.2 and 4.1.3 presents empirical models for valuation and wealth channels respectively.[24]

4.1.1 Empirical Specifications for the Trade Channel

To assess the mediator effects of trade in the oil price and current-account imbalances relationship, the following three models have been estimated. The empirical specifications mainly based on related studies on the subject (e.g. Kilian *et al.* (2009); Bodenstein *et al.* (2011), and Raheem (2017).

[24]The variables included in the analysis have been derived from the previous empirical studies on current accounts see Calderón, Chong et al. (2007), Calderon, Chong et al. (2002b), Chinn *et al.* (2003); Gruber and Kamin (2007), Chinn and Ito (2007), Cheung *et al.* (2010), Brissimis, Hondroyiannis et al. (2012),Allegret *et al.* (2014); Kilian *et al.* (2009).

$$TOT_{it} = \alpha_1 + \alpha_2 OILP_{it} + Z_{it}\alpha_3 + \varepsilon_{it} \quad (4.1)$$

$$CA_{it} = \beta_1 + \beta_2 OILP_{it} + \beta_3 TOT_{it} + Z_{it}\beta_4 + \varepsilon_{it} \quad (4.2)$$

In empirical model 1 (Eq. 4.1) the dependent variable is the term of the trade (TOT_{it}). The oil price ($OILP_{it}$) is our variable of interest, whereas (Z_{it}) is the set of control variables including the stock of net foreign assets as a percentage of GDP, trade openness, population growth, dependency ratio, GDP per capita; and the GDP growth rate. In the second model (Eq. 4.2) the dependent variable is the current account balance (CA_{it}) of oil-importing countries, whereas the dependent variable of model 1 (Eq. 4.1) is taking as an independent variable. The variable of interest ($OILP_{it}$) and control variables are the same as of model 1 (Eq. 4.1). However the 1st and 2nd lag of the current account has been used keeping in view the periodic nature of the variable. The 1st lag of the each mediator variable used in estimation for lucid analysis.

The non-oil trade balance (NTB_{it}) is added to above empirical model to capture the trade composition effect. The rationale of estimating the non oil trade balance parameter can be stated in the following two reasons why? Firstly, due to the reasonable availability of alternative energy sources in the oil-importing countries, adjustment of cost-share of oil in their production process may not be an issue. Secondly, the net-oil importing countries can also reduce the negative effect of oil shocks by enhancing non-oil exports to their oil-exporting counterparts, thus enhancing their trade balance (the trade composition effect) as specified by Kilian *et al.* (2009), Rafiq *et al.* (2016).

4.1.1 Empirical Specifications for the Valuation Channel

The second channel by which oil price shock affect the current account balances of a country is the valuation channel. In general, the valuation channel captures the effect of oil price shock on current account balances through the change in the external portfolio position and asset prices Kilian *et al.* (2009). The related literature argues for the different mediator roles of this channel in the oil price and external balances of oil-importing and oil-exporting countries. However, to analyze the mediator role of the valuation channel in the oil price shock and current account balances the following two models have been estimated (Eqs. 4.4, 4.5). The received studies by Lane *et al.* (2006); and Gourinchas *et al.* (2007) explain the valuation channel is a moment in asset prices are due to movement in the exchange rate. Follows Gourinchas *et al.* (2007) the following empirical specifications have been estimated to capture the impact of oil price shock on current account imbalances through the valuation channel.

$$NFA_{it} = \gamma_1 + \gamma_2 OILP_{it} + \gamma_3 Z_{it} + \varepsilon_{it} \quad (4.3)$$

$$CA_{it} = \tau_1 + \tau_2 OILP_{it} + \tau_3 NFA_{it} + \tau_4 Z_{it} + \varepsilon_{it} \quad (4.4)$$

In Eq. 4.4 the dependent variable is the price of equities (NFA_{it}), whereas the variable of interest is the oil price ($OILP_{it}$) and Z_{it} is a set of control variables as described earlier in the case of Eq. and Eq. 4.2. γ_2 is the effect of oil price on equity price of the country it is expected to be negative/positive for oil-importing/exporting economy. In Eq. 4.4 the dependent variable is the current account balance CA_{it}, whereas, τ_3 is the equity price effect on current account balances in the presence of oil price shocks.

4.1.1 Empirical Specifications for the Wealth Channel

The third channel that we want to investigate is the wealth channel. The received literature came with different effects of an oil price change on the current account of oil exporting and importing countries. Bénassy-Quéré *et al.* (2007) argue that with an increase in oil price, wealth transferred to oil-exporting countries in terms of export earnings that improve its current account balance. Improvements of current-account balance in terms of the local currency, in turn, appreciate the currency of the exporting country, whereas in the case of importing countries it works in the opposite direction. To investigate the role of the wealth channel, the following empirical specifications (Eqs. 4.5 and 4.6) are estimated;

$$EX_{it} = \omega_1 + \omega_2 OILP_{it} + Z_{it}\omega_3 + \varepsilon_{it} \quad (4.5)$$

$$CA_{it} = \upsilon_1 + \upsilon_2 OILP_{it} + \upsilon_3 EX_{it} + Z_{it}\upsilon_4 + \varepsilon_{it} \quad (4.6)$$

In Eq. 4.5 the dependent variable is exchange rate (EX_{it}), whereas the variable of interest is the price of oil $(OILP_{it})$ and (Z_{it}) is a vector of control variables as in previous models. In Eq. 4.6 current account is our dependent variable, whereas the exchange rate is used as an explanatory variable. In Eq. 4.5 ω_2 is the effect of oil price on the exchange rate of the economy which is expected to be negative for the oil-importing economy and vice versa for the oil-exporting economy. $\upsilon_3$will show the effect of exchange rate appreciation/depreciation on the current accounts of the oil-exporting /importing economy and is expected to be positive/negative) for oil-exporting/importing) economy.

4.1 Derivation of the Mediators Effects

Having presented empirical specifications of the different mediators, now we can derive the effects of mediators. Three types of mediators' effects can be derived, that indirect, direct, and total effects. The indirect effect is derived by taking a derivative of the presented empirical specifications using chain rule as follows. The Eq. (4.1) has following indirect effect.

$$\frac{\partial CA_{it}}{\partial OILP_{it}} = \frac{\partial CA_{it}}{\partial ToT_{it}} \times \frac{\partial TOT_{it}}{\partial OILP_{it}}$$

According to the chain rule used, we can calculate the indirect effect as follows from Eqs. 4.1 and 4.2; as

$$\frac{\partial CA_{it}}{\partial OILP_{it}} = \alpha_2 \beta_3 \tag{4.7}$$

Eq. 8 consists of two coefficients from separate regressions, which gives the indirect effect of term trade influence on oil price to the current account. Similarly, indirect effects for valuation and wealth channels using Eqs. 4.3,4.4, 4.5, and 4.6 are as follows;

$$\frac{\partial CA_{it}}{\partial OILP_{it}} = \gamma_2 \tau_3 \tag{4.8}$$

$$\frac{\partial CA_{it}}{\partial OILP_{it}} = \omega_2 \upsilon_3 \tag{4.9}$$

Total effect of mediator on oil price current account relationship can be interpreted as

Total effect = Direct effect + Indirect effect (4.10)

The magnitude and significance of Eqs.4.7,4.8,4.9, and 4.10 are more interesting and informative for the oil-importing economy as it will convey the knowledge about the significance of different mediators playing their role in oil price current account

relationships.[25] These equations consist of two coefficients from separate regressions the significance of which can be tested using Bruin (2006) commands in the Stata package. The equation Eq.(4.10) has been estimated as Hayes and Preacher (2010) by using Bruin (2006). [26] The direct impact will be insignificant in case of full mediation and significant for partial mediation.

The direct effects are captured with the estimated coefficients of empirical models. The estimated coefficients $\beta_2, \tau_2, \upsilon_2$ in Eqs. 4.2,4.3,4.4, and 4.6 presents the direct effect of oil price on the current account as indicated by Baron and Kenny (1986). The total effect of the mediator is the sum of the indirect and direct effects.

4.1.2 Empirical Model for Asymmetric Impacts

To explore the symmetric and asymmetric impact of oil prices on industrial productivity and exchange rate of oil-importing economies the approach of dynamic common correlated estimators presented by Chudik *et al.* (2015) is used. The dynamic common correlated approach is delineated based on pooled mean group (PMG) technique Pesaran, Shin et al. (1997), Mean group (MG) estimation by Pesaran and Smith (1995), and CCE estimation Pesaran *et al.* (1995), and CCE estimation Pesaran (2006). This approach has an advantage over the other conventional methods for example these consider the cross-sectional dependence and allow for heterogeneous slopes and dynamic common correlated effects.

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[25] The above indirect, direct and total effect and their standard errors have been estimated using *delta method* by nlcom code in Stata 14.

[26] Bruin, J. 2006. newtest: command to compute new test. UCLA: Statistical Consulting Group. https://stats.idre.ucla.edu/stata/ado/analysis/.

Following Herrera *et al.* (2015) the DCCE model specification for this analysis is specified as:

$$\Delta IPI_{it} = \alpha_0 + \alpha_{1i} IPI_{i,t-1} + \alpha_{2i} OILP_{i,t-1} + \alpha_{3i} EX_{i,t-1} + \alpha_{4i} INV_{i,t-1} +$$

$$+ \sum_{j=1}^{N_1} \lambda_{ij} \Delta IPI_{i,t-j} + \sum_{j=0}^{N_2} \lambda \psi_{ij} \Delta OILP_{i,t-j} + \sum_{j=0}^{N_3} \gamma_{ij} \Delta EX_{i,t-j} + \sum_{j=0}^{N_4} \delta_{ij} \Delta INV_{i,t-j} +$$

$$\mu_i + \varepsilon_{it} \qquad (4.11)$$

where i=1,2,...,N is the number of countries; t =1,2,...,T is the number of periods μ_i is the group-specific effect ; IPI_{it} is the industrial production index $OILP_{it}$ represent oil prices (Proxied by Brent) EX_{it} represents the official exchange rate. INV_{it} is an investment as a percentage of gross domestic product. The log transformation of the series eases the computation of the elasticity coefficient for oil price-output movements for oil-importing economies.

For each cross-section, the long-run coefficient is computed as $-\frac{\alpha_2}{\alpha_1}$ and $-\frac{\alpha_3}{\alpha_1}$ respectively since in the long run, it is assumed that $\Delta OILP_{i,t-j} = 0$; $\Delta EX_{i,t-j} = 0$; $\Delta IPI_{i,t-j} = 0$. However, for each cross-section estimates are derived as ψ_j and $\gamma_j$for oil price and determinants of industrial productivity respectively in the short run.

By including the error correction term the to equation (4.11), it can be re-specified as below

$$\Delta IPI_{it} = \delta_i \upsilon_{i,t-1} + \sum_{j=1}^{N_1} \lambda_{ij} \Delta IPI_{i,t-j} + \sum_{j=0}^{N_2} \psi_{ij} \Delta OILP_{i,t-j} + \sum_{j=0}^{N_3} \gamma_{ij} \Delta EX_{i,t-j} +$$

$$\sum_{j=0}^{N_4} \delta_{ij} INV_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (4.12)$$

Where $\upsilon_{i,t-1} = IPI_{i,t-1} - \phi_0 - \phi_{1i} OILP_{i,t-1} - \phi_{2i} EX_{i,t-1} - \phi_{3i} INV_{i,t-1}$ is linear error correction term; the parameter δ_i is the error correction speed of adjustment term while

the underlying long-run coefficients have been explained earlier as $\phi_{1i} = -\frac{\alpha_{2i}}{\alpha_{1i}}$ and $\phi_{2i} = -\frac{\alpha_{3i}}{\alpha_{1i}}$.

Note that the oil price is not decomposed into positive and negative shocks in both of the above equations; so specified on the presumption of symmetric behavior of oil price on industrial productivity. The asymmetric form of the equation (1) is given below however the oil price is decomposed into positive and negative changes following Shin, Yu et al. (2014):

$$\Delta IPI_{it} = \alpha_0 + \alpha_{1i} IPI_{i,t-1} + \alpha_{2i} OIL^{+}_{i,t-1} + \alpha_{3i} OIL^{-}_{i,t-1} + \alpha_{4i} EX_{i,t-1} + \alpha_{5i} INV_{i,t-1} + \sum_{j=1}^{N_1} \lambda_{ij} \Delta IPI_{i,t-j} + \sum_{j=0}^{N_2} \gamma_{ij} \Delta EX_{i,t-j} + \sum_{j=0}^{N_3} \gamma_{ij} INV_{i,t-j} + \sum_{j=0}^{N_4} (\gamma^{+}_{ij} OIL^{+}_{i,t-j} + \gamma^{-}_{ij} OIL^{-}_{i,t-j}) + \mu_i + \varepsilon_{it} \quad (4.13)$$

In the above equation (4.14) the oil price variable has now been broken down into OIL^{+}_{it} and OIL^{-}_{it} depicting the changes in oil price both positive and negative respectively. The decomposed prices are defined theoretically as below:

$$OIL^{+}_{it} = \sum_{j=1}^{t} \Delta OIL^{+}_{ij} = \sum_{j=1}^{t} \max(\Delta OIL_{ij}, 0) \quad (4.14)$$

$$OIL^{-}_{it} = \sum_{j=1}^{t} \Delta OIL^{-}_{ij} = \sum_{j=1}^{t} \min(\Delta OIL_{ij}, 0) \quad (4.15)$$

After including an error correction term in equation (4.14) it can be re- specified as below

$$\Delta IPI_{it} = \tau_i \xi_{i,t-1} + \sum_{j=1}^{N_1} \lambda_{ij} \Delta IPI_{i,t-j} + \sum_{j=0}^{N_2} \gamma_{ij} \Delta INV_{i,t-j} + \sum_{j=0}^{N_3} \gamma_{ij} EX_{i,t-j} + \sum_{j=0}^{N_4} (\gamma^{+}_{ij} OIL^{+}_{i,t-j} + \gamma^{-}_{ij} OIL^{-}_{i,t-j}) + \mu_i + \varepsilon_{it} \quad (4.16)$$

In the above equation (4.17) $\xi_{i,t-1}$ is the error correction term that represents the long-run equilibrium in the asymmetric ARDL however, a parameter associated with it (τ_i)

conveys the magnitude of adjustment that is in presence of shock how long it takes the structure to calibrate to its long-run equilibrium.

4.1.3 Empirical Model to Analyze the Role of Moderators

In particular countries with prominent oil-producing sectors have higher current account balances, as positive shocks generate revenues that tend to increase saving more than investment Cheung *et al.* (2010). The increase in spending is less that revenue which improves the current account a trend established by Higgins *et al.* (2006), Cheung *et al.* (2010), Arezki *et al.* (2013). The increase in the price of oil is the source of windfall revenue for oil-exporting economies. The allocation of this revenue has important implications for the current accounts of the economy and for pattern of imbalances at global level. Further the international linkages and policy variable of the economy play a key role in the adjustment of countries' balance these either smooth the adjustment or increase the cost for adjustment. To analyze the role of financial integration and trade openness for OPEC compared to developing and developed economies the model has been developed following the adjustment process as reported by Rebucci, *et al.* (2006).

4.1.3.1 Role of Financial Integration in Adjustment of Oil Shocks

The key issue that has received little attention in the literature, is the role of financial integration while dealing with the adjustment of countries' balances. However it plays a vital role in the speed and cost of output adjustment.

The empirical investigation suggests a positive effect of trade openness on the current account balances for example Gruber *et al.* (2007) ; Barnes, Lawson et al. (2010a). The positive impact of trade openness on the current account reflects the countries that are

more integrated into international markets can approach foreign currency to invest abroad; this provides additional options for foreign investments.

To examine the potential effect exerted by financial integration on the oil price and current account relationship, there can be two avenues to be followed from the methodological point of view. Firstly, considering interaction terms in the regression model followed by Chinn *et al.* (2007). The second consists of modeling nonlinearity explicitly, which may be at play using the nonlinear process proposed by Gonzalez, Teräsvirta et al. (2017). This study follows Chinn *et al.* (2007) we use the interaction variable following because we are not considering the non-linearity explicitly. The use of interaction term will allow us to take into account non-linearity, but it does not explicitly model the dynamics exerted by non-linearity. The following Eq. 4.17 models the primary effects of financial integration on current account balances.

$$CA_{it} = \alpha_1 + \alpha_2 DCPS_{it} + \alpha_3 GDP_{it} + \alpha_4 EX_{it} + \alpha_5 OILP_{it} + \alpha_6 FI_{it} + \varepsilon_{it} \quad (4.17)$$

Whereas equation 4.17a incorporates the moderating effects of financial integration so the interaction between oil price and financial integration has been introduced.

$$CA_{it} = \alpha_1 + \alpha_2 DCPS_{it} + \alpha_3 GDP_{it} + \alpha_4 EX_{it} + \alpha_5 OILP_{it} + \alpha_6 OILP_{it} \times FI_{it} + \varepsilon_{it} \quad (4.17a)$$

Where $DCPS_{it}$ is a proxy for domestic demand, GDP_{it} is the proxy for income, EX_{it} stands for the exchange rate, $OILP_{it}$ stands for oil price and FI_{it} shows financial integration.

The level of financial integration varies with the level of development of the economies so dummies for two different levels of financial integration have been introduced in the following equation.

$$CA_{it} = \alpha_1 + \alpha_2 DCPS_{it} + \alpha_3 GDP_{it} + \alpha_4 EX_{it} + \alpha_5 OILP_{it} + \alpha_6 OILP_{it} \times FI_{it} \times D_{it}^{L} +$$

$$\alpha_7 OILP_{it} \times FI_{it} \times D_{it}^{h} + \varepsilon_{it} \quad (4.18)$$

$D^L = 1$ when lowest level of financial integration otherwise $D^L = 0$, where I denote the country (OPEC, developing and Developed) and t denotes the time (t=1999-2020).[27]

Adding the interaction term to the regression equation will enlarge to a great extent the relationship between the oil price and other variables in the model. It will communicate the information that the effect of oil price on current account for different levels of financial integration is different. α_5 will express the effect of oil price on current accounts. α_6 will capture the effect of oil price on the current account for the low level of financial integration where a positive value positive (negative) value of $\alpha_7$will imply higher the oil price greater (more positive) effect of the high level of financial integration will be on current account balances for oil-exporting (importing) country. The role of the moderating variable is different from the ordinary dependent independent variable relationship. The effect of moderating variable can be classified into three different categories enhancing that is increasing antagonistic that is reversing and buffering (decreasing) Thornhill, Saunders et al. (2009). The enhancing effect refers to a situation where an increase in the value of the moderator increases the primary effect explanatory variable on the dependent variable. The buffering effect is opposite to the enhancing effect where the primary effect of the independent variable is affected negatively by the increase in the value of the moderator.

[27] i=1,…,13 for OPEC, i=1,…,36 Developed and i=1,…,35 for Developing

4.1.3.2 Role of Degree of Trade Openness in Adjustments of Oil shocks

No economy in the world can survive in the isolation, hence, more or fewer world economies are integrated trade linkages, or trade openness can lead to comparative advantages. The literature relating its current account considers it an important determinant of the current account balance magnitude Clower and Ito (2011). However, its role in quantifying its magnitude for the adjustment of countries' balances has not been considered earlier.

A standard measure of trade openness (sum of exports and imports divided by GDP) is generally used in the empirical studies as a proxy for lower trade barriers and a better investment environment, which is expected to affect the current account, balances negatively Ciocyte and Rojas-Romagosa (2015). Some empirical studies argue for a positive effect of trade openness on the current account balances, for example, Barnes, Lawson et al. (2010b);Gruber *et al.* (2007). These studies mainly argue that countries with open trade face fewer constraints. Being more open leads those to be more integrated into international markets. They have ease of access to foreign currency that can be used to invest abroad. Further, this provides additional options for foreign investments Ciocyte *et al.* (2015).

The level of openness of the economy can accelerate or decelerate the process of adjustment in countries. To investigate the potential effect exerted by the level of openness of an economy to trade on the oil price –current account relationship we follow the technique of using interaction variable following Chinn *et al.* (2007) as it takes the nonlinearity into account but does not model it explicitly. In the first equation, the primary effects of trade openness have been modeled as follows

$$CA_{it} = \alpha_1 + \alpha_2 DCPS_{it} + \alpha_3 GDP_{it} + \alpha_4 EX_{it} + \alpha_5 OILP_{it} + \alpha_6 TOPN_{it} + \varepsilon_{it} \quad 4.19$$

Further in Eq. 4.19a moderating effects of trade openness are incorporated as the interaction between oil price and trade openness.

$$CA_{it} = \alpha_1 + \alpha_2 DCPS_{it} + \alpha_3 GDP_{it} + \alpha_4 EX_{it} + \alpha_5 OILP_{it} + \alpha_6 OILP_{it} \times TOPN_{it} + \varepsilon_{it} \quad (4.19a)$$

where $DCPS_{it}$ is a proxy for domestic demand, GDP_{it} is a proxy for income, EX_{it} stands for exchange rate $OILP_{it}$ stands for oil price where TO_{it} shows trade openness.

Tariffs and trade restrictions in-country can lead to different levels of trade openness for a particular economy. Considering trade openness a qualitative variable the dummies for two different levels of trade openness are used. The more open and less open economies dummies have been introduced in the following model (Eq. 4.20).

$$CA_{it} = \alpha_1 + \alpha_2 DCPS_{it} + \alpha_3 GDP_{it} + \alpha_4 EX_{it} + \alpha_5 OILP_{it} + \alpha_6 OILP_{it} \times TOPN_{it} \times D_{it}^{MO} + \alpha_7 OILP_{it} \times TOPN_{it} \times D_{it}^{LO} + \varepsilon_{it} \quad (4.20)$$

$D^{MO} = 1$ when the trade is more open in the economy otherwise $D^{MO} = 0$,

$D^{LO} = 1$ when the economy is less open in its trade internationally otherwise $D^{LO} = 0$,

where I denote the country as mentioned earlier. Adding the interaction term to the regression equation will enlarge to a great extent the relationship between the oil price and other variables in the model. It will communicate the information that effect of oil price on current account for different levels of trade openness. α_5 will express the effect of oil price on current accounts. α_6 will capture the effect of oil price on the current account for the low level of trade openness. The positive (negative) value of α_7 will imply higher the oil price greater (more positive) effect of a more open economy will be on current account balances for oil-exporting (importing) country. The role of the

moderating variable is different from the ordinary dependent independent variable relationship. The effect of moderating variable can be classified into three different categories enhancing that is increasing antagonistic that is reversing and buffering (decreasing).

The inclusion of interaction terms to regression will expand greatly the relationship between the oil price and other variables in the model. It will provide us the information about the effect of oil price on current account for different degrees of trade openness. The coefficients α_6 α_7 α_8 will have the same interpretation as those explained for financial integration (being the first moderator).

The expected signs for the parameters $\alpha_2, \alpha_3, \alpha_4$ as described by the adjustment process of Rebucci *et al.* (2006) is negative that is for an oil-importing economy increase in oil price will cause a decrease in disposable income causing a decrease in domestic demand which decrease in value of the currency of the country. The opposite will hold in the case of OPEC economies. However the oil price coefficient α_5 is expected to have a positive value for OPEC.

4.2 Definition and Construction of Variables

This section of the study presents the definition and construction of variables under consideration. The discussion comprises of the dependent, independent, and control variables used for all three analyses followed by the sample selection and data period for analyses.

4.2.1 Channel Analysis

The variable used for the examination of the mediation effects of the trade valuation and wealth effects are discussed have been derived from the previous empirical studies on current accounts, for example, Calderón *et al.* (2007), Calderon, Chong et al. (2002a), Chinn *et al.* (2003); Gruber *et al.* (2007), Chinn *et al.* (2007), Cheung *et al.* (2010), Brissimis *et al.* (2012),Allegret *et al.* (2014); Kilian *et al.* (2009) among others.

4.2.1.1Set of Dependent Variable

As the study aims to analyze the impact of oil price on current account balances, hence in this context variables used for the estimation of the equation from 4.1 to 4.21 are discussed in detail. The discussion of the dependent variable includes the variables appearing on the left side of the regression equation of the model 4.1 to 4.21.

Current Account Balance (CA_{it})

The first measure of the current account balance is the sum of the balance of trade (exports minus imports), net income from abroad, and net current transfers, which is taken as a percentage of GDP. The data is taken from the World Bank data set, World Development Indicator (WDI), and IMF data set, World Economic Outlook (WEO).

Terms of Trade (TOT_{it})

The terms of trade (TOT_{it}) is the relative price of exports in terms of imports of an economy. Follow this definition, the term of trade is constructed by dividing the exports value index to import value index multiplied by 100. The data of both export and import index has been taken from WDI with a base period 2000=100.

Net Foreign Assets (NFA_{it})

Net foreign assets (NFA_{it}) is measures the value of foreign assets owned by a nation, less the value of domestic assets that are held by foreigners, adjusted for fluctuations in valuation and exchange rates. Data on net foreign assets are taken from WDI, however, it is in the current local currency, which is converted in US dollars by adjusting the country's exchange rate and is taken as a percentage of GDP.

Exchange Rate (EX_{it})

The exchange rate series is taken as domestic currency unit per dollar. The inclusion of countries to Euro currency in 1999 discontinues the series. The historic continuity of data is maintained by conversion. For Euro countries, the conversion factor provided by IFS of IMF after 1998 is used to fix the exchange rate. The data on the variable is taken from the World Development indicator (WDI) of the World Bank data set. The variable of the exchange rate is used in two denomination first it is used as the real exchange rate REX_{it} the real exchange rate is obtained by deflating the nominal by CPI. The second denomination is used as the nominal exchange rate EX_{it}.

Industrial Production Index (IPI_{it})

The study uses an industrial production index as a dependent variable. Thc industrial production index is calculated by the Central Statistics Organization and it is composed of eight core industries of the economy. It is calculated on the monthly basis. The annual data on the variable has been taken from International Financial Statistics. The variablc is uscd in logarithm form.

Industrial production is the main parameter of the economic activity, of any country which provides information about the changes in production where GDP provides the value of said production[28]. Hence in this study, we used the industrial production index instead of GDP to broaden the scope of the analysis.

4.2.1.2 Independent Variables

Oil Price ($OILP_{it}$)

Among independent variables, oil price (OLP_{it}) is our variable of interest that has taken Crude Oil Price, Brent series. which is the leading global price benchmark. Data on the oil prices of the sample countries is taken from the EEO of the IMF data set, which is measures the US $ per barrel. The variable is used in logarithm form.

Population Growth (POP_{it})

Population growth (POP_{it}) is one of the control variables, which is the percentage change in the total population over a unit of time. Data on the population growth are taken from the WDI of the World Bank data set.

Dependency Ratio (DPR_{it})

Another demographic variable used in the study is the dependency ratio(DPR_{it}), which is measure as the ratio of the dependent population (below 15 and above 65) to the

[28] Industrial production index is calculated and printed on a monthly base by the Central Statistics Organization (CSO). It consists of eight core industries (Steel, Electricity, Cement, Petroleum, Coal, Crude oil, Natural Gas and Fertilizer). It gives details on the productivity, growth, slowdown, viability of these industries.
GDP Growth provides information about goods and services that is manufactured in the territory of country in a fiscal year.

working-age population (between 15 and 64). Data on the dependency ratio are taken from WDI.

Trade Openness ($TOPN_{it}$)

Another control variable used in the study is trade openness($TOPN_{it}$), which is measure as trade (exports plus imports) to GDP ratio. The data on trade openness are taken from WDI.

Gross Domestic Product GDP_{it} and Gross Domestic Product Growth Rate ($GDPG_{it}$)

The data on gross domestic product is used in current US dollars. The data is taken from the World Bank data set, World Development Indicator (WDI). The data on the variable is used in the current $. The variable is used for the proxy of income. The data on the annual growth of GDP ($GDPG_{it}$) has been taken from WDI.

Non-Oil Trade Balance (NTB_{it})

Follows Kilian *et al.* (2009) and Rafiq *et al.* (2016) we analyzed the trade composition effect. In this context, in the case of high oil-importing countries, the non-oil balance is used as an independent variable. Follows to Kilian *et al.* (2009), the non-oil balance is calculated by subtracting the oil balance from the total balance. Data on oil and non-oil balances are taken from WDI. The data on variables under consideration are annual that covers the period from 1980-2019.

Investment population growth and $(INV_{it}), (POP_{it})$

Investment, population growth, and export manufacturing determinants of industrial production by Ozturk and Agan (2017) and Mohsen, Chua et al. (2015). The data on investment as a percent of gross domestic product, export manufacturing, and population growth has been used from the World Development Indicator.

Oil Shocks Decomposition (OIL_{it}^{+}) and (OIL_{it}^{-})

The oil price variable has been further divided into positive and negative shocks by using Shin *et al.* (2014) are used as explanatory variables. The criterion for division into positive and negative is provided in Eq. (4.14) and Eq. (4.15).

Domestic Credit to Private Sector $(DCPS_{it})$

The proxy for domestic demand used is domestic credit to the private sector is defined as a percentage. The data on the variables is appearing as Domestic credit to the private sector by banks (% of GDP), Domestic credit provided by the financial sector (% of GDP), and Domestic credit to the private sector (% of GDP). The data is taken from the World Bank data set, World Development Indicator (WDI).

4.2.1aMeasuring Financial Integration

Financial integration is defined as a process whereby financial markets in neighboring, regional, and/or global economies are closely linked together Lanc and Milesi-Ferretti (2003) . In the literature, three different measures have been presented

(i) the Price-based measure, which represents the asset prices discrepancies across independent national markets.

(ii) the news-based measure analyze the impact of factors on the asset's return process.

(iii) the quantity-based measure provides the magnitudes of the effects of frictions on the supply and demand of assets.

A international financial integration is as follows:

$$IFIGDP_{it} = \frac{(FA_{it}+FL_{it})}{GDP_{it}} \quad (4.21)$$

where *FA* refers to the stocks of foreign assets and *FL* and refers to the stocks of foreign liabilities at the aggregate level. The international trade in debt instruments is driven by special factors, we have considered an equity-based measure as follows:

$$FI_{it} = \frac{(PEQA_{it}+FDIA_{it}+PEQL_{it}+FDIL_{it})}{GDP_{it}} \quad (4.22)$$

The term *PEQA (L) represents* stocks of portfolio equity asset (liabilities) and *FDIA (L)* are the and FDI assets (liabilities). Hence, FI_{it} is a measure of the number of equity cross-holdings both portfolio and FDI Lane *et al.* (2003). The variable used for calculation is a net foreign direct investment FDI_{it} portfolio investment NPI_{it} and GDP_{it} all calculated as current US $. The sum of FDI and portfolio investment is divided by GDP to get financial integration.

Foreign Direct Investment (BoP, current US $) ($FDI_{it}$)

It is an investment in the economy by foreigners measured in the current US dollar. The data for the variable has been taken from World Development Indicators.

Net Portfolio Investment (current US $)($NPI_{it}$)

It is defined as investment in the securities and debt instrument for any economy given in dollars. The data on the variable has been taken from World Development Indicators.

The sum of the foreign direct investment and portfolio investment has been divided into GDP (defined earlier) series to obtain the financial integration of the economy.

4.2.1b Measuring the Trade Openness ($TOPN_{it}$)

Regarding trade openness, the ratio of real exports plus imports to real gross domestic product (both expressed in local currency at constant prices) has been considered a measure of openness to international goods and services.

$$Trade\ Openness_{IT} = \frac{Exports+Imports}{GDP} \times 100 \qquad (4.23)$$

Trade openness is measured as trade as a percentage of GDP. The data is taken from the World Bank data set, WDI.

Criteria to Quantify Dummy Variables

The above moderators have been categorized into two categories namely low and high. To quantify the variables into different degrees a threshold has been taken from the obtained data the values below that threshold have been assigned a dummy of low financial integration (0 or 1). The values which are higher than the threshold level have been taken as high financial integration and more openness of trade respectively.

4.2.2 County's Sample and Selection Criteria

We carried out the analysis on the cross-country panel of 160 countries that are divided into three groups based on their level of oil imports. The low oil importer countries having oil import holds 0-10 % of overall imports, medium oil importer countries that hold 10-20% of overall imports, and major oil importer countries holding 20-30% of the overall import bill. The low and medium groups include 50 and 89 countries respectively,

whereas the major oil importer group contains 21 countries.[29]The sample countries are grouped based on the average fuel imports data from the period 1980 to 2018. Estimation of mediation analysis consists of a panel of 160 countries.

The asymmetric response analysis is carried out using the period of 1990-2019. The number of cross-sections used in the analysis is the first group comprises of 12 countries medium oil importing as 21 and low oil-importing economies comprises of 7 countries. However, the analysis was initiated by taking a sample of the 80 countries. The sample was reduced due to non-availability of data on industrial production index and later on estimation stage due to hindrance in estimation due to the presence of more missing values on the main variable being an unbalanced panel.

The analysis of the role of moderators in the adjustment of imbalances consists of cross section for OPEC countries is 13, the total number of all developed economies is 36 countries that have been included in the analysis however the cross section of developing economies contains the 35 countries for the analysis to be smooth[30]. The time period for this study is 1990-2019.

The time period for mediation analysis is 1980-2019. The analysis comprises of the following countries and country groupings for mediation and asymmetric response analysis.

[29]See Appendix A for the list of groups of countries.
[30] See Appendix A for the list of groups of countries.

Oil Importers

i. Major oil importers[31]

ii. Medium oil importer

iii. Low oil importers

The analysis of role of moderator for adjustment of balances is comprised of the following countries and country groupings:

i. Organization of the Petroleum Exporting Countries (OPEC)

ii. Developed Countries

iii. Developing Countries

4.3 Estimation Techniques

This section presents discussion of the state of art technique suitable to the relevant analysis. In this context, section 4.3.1 discusses estimation technique for channel analysis, whereas section 4.3.2 and 4.3.3 presents estimation technique for asymmetric and moderator analysis respectively.

4.3.1 Estimation Techniques for Channel Analysis

As our empirical specifications for the different channels of transmission presents the system of linear equations, hence estimation carried out with the Seemingly Unrelated Regression (SUR) estimation technique advanced by Zellner (1962). The SUR is the most appropriate estimation technique, the following reasons may justify why? Firstly, the SUR model captures efficiency due to the correlation of disturbances across country-

[31] The analysis will comprise of categorizing the world countries as 30%-20% (named as group C used interchangeably) of oil imports as their total imports as major importer, 20%-10% (B) as medium importer and 10%-5% (A) as low importer.

specific equations. Secondly, the SUR model estimates the system of linear equations with a different set of independent regregressors and accounts for the cross-equations correlation of error term.

Considering the data for different cross-section unit over time periods T is available. Assuming the set of equation as Eq 4.31.

$$y_i = X_i\beta_i + \varepsilon_i \qquad \text{i=1,2.....M} \tag{4.31}$$

Where the i depicts the i-th equation in system. It can be written in the matrix form as Eq (4.31a)

$$\begin{matrix} y_1 \\ \vdots \\ y_M \end{matrix} = \begin{bmatrix} X_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & X_M \end{bmatrix} \begin{matrix} \beta_1 \\ \vdots \\ \beta_M \end{matrix} + \begin{matrix} \varepsilon_1 \\ \vdots \\ \varepsilon_M \end{matrix} \tag{4.31a}$$

The parameters to be estimated in the i-th equation is Ki. The total number of coefficient to be obtained are $K = \sum_{i=1}^{m} K_i$. In addition $K_i > T_i$

Assuming strict exogeneity, i.e., $E(\varepsilon|X_1, \ldots, X_m) = 0$

It is viable to assume in SUR model the error term covariance matrix is not diagonal.

$$\Omega = \mathrm{E}(\varepsilon\varepsilon|\mathrm{X}_1, \ldots, \mathrm{X}_\mathrm{m}) = \begin{bmatrix} \sigma_{11}^2\mathrm{I} & \cdots & \sigma_{1\mathrm{m}}^2\mathrm{I} \\ \vdots & \ddots & \vdots \\ \sigma_{\mathrm{m}1}^2\mathrm{I} & \cdots & \sigma_{\mathrm{mm}}^2\mathrm{I} \end{bmatrix} \tag{4.32}$$

The system of equation with variance-covariance matrix being not diagonal of the error term, FGLS (feasible generalized least squares) can be used to estimate.

traditionally, estimation includes the two-step

1. Estimating the OLS regression for system of equations for consistent and unbiased parameterss of the variance-covariance matrix of the error term.

2. Based on the parameters of the variance-covariance matrix of the error term, standard GLS estimator are obtained.[32]

$$\hat{\beta}^{SUR} = (\dot{X}\hat{\Omega}^{-1}X)^{-1}\dot{X}\hat{\Omega}^{-1}y \quad (4.33)$$

Note that if the variance-covariance matrix of the error term is diagonal then β^{SUR} is approximately equal to the OLS estimator. The heterogeneity in the slopes can be estimated using SUR in case of large T and small N. In the context of long and narrow panel data, the SUR can be applied to account for a potential.

Suppose T> N then the linear model as a set of equations can be expressed as following.

$$y_1 = \acute{\beta}_1 X_1 + \varepsilon_1 \quad (4.34)$$

$$y_2 = \acute{\beta}_2 X_2 + \varepsilon_2$$

$$\vdots = \vdots$$

$y_N = \acute{\beta}_N X_N + \varepsilon_N$ where $\acute{\beta}_N$ is the vector of the structural estimators.

The SUR method takes into account the correlation in sytem of equation. In the case of panel data, this correlation cross-sectional dependence. The SUR method gives more efficient parameters as it takes into account for cross equation dependence. LM statistic (Breusch and Pagan, 1980) can be used to test cross-equation dependence.

$$LM = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{i,j}^2 \quad (4.35)$$

Where $\hat{\rho}_{i,j}^2$ is is cross-sectional correlation coefficient:

$$\hat{\rho}_{i,j} = \frac{\sum_{t=1}^{T}\hat{\varepsilon}_{it}\hat{\varepsilon}_{jt}}{(\sum_{t=1}^{T}\hat{\varepsilon}_{it})^{\frac{1}{2}}(\sum_{t=1}^{T}\hat{\varepsilon}_{jt})^{\frac{1}{2}}} \quad (4.36)$$

---

[32] Where estimation has been carried out by using commands in stata from Stata module: Estimation of system regression equations with unbalanced panel data and random effects. Minh Nguyen and Hoa Nguyen. 2010

The LM statistic is feasible for fixed N as $T \to \infty$ and is distributed with χ^2 distribution with $N(N-1)/2$ degrees of freedom. The commands for analysis will be taken from[33] Nguyen and Nguyen (2010).

4.3.2 Estimation Technique for Asymmetric Impacts

To explore the symmetric and asymmetric effect of price of oil on industrial productivity and exchange rate of oil importing economies the approach of dynamic common correlated estimators presented by Chudik *et al.* (2015) will be used. The dynamic common correlated approach is delineated on the basis of pooled mean group (PMG) technique Pesaran *et al.* (1997), Mean group (MG) estimation by Pesaran *et al.* (1995)., and CCE estimation Pesaran *et al.* (1995), and CCE estimation Pesaran (2006). This approach has an advantage over the other conventional methods. These consider the cross-sectional dependence and allow for heterogeneous slopes and dynamic common correlated effects.

Assume the following equation having heterogeneous coefficients Pesaran (2006)

$$y_{it} = a_i + \beta_i' X_{it} + u_{it} \tag{4.37}$$

$$u_{it} = \gamma_i' f_t + e_{it} \tag{4.38}$$

Where f_t is unobserved common factor,$\gamma_i$hetrogenous factor loading and α_i is unit specific effect.e_{it} is iid error term. Peasran (2006) shows that assuming strict exogeneity (1) can be estimated by approaching the unobserved common factors with averages over cross section. This estimator is recognized as CCE estimator. The baseline concept of the

[33] Nguyen, M. and Nguyen, H. (2010). Stata Module: estimation of system of regression equations with unbalanced panel data and random effects: Working Paper.

CCE estimator is to reduce the unobserved factor by cross sectional averages as the cross sectional dimension expands Pesaran (2006).

Given the dynamic panel as

$$y_{it} = a_i + \lambda_i y_{i,t} + \beta_i' X_{it} + u_{it} \quad (4.39)$$

The errors being weakly dependent so the lag of the dependent variable is not exogenous. The result is the estimator is inconsistent. However it can gain consistency as $\sqrt[3]{T}$ lags of the cross section averages is added for both exogenous and dependent variable. The equation estimated is as below

$$y_{it} = a_i + \lambda_i y_{i,t} + \beta_i' X_{it} + \sum_{t=0}^{PT} \delta_{il}' \bar{Z}_{t-l} + e_{it} \quad (4.40)$$

The mean group (MG) estimates are as following; $\hat{\pi}_{MG} = \frac{1}{N}\sum_{i=1}^{N} \pi_i$ (4.41)

The variance of the MG estimator is estimated by

$$\widehat{Var}(\hat{\pi}_{MG}) = N^{-1}\hat{\Sigma}_{\pi} = \frac{N}{N(N-1)}\sum_{i=1}^{N}(\hat{\pi} - \hat{\pi}_{MG})(\hat{\pi}_i - \hat{\pi}_{MG})' \quad (4.42)$$

The asymptotic distribution of the MG estimates is (Chudik and Pesaran 2015b)

$$\sqrt{N}(\hat{\pi}_{MG} - \pi) \xrightarrow{d} N(0, \pi_{MG}) \quad (4.43)$$

The pooled version of the CCE estimator can also be obtained by following Pesaran (2006) .the pooled mean group estimator are based on the assumption that long run effect is homogeneous and short run effect is hetrogenous . the equation for pooled mean group is transformation of the equation (1) in error correction form that is

$$\Delta y_{it} = \phi_i(y_{it-1} - \theta_i' X_{it}) + a_i + \beta_i' \Delta X_{it} + u_{it} \quad (4.44)$$

The $\theta_i = (1 - \alpha_i)$ is parameter for the speed of adjustment for error correction, it is expected to have negative value. $\theta_i = {}^{\beta_i}/_{\phi_i}$ is the coefficient for long run and

homogenous by assumption however β_i shows the dynamic of short term and across units it is hetrogenoues. Pesaran, Shin et al. (1999) proposed maximum likelihood to obtain the long run estimates and OLS method to estimate the short run parameters. The condition for the estimator to be consistent is that disturbances are distributed independently over all individual and time mean having zero value and variance to be strictly greater than zero.

4.3.3 Estimation Technique for Role of Moderators in Adjustment:

The analysis for moderators playing a role between oil price and current account relation will be done by using random effects method as fixed effects uses within unit change and it ignores variations among unit. Hausman test for exogeneity will be conducted to obtain efficient estimators.in case of unobserved effects to be exogenous the fixed effects and random effects are asymptotically equivalents. The rejection of nul hypothesis leads to consistency of parameter estimated by fixed effect model and vice vers.

4.4 Descriptive Statistics for Channels Analysis

The channel analysis comprises of country grouped into three categories as mentioned above the category with least oil imports is group A. Following tables (4.1, 4.2 and 4.3) present the variable under consideration for three groups of countries.

The descriptive statistics of the low and medium and high oil importing economies is presented in Tables 4.1, 4.2 and 4.3 respectively. The analysis of number of observation to access the data availability shows that highest number of observation are available for main variables of interest that is oil price and current accounts of the economies. The data for both variables is present for whole sample period. The demographic variable that is

population growth POP_{it} also holds maximum number of observation however the numbers of observation for the net foreign assets NFA_{it} are low in the sample.

Table 4.1: Descriptive Statistics for Least Oil Importer

Group A: Least Oil Importer

Variable	No. Obs.	*Mean*	*Std. Dev.*	*Min*	*Max*
OLP_{it}	1,950	3.517	0.643	2.549	4.714
TOT_{it-1}	1,362	4.752	0.374	3.453	6.284
POP_{it}	1,950	1.877	1.839	-7.291	16.331
$GDPG_{it}$	1,728	3.635	8.254	-64.047	149.973
CA_{it}	1,791	0.779	15.728	-240.521	106.836
$TOPN_{it}$	1,707	90.163	63.484	0.020	531.737
CAB_{it}	1,793	4.139	29.147	-149.646	420.569
DPR_{it}	1,774	63.173	19.716	16.451	109.801
NFA_{it}	1,362	2.582	1.748	-8.314	9.879
REX_{it}	1,569	11.963	59.140	0.002	594.174
LEX_{it}	1,759	2.144	3.177	-17.325	10.338

Table 4.2: Descriptive Statistics for Medium Oil Importer

Group B: Medium Oil Importer

Variable	No. Obs.	*Mean*	*Std. Dev.*	*Min*	*Max*
OLP_{it}	3,471	3.517	0.643	2.549	4.714

Table 4.2: Descriptive Statistics for Medium Oil Importer Cont.

TOT_{it-1}	2,395	4.716	0.265	3.063	5.754
POP_{it}	3,471	1.451	1.295	-5.814	7.061
$GDPG_{it}$	3,151	3.511	5.012	-44.901	88.957
CA_{it}	3,163	-2.84e-07	6.77e-06	-0.000	2.88e-06
$TOPN_{it}$	3,089	79.791	49.282	6.320	441.603
CAB_{it}	3,330	-1.639	46.685	-805.963	326.917
DPR_{it}	3,283	68.078	20.109	35.795	119.138
NFA_{it}	2,941	36.115	1439.248	-3805.806	77701.11
REX_{it}	2,761	7.251	27.831	0.001	307.286
LEX_{it}	2,981	2.643	3.378	-19.658	22.628

Table 4.3: Descriptive Statistics for High Oil Importer

Group C: High Oil Importer

Variable	No. Obs.	*Mean*	*Std. Dev.*	*Min*	*Max*
OLP_{it}	819	3.517	0.644	2.549	4.714
TOT_{it-1}	638	4.684	0.264	3.915	5.559
POP_{it}	819	1.960	1.463	-2.258	7.849
$GDPG_{it}$	736	3.504	6.950	-51.030	106.279
CA_{it}	767	-6.633	9.169	-80.051	13.375
$TOPN_{it}$	730	88.234	47.081	12.352	311.355
CAB_{it}	764	-1.370	13.295	-104.181	105.94

DPR_{it}	778	72.906	19.827	28.360	113.004
NFA_{it}	685	5.311	38.778	-664.204	98.526
REX_{it}	669	4.106	6.189	0	35.018
LEX_{it}	717	3.208	3.533	-23.025	7.685

The oil price $OILP_{it}$ has average value of 3.5 $ with variation of 0.64 over the sample period. The maximum price over period has been 4.71.[34] However the minimum price of oil charged during period are 2.5 $. The average value for terms of trade TOT_{it} is same for all three groups that is 4.6 and 4.7 with variation being 0.27 to 0.37 in three groups. The average value of population growth POP_{it} is 1.87 for least oil importer with 1.45 average for medium imports of oil and 1.96 that is highest for oil imports to highest with the least variation in medium oil importing economies. The average for the growth rate of GDP $GDPG_{it}$ is 3.6 for group having least oil imports and 3.5 for the other two. The average value of current accounts as percentage of GDP CA_{it} is positive with highest volatility in least oil importing economies and negative for other two groups. The average of trade openness $TOPN_{it}$ is highest with highest volatility for least oil importing economies. The average of current account balances CAB_{it} measured in dollars is again positive for least oil importing group and negative for other two groups. The dependency ratio DPR_{it} is having approximately same for three groups with different average value that is 63.17, 68.07 and72.90 for three groups respectively. The average value of net foreign asset NFA_{it} is 2.5 for lowest oil importing economies and highest in medium oil importing economies that is 36.1 the variation is also highest in this group. The average of real exchange rate REX_{it} is least for highest oil importing economies and volatility

[34] The descriptive statistics of the variables are provided here of the form of variable used for the analysis. As the oil price has been used in logarithm form so statistics of logarithm of oil price are given and discussed.

being highest for least oil importing economies. The average of nominal exchange rate LEX_{it} is least for low importing economies the volatility also being least for the group.

4.5 Preliminary Analysis of Data for Asymmetric Analysis

The descriptive statistics for preliminary analyses are presented in tables 4.4, 4.5 and 4.6, whereas tables 4.7 and 4.8 presents the results of homogeneity test and cross sectional dependence test respectively. Finally table 4.9 presents panel unit root tests given dimension of the data used in study. We have presented the mean standard deviation minimum and maximum value of the included variable of the analysis. The average value of Brent oil is 3.65 $ over the period of 1990-2019 with less variation of 0.67. The positive shock series has less volatility than negative shocks. The official exchange rate over the mentioned period has the highest average value for high oil importing economies with the highest volatility for medium oil importing and least for lowest oil importing economies. The average value for industrial productivity is more or less same for all oil importing nations. The volatility of industrial productivity ranges from 0.27-0.38 . The observations for industrial productivity are least. The presence of this variable mattered for inclusion of the economy in the analysis as most of economies were dropped from analysis for not having the sufficient number of observation of this variable. The average value of investment as percent of gross domestic product is highest for low oil importing economies and least for medium oil importing nations. However the volatility is highest in highest oil importing economics. The average value of manufacturing exports is highest for medium oil importing economies and least for highest oil importing economies. The volatility of manufacturing exports is highest for highest oil importing economics. The reason can be high oil imports and oil being the basic ingredient of

production process. The average growth rate of population is highest for high oil importing nations with volatility also being highest.

Table 4.4: Descriptive Statistics of Oil Price and Industrial Productivity for Group A Lowest oil Importing Economies

	OIL_{it}	$OIL^{+}{}_{it}$	$OIL^{-}{}_{it}$	EX_{it}	IPI_{it}	INV_{it}	EXM_{it}
Mean	3.6569	5.6513	-4.1467	1.5630	4.5191	23.8524	67.9796
Std. Dev.	0.6752	8.02695	10.2944	1.6799	0.2965	4.7563	23.5633
Min	2.5496	0	-46.5532	-0.6936	3.0569	14.49	13.2354
Max	4.714	31.7443	0	5.4920	5.0856	46.924	93.8858
Obs.	360	360	360	355	330	353	338

Table 4.5: Descriptive Statistics of Oil Price and Industrial Productivity for Group B Medium oil Importing Economies

	OIL_{it}	$OIL^{+}{}_{it}$	$OIL^{-}{}_{it}$	EX_{it}	IPI_{it}	INV_{it}	EXM_{it}
Mean	3.6569	5.6513	-4.1467	1.9074	4.4955	22.0542	72.5896
Std. Dev.	0.6748	8.0221	10.2883	2.4691	0.27933	4.6771	21.4955
Min	2.5496	0	-46.5532	-6.0998	3.1056	5.834	3.3906
Max	4.7147	31.7443	0	7.6792	5.3915	38.193	373.2282
Obs.	630	630	630	629	616	630	609

Table 4.6: Descriptive Statistics of Oil Price and Industrial Productivity for Group C High oil Importing Economies

	OIL_{it}	$OIL^{+}{}_{it}$	$OIL^{-}{}_{it}$	EX_{it}	IPI_{it}	INV_{it}	EXM_{it}
Mean	3.6569	5.6513	-4.1467	4.2078	4.3627	23.0670	60.0507
Std. Dev.	0.6759	8.0349	10.3047	2.7922	0.38393	8.0041	26.1565
Min	2.5496	0	-46.5532	-10.4291	3.1287	4.039	6.1007
Max	4.7147	31.7443	0	7.2452	5.0768	41.374	96.0328
Obs.	210	210	210	202	201	205	200

4.5.1 Analytical Framework

The cross-sections are considered correlated in analysis of energy sector due to three factors (i) Unexceptional shocks; (ii) Mutual institutes; and/or (iii) Spillover effects either

local or regional. The oil price shocks are a specific case of common shocks to oil importing economies. The cross sectional correlation among the errors of panel regressions can give the estimates of parameter which are inconsistent and results in incorrect inferences when standard estimation methods are used Kapetanios, Pesaran et al. (2011). So the dependency among cross sections has been checked before checking order of integration of the variables. For this purpose cross section Dependency (CSD) tests by Pesaran (2004) has been used.

There is substantial degree of heterogeneity hence the relationships will be different for each state. And if the coefficients are assumed homogeneous mistakenly (when the true parameter of a dynamic panel are not homogeneous in fact), then the estimates will be inconsistent Pesaran *et al.* (1995). The slope heterogeneity test of Pesaran and Yamagata (2008) has been used by the study. This test has superiority to other heterogeneity test due to fact that standard tests do not take into account dependency across the cross sections. Further Pesaran *et al.* (2008) is suitable with small sample size (N) and large time period (T), i.e. ,$T > N$[35]. Since, both properties of cross sectional correlation and $T > N$ is being present in all groups of the study at hand hence uses this slope heterogeneity tests. To consider slope heterogeneity tests equation are specified by

$$\tilde{\Delta}_{SH} = (N)^{\frac{1}{2}}(2k)^{-\frac{1}{2}}\left(\frac{1}{N}\tilde{S} - k\right) \tag{4.51}$$

$$\tilde{\Delta}_{ASH} = (N)^{\frac{1}{2}}\left(\frac{2k(T-k-1)}{T+1}\right)^{-\frac{1}{2}}\left(\frac{1}{N}\tilde{S} - k\right) \tag{4.52}$$

[35] Study sample contains 3 groups all having a case of T>N.

$\tilde{\Delta}_{SH}$ and $\tilde{\Delta}_{ASH}$ express delta and adjusted delta tilde ,respectively. The $\tilde{\Delta}_{SH}$ is based on the assumption $(N,T) \overset{j}{\to} \infty$ such that ${\sqrt{N}}/{T^2} \to 0$ however, if the panel regression model is first order autoregressive model then $(N,T) \overset{j}{\to} \infty$ and ${N}/{T} \to k$ so mean variance bias adjusted $\tilde{\Delta}_{SH}$ is expressed as $\tilde{\Delta}_{ASH}$ above.

To analyze the order of integration of the variables of the study, Im, Pesaran et al. (2003), Cross-Sectionally Augmented Dickey- Fuller (CADF) and Cross-Sectionally Augmented IPS (CIPS) have been used. Im *et al.* (2003) and Cross-Sectionally Augmented Dickey-Fuller (CADF) are first-generation unit root tests while the CIPS is second generation unit root test. The salient feature of CIPS test used here is based on the fact that it supposes crosss sectional dependency when compared with other tests. The presence dependency among cross-sections can provide misleading results by applying the conventional panel unit root tests. Now withstanding this, to circumvent the biased in the outcomes to any unit root test the study have used all indicated unit root tests in sequence. CIPS's equation is specified as:

$$\Delta W_{i,t} = \varphi_i + \varphi_i Z_{i,t-1} + \varphi_i \overline{W}_{t-1} + \sum_{i=0}^{p} \varphi_{il} \Delta \overline{W}_{t-1} + \sum_{i=1}^{p} \varphi_{il} \Delta \overline{W}_{i,t-1} \mu_{it} \qquad (4.53)$$

The $\overline{W}$ in above equation is the cross section means and is specified as below:

$$W^{i,t} = \varphi^1 \overline{lnlop}^{i,t} + \varphi^2 \overline{lnlex}^{i,t} + \varphi^3 \overline{lninv}^{i,t} + \varphi^4 \overline{lnexm}^{i,t} \qquad (4.54)$$

The test statistics of CIPS is specified as

$$\overline{CIPS} = N^{-1} \sum_{i=1}^{n} CDF_i \qquad (4.55)$$

The CDF means cross sectionally augmented Dickey- Fuller (CADF).

4.6 Preliminary Analysis for Moderator

The statistical analysis for the variables used is provided here in table 4.7 to illicit the statistical properties.

Table 4.7: Summary Statistics for Moderators

Variable	OPEC	DEV	DED	OPEC	DEV	DED	OPEC	DEV	DED
	No of Obs.				***Mean***			***Std. Dev.***	
CA_{it}	284	769	792	5.419	-2.397	-0.626	16.232	6.166	5.953
$DCPS_{it}$	247	692	635	24.345	50.615	100.597	22.231	39.108	50.495
GDP_{it}	261	735	756	25.024	25.223	26.149	1.518	1.855	1.828
EX_{it}	270	734	751	3.982	3.489	2.117	3.103	2.498	2.147
$OILP_{it}$	286	770	792	3.968	3.968	3.968	0.477	0.477	0.477
FI_{it}	251	708	752	0.052	.312	0.0739	0 .096	0.456	0.566
$OILP * FI_{it}$	251	705	736	2.121	2.059	1.210	2.046	2.026	1.854
$DCPSBNK_{it}$	249	694	635	24.33	46.360	93.290	22.081	34.440	46.120
$DCPSFIN_{it}$	247	691	629	22.46	65.225	125.133	33.392	42.396	60.112
$TOPN_{it}$	254	734	753	87.221	72.383	103.887	35.791	35.141	62.620
$OILP * TOPN_{it}$	254	735	753	1.894	1.892	1.598	2.060	2.027	2.006

The number of cross section for OPEC countries is 13, for smooth analysis the total number of developed economies all 36 countries have been included in the analysis however the cross section of developing economies contains the 35 countries. The average value of the current account as percentage of GDP $CA_{it}$for OPEC is 5.419 depicting the surplus over the period of 1999-2020 revenues of oil might be reason for such magnitude. For developing it is showing deficit over the period. The volatility being highest for the OPEC countries might be related to variation in oil price during period. The mean and volatility of domestic credit to private sector is highest for developed and least for OPEC economies. The mean and standard deviation of exchange rate for OPEC is highest and least for developed. The domestic credit to private sector as percentage of

GDP $DCPS_{it}$ has average value of 25.22 for both OPEC and developing and 26.149 for developed economies. The mean value of domestic credit to private sector by banks as percent of GDP $DCPSBNK_{it}$ is highest for developed economies with volatility also being highest. The average and volatility for developed economies is again highest of the variable domestic credit provided by financial sector as percent of GDP $DCPSFIN_{it}$. The average of trade openness is also highest in case of developed economies and least for OPEC countries.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Introduction

As the study aims to empirically examine the effect of oil price fluctuation on the current account while exploring the mediation effects. Therefore, we approach this chapter in different sections. The first section (5.1) presents the results of our estimated empirical models (Eqs. 4.1 to 4.6). The second section (5.2) presents the results and interpretation of the mediation analysis (Eqs. 4.7 to 4.10).

5.2 Estimated Results of the SUR Models and Interpretation

This section comprises three sub-sections. The first sub-section 5.1.1 discusses the results of SUR models for trade channel (Eqs. 4.1 and 4.2), sub-section 5.1.2 presents the results of SUR models for valuation channel (Eqs. 4.3,4.4), finally, sub-section 5.1.3 shows the estimated SUR models results of wealth channel (Eqs. 4.5,4.6).

5.2.1 Discussion of Results of SUR Models for Trade Channel

Table 5.1 presents the estimated results of our empirical models (4.1 and 4.2) that capture the impact of price fluctuation on current account balances through the trade channel. As discussed earlier that the sample countries are divided into three groups. Country groups A, B and C present low, medium, and major oil-importing countries respectively. In the case of each group, empirical models 1, 2 (Eqs.4.1, 4.2) are estimated, whereas in the case of country group C (major oil-importing countries) the empirical model is re estimated incorporating the the non oil balance NTB_{it} .

Table 5.1: Estimated Results of Empirical Models (4.1, 4.2) Trade Channel

Variables	Country Group A		Country Group B		Country Group C		Country Group C(NTB)[36]	
	TOT_{it}	CA_{it}	TOT_{it}	CA_{it}	TOT_{it}	CA_{it}	TOT_{it}	CA_{it}
$OILP_{it}$	0.068***	0.821	0.012***	-0.538***	0.001	-1.371***	-0.003	-1.504***
	(0.007)	(0.504)	(0.004)	(0.154)	(0.006)	(0.406)	(0.015)	(0.525)
$GDPG_{it}$	0.002***	0.155***	0.002***	-0.111***	0.002*	-0.081	0.004*	-0.110
	(0.001)	(0.035)	(0.001)	(0.023)	(0.001)	(0.059)	(0.003)	(0.084)
TOT_{it}	0.860***	----	0.911***	----	0.937***	----	0.959***	----
	(0.013)		(0.009)		(0.016)		(0.033)	
POP_{it}	0.004	----	-0.002	----	0.003	----	0.009*	----
	(0.002)		(0.002)		(0.003)		(0.006)	
CA_{it-1}	----	0.660***	----	0.749***	----	0.640***	----	0.385***
		(0.028)		(0.021)		(0.042)		(0.090)
CA_{it-2}	----	0.092***	----	0.088***	----	0.045	----	-0.005
		(0.028)		(0.021)		(0.042)		(0.067)
DPR_{it}	----	-0.050***	----	-0.017***	----	-0.056***	----	0.003
		(0.015)		(0.006)		(0.014)		(0.019)
$TOPN_{it}$	----	-0.009***	----	0.005***	----	-0.022***	----	0.054***
		(0.004)		(0.002)		(0.006)		(0.010)
NTB_{it}	----	----	----	----	----	----	-0.001	0.612***
							(0.005)	(0.204)
CONS.	0.402***	1.525	0.376***	4.114***	0.280***	14.193***	0.195	-19.170***
	(0.054)	(3.839)	(0.042)	(1.806)	(0.076)	(4.709)	(0.222)	(8.609)
No. Obs.	1081	----	2046	----	554	----	88	----
R^2_1	0.862	----	0.846	----	0.870	----	0.932	----
R^2_2	0.586	----	0.705	----	0.592	----	0.690	----

Note: Standard Error in parenthesis * indicates p<.10 **p<.05 *** p<.01

Results presented in table 5.1 show that the coefficient of oil price($OILP_{it}$) in the first equation (column 2) is showing a positive elasticity (0.068) which is significant for group A. Results indicate that a one percent increase in oil price increases the terms of trade by

[36]NTB represent Non-Oil Trade Balance, which captures trade composition effect.

0.06 percent for economies having least oil imports. Similarly, for group B (column 4) this coefficient appears positive (0.012) and statistically significant, however relatively lower than group A. Whereas for country group C(column 6) it holds the lowest (0.001)value, which is statistically insignificant. Generally, results indicate that the term of trade of the oil-importing country is positively associated with the increase in oil prices. However, the impact is decreasing with an increase in the share of oil imports in total imports. The results may be justified in the exports' earning of oil-importing countries, that increase in oil price may increase the exports demand of oil-importing countries in the oil-exporting countries. Hence, the positive increase in exports' earning may overlap the negative effects of the increase in oil prices. The results are in line with the findings of Backus *et al.* (2000) that came with the findings that there exists a positive correlation between an increase in oil prices and term of trade for importers' countries.

The control variable GDP growth ($GDPG_{it}$) that is common in all specifications holds a positive coefficient and statistically significant in Eq.1 for all three groups. The result shows that the country term of trade is improving with an increase in GDP growth. The result is in line with the findings of Mendoza (1997) that came with the findings that GDP growth and term of trade are moving in parallel. Results show that the term of trade is positively and significantly associated with its lag (TOT_{it-1}). This is evident from the fact that for all three groups the lag values of the term of trade enter the model positively and statistically significant. The control variable population growth (POP_{it})does not have significant effect on the term of trade for all three groups.

Here and now we are presenting an interpretation of our second empirical model (Eq.2), whereas the dependent variable is the current account (CA_{it}). The variable of interest is oil price ($OILP_{it}$), and control variables are trade openness (TOP_{it}), dependency ratio (DPR_{it}),and the lags of dependent variables (CA_{it-1}), ($CA_{it}-2$). The variable of interest oil price ($OILP_{it}$) enters the model with a positive sign, however not significant for group A. The result indicates that the current account of countries having a low dependency on oil imports is not affected by the change in oil prices. However for group B, oil prices have a significant and negative effect on the current account. The result indicates that a one percent increase in oil prices generates a 0.0053 deficit of the current account. Some received studies on the subject came with similar findings. Similarly, for group C the oil price holds a negative sign which is statistically significant. The estimated coefficient indicates that a 10 percent increase in oil price causes 0.13 units of current account deficit. The economic justification for such negative effect can be incraes in oil price might be causing increase export goods price. The increased price of export will shrink the export demand of oil importing economies causing deficit. The result is in line with the Huntington (2015) findings that the intensity of oil price shocks on the current account increases with an increase in oil imports. In general, the estimated results seem quite interesting. For instance, in case of group A, having lowest oil imports, oil prices cannot signify its role in the determination of their current account. Whereas, for higher oil-importing countries (Groups B,C), oil prices pose negative and significant effects on the current account.

The first and second lags of dependent variable $(CA_{it-1}), (CA_{it-2})$enters the model positively and significant statistically, apart from one coefficient (second lag in case of group C). Results indicate that whatever the nature of the economy in terms of oil imports, the position of the current account depends on the past profile. The findings are in line with the findings of Calderón *et al.* (2007) who found a positive and significant relationship between the current account and its past values.

The demographic variable, dependency ratio (DPR_{it})holds a negative sign and statistically significant in all three cases. The result may be explained in the view of Life-Cycle-Hypothesis, which explains that an increase in dependency ratio increases current consumption that in inturn increases the demand for imported goods. Our result indicates that for group A the dependency ratio holds a negative coefficient (-0.50), in the same way for group B and C it holds (-0.017) and (-0.056) respectively. Our findings are consistent with the findings of Chinn *et al.* (2007); Gruber *et al.* (2007) and Chinn *et al.* (2008) among others.

The trade openness $(TOPN_{it})$ enters for all three groups significantly, however, for groups A and C it holds a negative sign. However for group B, the trade openness is positive (0.005) and significant at one percent level of significance. The one possible justification of negative sign is in the nature of traded goods, that most of the developing countries export primary goods, whereas import value-added goods. Therefore, the outward trade policies putting a negative effect on their current accounts. Some studies on the subject are, for example (Allegret *et al.*, 2014); Chinn *et al.* (2003) among others.

The positive coefficient for group B may be justified in the volume of exports of these economies that should increase because of trade openness.

The GDP growth has a positive (0.155) and significant effect on current account for group A. However for group B GDP growth enters the model negatively and statistically significant, in the case of group C it holds a negative sign, however, statistically insignificant. In table columns 8 and 9 presents the estimated results for country group C, where the effects of non-oil trade balance (NTB_{it})are examined on dependent variables TOT and CA respectively. Results reveal that non-oil trade balance has no significant effect on TOT, whereas CA increasing with an increase in the non-oil trade balance. All other variables hold almost the same results as in previous cases.

5.2.2 Discussion of Results of SUR Models for Valuation Channel

The oil price shocks have an impact on the net foreign asset position of oil importing countries. In order to examine how oil price shocks, affect the net foreign asset position of oil importer, we estimate empirical models (Eqs. 4.3, 4.4). Table 5.2 presents the estimated results of our empirical models for all three country groups. Following Kilian *et al.* (2009) in Eq. 4.3 the dependent variable is net foreign assets as a percentage of GDP, whereas in Eq. 4.4 the dependent variable is the current account as a percentage of GDP.

Table 5.2: Estimated Results of Empirical Models (4.3, 4.4) Valuation Channel

Variables	Country Group A		Country Group B		Country Group C	
	NFA_{it}	CA_{it}	NFA_{it}	CA_{it}	NFA_{it}	CA_{it}
$OILP_{it}$	-0.038	-0.482	1.200*	-0.665***	-0.947***	-
	(0.033)	(0.481)	(0.668)	(0.160)	(0.355)	1.489***
						(0.396)
NFA_{it-1}	0.804***	-----	0.356***	-----	0.921***	-----
	(0.034)		(0.013)		(0.042)	
NFA_{it-2}	0.178***	-----	0.208***	-----	0.038	------
	(0.035)		(0.012)		(0.042)	
TOT_{it-1}	0.110*	2.401***	0.061	0.298	-0.850	-0.339
	(0.058)	(0.818)	(1.644)	(0.381)	(0.855)	(0.937)
POP_{it}	-0.027***	-----	0.097	-----	-0.437***	-----
	(0.009)		(0.357)		(0.157)	
$GDPG_{it}$	0.001	0.062	0.124	-0.130***	-0.067	-0.077
	(0.003)	(0.039)	(0.102)	(0.024)	(0.053)	(0.058)
$TOPN_{it}$	0.000*	0.002	0.141***	0.004*	0.008	-
	(0.000)	(0.004)	(0.009)	(0.002)	(0.005)	0.025***
						(0.006)
NFA_{it}	-----	0.059	-----	0.006*	-----	0.026
		(0.156)		(0.003)		(0.018)
DPR_{it}	-----	-0.047***	-----	-0.016***	-----	-
		(0.015)		(0.006)		0.051***
						(0.013)
CA_{it-1}	-----	0.808***	-----	0.745***	-----	0.628***
		(0.033)		(0.022)		(0.041)
CA_{it-2}	----	-0.035*	----	0.080***	-----	0.080*
		(0.033)		(0.022)		(0.043)
CONS.	-0.287	-6.910*	-9.654	1.573	8.900**	11.164**
	(0.237)	(3.641)	(7.762)	(1.873)	(4.062)	(4.538)
No. Obs.	815	----	1981	----	533	----
R^2_1	0.918	----	0.742	----	0.909	----
R^2_2	0.703	----	0.695	----	0.623	----

Note: Standard Error in parenthesis * indicates p<.10 **p<.05 *** p<.01

Our variable of the interest oil price ($OILP_{it}$) in the first model (Eq.4.4) has a different response to the dependent variable (Net-Foreign Assets as a Percent of GDP). For group A (column 2) it holds a negative sign, however statistically insignificant. The result indicates that oil price shocks have no effects on the net foreign assets of economies having oil imports less than 10 of their total imports. Whereas, the oil price enters tbe

model negatively and statistically significant for group B. Result reveals that economies relatively more dependent on imported oil, their net foreign assets increases with an increase in oil price.

On the other hand, the rise in oil price decreases net foreign assets in the case of economies heavily dependent on imported oil (group C). This is evident from the fact that for group C (column 6), the oil price holds a negative sign that is statistically significant. In general, the estimated results appear justifiable. For instance, in the case of group A, having the lowest oil imports, any change (rise) in oil prices has no substantial effect on net foreign assets. Whereas, for higher oil-importing countries (Groups B,C), oil prices pose significant effects on the net foreign assets. More interestingly, in the case of economies heavily dependent on imported oil (group C) net foreign asset decreases with an increase in oil prices.

The first lag (NFA_{it-1}) of the dependent variable enters the model positively and statistically significant for all three groups. The results indicate that net foreign assets depend on its lag values, the greater are the existing stock of assets the greater would be the current stock of assets. Similarly, the second lag (NFA_{it-2}) enters the model positively and statistically significant for group A, and B, however insignificant in the case of group C. The term of trade with its first lag (TOT_{it-1}) enters positively and significantly in case of group A, however, for other two groups (groups B, C), it holds positive sign but statistically insignificant. Population growth (POP_{it}) poses a negative effect on capital gains in the lower importer of oil (group A), and a higher importer (group C), whereas in the case of group B (countries having oil imports holding 10-20

percent share of its total imports) population growth can not signify its role in the determination of capital gain.

Almost for all three groups, the growth of GDP ($GDPG_{it}$)cannot signify its role in the determination of capital gain. For the first two groups (A, B) results indicate that countries having more open to international trade improves their capital gain compared to their less open counterparts. However, the trade openness has no effect on the capital gain for group C (higher oil importer countries).

The results of our second regression equation (Eq. 4.4), the dependent variable (value addition) is measured with the current account as a percentage of GDP, instead of net foreign assets as a percentage of GDP. Apart from the dependency ratio (DPR_{it}), that replaced population growth (POP_{it}), all other explanatory variables are the same. Results presented in Table 5.2 show that variable of interest and other control variables hold the same results as in the case of Eq. 4.4. As far as lags of the dependent variable are concerned(CA_{it-1}, CA_{it-2}), both lags appear significant and positive for all three groups, which indicate that the current shape of current account depends on the past, whatever oil imports profile the country holds.

5.2.3 Discussion of Results of SUR Models for Wealth Channel

Table 5.3 presents the estimated results of our empirical models (4.5, 4.6) that capture the impact of oil price fluctuation on current account balances through the wealth channel. As discussed earlier that the sample countries are divided into three groups. Country groups A, B and C present low, medium, and major oil-importing countries respectively. In empirical model 4.6 the dependent variable is the exchange rate, whereas, in model 4.6

the dependent variable is current account balance. The following tables 5.3 and 5.4 show the estimated results of our empirical models. In table 5.3, the dependent variable of model 4.5 is real exchange rate, whereas table 5.4 illustrates the estimated results of model 4.5 with the nominal exchange rate as a dependent variable.

Table 5.3: Estimated Results of Empirical Models (4.5, 4.6) Wealth Channel (using Real Exchange Rate)

Variables	Country Group A		Country Group B		Country Group C	
	EX_{it}	CA_{it}	EX_{it}	CA_{it}	EX_{it}	CA_{it}
$OILP_{it}$	-0.544	-0.468	-0.246***	-0.503***	-0.149***	-1.443***
	(0.645)	(0.644)	(0.069)	(0.178)	(0.054)	(0.471)
REX_{it-1}	0.948***	-----	0.928***	-----	0.943***	-----
	(0.005)		(0.005)		(0.008)	
NFA_{it}	0.000	-0.000	0.000	0.004	-0.003	0.041*
	(0.000)	(0.000)	(0.002)	(0.004)	(0.003)	(0.022)
$POPG_{it}$	0.044	-----	0.041	-----	0.030	-----
	(0.196)		(0.038)		(0.023)	
$GDPG_{it}$	-0.021	0.239***	-0.033***	-0.097***	-0.021**	0.030
	(0.043)	(0.042)	(0.011)	(0.027)	(0.009)	(0.074)
TOT_{it}	-0.543	4.833***	0.162	0.367	-0.052	-0.486
	(1.191)	(1.155)	(0.174)	(0.432)	(0.144)	(1.228)
$TOPN_{it}$	-0.001	-0.012**	-0.000	0.003	0.000	-0.029***
	(0.005)	(0.005)	(0.001)	(0.003)	(0.001)	(0.008)
REX_{it}	------	0.000	------	0.001	------	-0.043
		(0.006)		(0.013)		(0.073)
CA_{it-1}	-----	0.680***	-----	0.761***	-----	0.595***
		(0.035)		(0.025)		(0.047)
CA_{it-2}	-----	0.070**	-----	0.068***	-----	0.087*
		(0.034)		(0.025)		(0.050)
DPR_{it}	-----	-0.061***	-----	-0.022***	------	-0.053***
		(0.020)		(0.006)		(0.016)
CONS.	4.981	-16.956***	0.316	0.981	0.886	11.220*
	(4.772)	(5.105)	(0.803)	(2.068)	(0.673)	(5.756)
No. Obs.	828	------	1594	------	439	-----
R^2_1	0.98	------	0.98	------	0.98	------
R^2_2	0.61	------	0.70	------	0.59	------

Note: Standard Error in parenthesis * indicates p<.10 **p<.05 *** p<.01

Table 5.4: Estimated Results of Empirical Models (4.5, 4.6) Wealth Channel (using Nominal Exchange Rate)

Variables	Country Group A		Country Group B		Country Group C	
	EX_{it}	CA_{it}	EX_{it}	CA_{it}	EX_{it}	CA_{it}
$OILP_{it}$	-0.066***	-0.738	-0.031***	-0.471***	-0.030*	-1.389***
	(0.013)	(0.619)	(0.008)	(0.176)	(0.018)	(0.462)
LEX_{it-1}	0.990***	------	0.974***	------	0.926***	------

	(0.003)		(0.002)		(0.005)	
NFA_{it}	0.000	-0.000	-0.002***	0.002	-0.007***	0.044*
	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)	(0.023)
$POPG_{it}$	0.006*	-----	0.029***	-----	0.003	-----
	(0.004)		(0.004)		(0.008)	

Table 5.5: Estimated Results of Empirical Models (4.5, 4.6) Wealth Channel (using Nominal Exchange Rate)

$GDPG_{it}$	-0.001	0.187***	-0.006***	-0.104***	-0.002	0.025
	(0.001)	(0.040)	(0.001)	(0.027)	(0.003)	(0.074)
TOT_{it}	-0.048**	4.645***	0.007	0.453	-0.072	-0.560
	(0.024)	(1.106)	(0.019)	(0.437)	(0.051)	(1.224)
$TOPN_{it}$	-0.000	-0.012**	0.000	0.004	-0.001**	-0.030***
	(0.000)	(0.005)	(0.000)	(0.002)	(0.000)	(0.008)
CA_{it-1}	-----	0.670***	-----	0.754***	-----	0.587***
		(0.033)		(0.024)		(0.047)
CA_{it-2}	-----	0.058*	-----	0.079***	-----	0.087*
		(0.033)		(0.024)		(0.050)
DPR_{it}	-----	-0.056***	-----	-0.021***	-----	-0.055***
		(0.021)		(0.006)		(0.018)
LEX_{it}	-----	-0.324**	-----	0.012	-----	-0.005
		(0.151)		(0.053)		(0.161)
CONS.	0.557***	-14.063***	0.211**	0.373	0.886***	11.430**
	(0.095)	(4.816)	(0.088)	(2.079)	(0.236)	(5.783)
No. Obs.	885	-----	1640	-----	439	-----
R^2_1	0.99	-----	0.99	------	0.99	-----
R^2_2	0.61	------	0.70	------	0.59	-----

Note: Standard Error in parenthesis * indicates p<.10 **p<.05 *** p<.01

Results presented in Table 5.3 indicate that for country group A our variable of interest oil price ($OILP_{it}$) enters the model negatively, which is statistically insignificant. The result shows that a change in oil price cannot shape the real exchange rate of economies having less dependency on imported oil. Like group A, country groups B and C, the variable of interest ($OILP_{it}$) holds a negative sign, however statistically significant. The results indicate that an increase in oil price decreases the real exchange rate in economies that relatively relies more on imported oil. The response of oil price to the nominal exchange rate presented in Table 5.4 shows that for all country groups, an increase in oil price has a negative effect on the nominal exchange rate. The main conclusion that can be

drawn from the findings is that increase in oil price poses a negative effect on exchange rates (real and nominal) regardless position a country holding in terms of oil imports.

The negative relationship can be defined in a way that increase in oil appreciates the cuurency of the country importing oil where the magnitude of appreciation is high with increase in oil price as compared to nominal exchange rate. The economic justification can be that increase in oil price increases the import bill that decreases the deamand of the imports the lesser demand of imports improves the balance of payments and exchange rate appricitaes.

The net foreign asset as a percentage of GDP (NFA_{it}) to real exchange rate is insignificant in all three groups, results indicate that net foreign asset has no effect on the determination of real exchange rate. However, for the groups B and C, the nominal exchange rate is negatively associated with a net foreign asset of countries relatively more dependent on importing oil. Similarly, the growth rate of population ($POPG_{it}$) cannot signify its role in the determination of real exchange rate for all groups, but for country group A and B nominal exchange is positivcly associated with population growth. The growth rate of GDP ($GDPG_{it}$) enters the model with a negative sign and statistically insignificant for group A. However, for groups B and C the growth rate of GDP enters the model negatively and statistically significant. The result indicates that the real exchange rate deprecates with the increase of the growth of GDP for countries dependent more on imported oil. The terms of trade (TOT_{it}) have no significant effect on the real exchange rate for all three groups of countries; however, it poses a negative effect on the nominal exchange rate in the case of country group A. For all three groups of country trade openness, ($TOPN_{it}$) is insignificant, which indicates that trade openness

does not play any role in the determination of the real exchange rate of countries under consideration. The lag of real exchange rate (REX_{it-1}) enters the model with a positive sign that is statistically significant for all three groups. Similar results have been found in the case of the nominal exchange rate.

Tables 5.3 and 5.4 present the estimated results of our empirical model 6 (Eq. 4.6), where the wealth channel has been captured with the current account. Hence, the dependent variable exchange rate is replaced with the current account as a percentage of GDP. Two changes have been made in independent variables. Firstly, the population growth is replaced with the dependency ratio, and secondly, the exchange rate is used as an independent variable.

Our variable of interest ($OILP_{it}$) enters the model with a negative sign that is statistically insignificant in the case of group A. The result indicates that countries that relies less on the imports of oil (less than 10 %), their current account are not affected by a change in oil prices. Whereas, for groups B and C the variable oil price holds negative sings that are statistically significant. The estimated results point towards the findings that countries' relatively more reliance on the imported oil, their current account balance drops with an increase in oil prices. The estimated results make sense that with an increase in oil prices imported bill of oil importing countries increases with increase in oil prices and therefore worsening current account balance.

Among the control variables, growth of GDP ($GDPG_{it}$) shows the mixed result, in the case of group A, for instance, it holds a positive sign, whereas for group B it enters the model with a negative sign. For both groups (A, B) growth of GDP has s significant

effect on the current account. Estimated results reveal current account balance of countries more reliant on imported oil is does not change with the change in the growth of GDP. The impact of the terms of trade (TOT_{it}) on the current account is not the same among different groups. For instance, for group A, it enters the model positively and statistically significant, which indicates that terms of trade and current account have a parallel movement. For other groups (B, C), terms of trade does not significant effect on the current account. Trade openness ($TOPN_{it}$) has a negative and significant effect on the current account in case of group A and C, whereas insignificant in case of group B. In all three groups exchange rate does not signify its role in the determination of current account. The dependency ratio (DPR_{it}), in all three cases, enters the model negatively and statistically significant, which indicates that the current account of oil-importing countries dips with the increase of dependency ratio. Both lags of the dependent variable appear significant and positive for all three groups, which indicate that the current account depends on its lag values.

5.3 Discussion of Mediation Analysis Results

This section of the study presents estimated results of Eqs. $4.8 - 4.10$, that capture the indirect effects of independent variables on the dependent variable. The following table 5.5 presents the estimated results of different mediator variables on dependent variables for different groups. Table 5.5 segregated into four panels, panel A presents the mediation effect of terms of trade, B presents net foreign assets, and panels C and D presents the mediation effects of capital gain and real exchange rate respectively.

Table 5.6: Mediation Effects of Different Variables

Country Groups Fuel Imports as Percentage of Total Imports	(A): Mediation Effect of Terms of Trade			
	Indirect Effect	Direct Effect	Total Effect	Proportion of Effect Mediated
Group A	-0.011	0.821	0.807*	-0.032
	(0.058)	(0.504)	(0.478)	(0.125)
Group B	-0.004	-.538***	-0.542***	0.004
	(0.005)	(0.154)	(0.154)	(0.005)
Group C	-0.001	-1.371***	-1.372***	-0.000
	(0.006)	(0.406)	(0.406)	(0.002)
Group C: (Non-Oil Balance)	-0.044	-1.512***	-1.588***	-0.016
	(0.046)	(0.523)	(0.544)	(0.022)
	(B): Mediation Effect of Net Foreign Assets			
	Indirect Effect	Direct Effect	Total Effect	Proportion of Effect Mediated
Group A	-0.002	-0.483	-0.485	0.003
	(0.006)	(0.482)	(0.483)	(0.007)
Group B	0.007	-0.665***	-0.658***	-0.003
	(0.005)	(0.161)	(0.159)	(0.003)
Group C	-0.024	-1.489***	-1.514***	-0.008
	(0.019)	(0.396)	(0.402)	(0.008)
	(C): Mediation Effect of Capital Gains			
	Indirect Effect	Direct Effect	Total Effect	Proportion of Effect Mediated
Group A	0.033	-2.031*	-1.998*	0.016
	(0.091)	(1.3161)	(1.317)	(0.047)
Group B	-0.022*	-0.595***	-0.618***	0.015
	0.013)	(0.161)	(0.161)	(0.014)
Group C	-0.085	-1.110***	-1.196***	-0.008*
	(0.069)	(0.385)	(0.389)	(0.027)
	(D): Mediation Effect of Real Exchange Rate			
	Indirect Effect	Direct Effect	Total Effect	Proportion of Effect Mediated
Group A	-0.0002*	-0.468*	-0.468	0.001*
	(0.003)	(0.644)	(0.643)	(0.004)
Group B	-0.000*	-0.503***	-0.503***	0.001*
	(0.003)	(0.177)	(0.177)	(0.003)
Group C	0.006*	-1.443***	-1.436***	0.001
	(0.011)	(0.471)	(0.469)	(0.004)

Note: Standard error is in parenthesis, *, **, *** denotes level of significance at 10, 5 and 1 percent respectively.

Panel A of table 5.5, which presents the mediation effects of the term of trade, estimated results indicate that the mediation effects decrease with an increase in the imports of oil. For instance, for group A having countries the least importer of oil holds a relatively stronger coefficient (-.011). For group B where imports increase to 10-20%, it holds a

relatively lower coefficient (-.004) and holds lowest (-0.0005) for countries the highest oil importer (oil imports are 20-30%). Results indicate that the oil price effect on the current account of the oil importing is shrinking with an increase in oil imports. The insignificance of indirect effect of term of trade provides a plausible reason to agree for the potential role of additional mediator present to play its role in the relationship of oil price to current accounts. This argument is further justified by significant direct effect as direct effect is significant negative for group B and group C. The significance of direct effect provides the evidence of partial mediation.

Panel B shows the indirect effects of net foreign assets. Results indicate that for all three groups of economies the indirect effect appears insignificant. Whereas the direct effect of the net foreign asset on oil price current account relationship is negative and significant for group B and C relatively higher oil importing countries. This term provides important information about the presence of partial mediation taking place in oil price and current account relationships.

The capital gain is calculated as the difference between changes in net foreign assets and current account balances taken as a percentage of GDP. Panel C of Table 5.5 presents the mediation effects of the capital gain channel. Results show that among groups of countries, for group B the indirect effect is significant, which indicates that countries with magnitude of dependence of 10 to 20 percent on imported the capital gains signify its role as a mediator. The direct effect is significant for all of the groups indicating the presence of partial mediation. The total effect is also significant and negative for all three groups. The proportion of effect mediated goes on to decrease as imports of oil go on increasing

down the groups. The proportion of meditated effect is significant for a group having reliance 20-30 percent on imported oil.

The mediation role of the wealth channel is assessed in the oil price and current account relationship through the real exchange rate. Panel D of Table 5.5 presents the mediation effect of the real exchange rate. Results show that for all groups the indirect effect is significant, which provides evidence for the presence of wealth effects for the adjustment of imbalances due to oil price shocks. Similarly, the direct effects for all groups are significant indicating the presence of partial mediation. As far as the total effect is concerned, it appears positive and significant for group A and B, and insignificant for group C. Two key outcomes can be drawn from the mediator's results presented in table 5.5. Firstly, in all mediators, the direct effect goes on increasing with the increase in oil imports. Secondly, proportion of mediation effects decreasing with oil imports in the case of trade assets and wealth channel, whereas in the case of the real exchange rate channel it increases as oil imports increases.

5.4 The Results and Discussion of Asymmetric Analysis

The results of Pesaran *et al.* (2008) slope heterogeneity test are presented in Table 5.6. The results point to the heterogeneity problem for both symmetric and asymmetric models for all of the groups of oil importing economies. The hetrogeniety of the models implies that conventional unit root test will give biased results. Existence of heterogeneity demands the consideration of it while conducting the unit root tests as in presence of heterogeneity conventional unit root tests will give biased results. For all groups of oil importing economies the test statistics are significant in case of both models. The significant test statistics of all $\tilde{\Delta}$ and $\tilde{\Delta}_{adusted}$ confirms the heterogeneity across countries of the sample. So existence of heterogeneity requires incorporating this fact for finding the order of integration. For such purpose the cross sectionally Augmented IPS (CIPS) has been used which estimates the order of integration in heterogeneous panels.

Table 5.7 Slope Heterogeneity Test

Models	Country Groups	Statistics	Values
Symmetric	A group	$\tilde{\Delta}$	12.723***
		$\tilde{\Delta}_{adusted}$	14.883***
	B Group	$\tilde{\Delta}$	22.212 ***
		$\tilde{\Delta}_{adusted}$	25.550 ***
	C group	$\tilde{\Delta}$	9.332 ***
		$\tilde{\Delta}_{adusted}$	10.581 ***
Asymmetric	A group	$\tilde{\Delta}$	8.641 ***
		$\tilde{\Delta}_{adusted}$	10.108 ***
	B Group	$\tilde{\Delta}$	14.242 ***
		$\tilde{\Delta}_{adusted}$	16.382 ***
	C group	$\tilde{\Delta}$	9.715***
		$\tilde{\Delta}_{adusted}$	10.690***

*** represents significance at 1% level. The null hypothesis is slope coefficients are homogenous.
Note: the case of normally distributed errors the mean-variance bias adjusted $\tilde{\Delta} = \tilde{\Delta}_{adusted}$

The results of the cross sectional dependence (CSD) Pesaran (2004) test (below table 5.7) depicts that cross section are not independent, which is obvious from significance of the test statistics[37]. The null of cross sectional independence (at the 1% level) is rejected for each variable present in the model by test statistics. From the results it is evident cross sections are dependent .More ever the value for coefficients of absolute mean correlation ranged from 0.4–1.0 (last three columns of Table 5.7). High values for mean correlation coefficient confirms the presence of correlation between the cross sections of the panel.

Table 5.8: Cross section DependenceTest

Variable	CD Test			Correlation		
	A group	B Group	C group	A group	B Group	C Group
IPI_{it}	18.613 ***	31.01***	13.429***	0.54	0.56	0.60
$OILP_{it}$	44.497 ***	79.37***	25.1***	1.00	1.000	1.00
EX_{it}	25.291 ***	31.71***	8.738***	0.60	0.44	0.44
OIL_{it}^{+}	44.497 ***	79.37***	25.1***	1.00	1.00	1.00
OIL_{it}^{-}	44.497 ***	79.37***	25.1***	1.00	1.00	1.00
INV_{it}	3.886***	11.649***	-1.218	0.39	0.33	0.42
EXM_{it}	12.003***	14.036***	8.156***	0.49	0.39	0.34
POP_{it}	7.378***	2.001	13.619***	0.38	0.31	0.59

[37] CD test by command xtcdf code Stata-14 null hypothesis being cross section are independent

Note:*** represents significance at 1% level. The null hypothesis is cross-sections are independent.

The issue of non satationarity deserves attention when dealing with macro panel data. Hence as precondition for Non-Stationarity we subjected each series of our model to unit roots tests. Keeping in view nature of data set that is unbalanced, hence the unbalanced unit root tests Im *et al.* (2003), cross sectionally Augmented Dickey Fuller (CADF) and Cross Sectionally Augmented IPS (CIPS) are applied. Following, Table 5.8 presents the results of first generation and second generation panel unit root tests.

Table 5.9:Panel Unit Root Test

Variables	Country Groups	Level		First-difference		Order
		Intercept	Intercept and trend	Intercept	Intercept and trend	
First Generation Tests						
Im, Pesaran and Shin (IPS, 2003)						
IPI_{it}	A Group	0.4462	0.1773	-6.5389***	-4.6024***	I(1)
$OILP_{it}$		1.3701	1.3488	-10.7720***	-8.2295***	I(1)
EX_{it}		-2.3299***	-0.1002	-8.7286***	-6.4587***	I(1)
OIL_{it}^{+}		-6.1765***	-4.2490***	--	--	I(0)
OIL_{it}^{-}		-9.2038***	-8.6433***	--	--	I(0)
EXM_{it}		-0.5971	0.6212	-7.0545***	-5.4529***	I(1)
INV_{it}		-3.4169***	-2.2224***	--	--	I(0)
POP_{it}		-2.6479***	-7.4925***	--	--	I(0)
IPI_{it}	B Group	0.5146	1.7438	-10.5654***	-9.3824***	I(1)
$OILP_{it}$		1.6211	1.5959	-12.7456***	-9.7372***	I(1)
EX_{it}		-5.149***	-7.137***	--	--	I(0)
OIL_{it}^{+}		-7.3081***	-5.0274***	--	--	I(0)
OIL_{it}^{-}		-10.890***	-10.2269***	--	--	I(0)

EXM_{it}		-2.8103***	-2.2816***	--	--	I(0)
INV_{it}		-3.3488***	-2.3465***	--	--	I(0)
POP_{it}		-7.9016***	-9.8396***	--	--	I(0)
IPI_{it}	C Group	-0.2136	1.9359	-6.2083***	-9.5165***	I(1)
$OILP_{it}$		1.1187	1.1013	-8.7953***	-6.7193***	I(1)
EX_{it}		-5.4890***	-5.8348***	--	--	I(0)
OIL_{it}^{+}		-5.0431***	-3.4693***	--	--	I(0)
OIL_{it}^{-}		-7.5149***	-7.0573***	--	--	I(0)
EXM_{it}		-1.2192	-1.3988*	-7.9422***	-6.3247***	I(1)
INV_{it}		-1.6596**	-0.7962	-8.5278***	-7.3276***	I(1)
POP_{it}		-3.2940***	-7.2919***	--	--	I(0)
Cross-Sectionally Augmented Dickey-Fuller (CADF)						
IPI_{it}	A Group	9.801	-3.357***	--	--	I(0)
$OILP_{it}$		2.610***	1.700	--	--	I(0)
EX_{it}		-9.427***	-9.316***	--	--	I(0)
OIL_{it}^{+}		17.488***	16.741	--	--	I(0)
OIL_{it}^{-}		2.610***	1.700			I(0)
EXM_{it}		-1.827**	-2.370***	--	--	I(0)
INV_{it}		-1.028	0.477	-7.628***	-6.193***	I(1)
POP_{it}		-2.765***	-3.033***	--	--	I(0)
IPI_{it}	B Group	-0.309	2.991	-5.772***	-4.530***	I(1)
$OILP_{it}$		2.610***	1.700	--	--	I(0)
EX_{it}		0.553	5.374	-4.826***	-4.019***	I(1)
OIL_{it}^{+}		2.610***	1.700	--	--	I(0)
OIL_{it}^{-}		2.610***	1.700	--	--	I(0)
EXM_{it}		-1.921	-2.272	-7.707***	-5.835***	I(1)
INV_{it}		-2.073*	-2.534	-3.788***	-3.876***	I(1)
POP_{it}		-2.499***	-3.365***	--	--	I(0)
IPI_{it}	C Group	1.098	2.851	-2.669***	-2.602***	I(1)
$OILP_{it}$		2.610***	1.700	--	--	I(0)
EX_{it}		-3.222***	-2.664***	--	--	I(0)
OIL_{it}^{+}		2.610***	1.700	--	--	I(0)
OIL_{it}^{-}		2.610***	1.700	--	--	I(0)
EXM_{it}		-1.900**	-1.330*	--	--	I(0)
INV_{it}		-0.627	1.180	-6.217***	-5.340***	I(1)
POP_{it}		-2.955***	-4.020***	--	--	I(0)

2nd Generation Tests

Cross-Sectionally Augmented IPS (CIPS)						
IPI_{it}	A Group	-1.598	-1.779	-4.061***	-4.246***	I(1)
$OILP_{it}$		2.610	1.700	2.610***	1.700***	I(1)
EX_{it}		-1.721	-2.322	-4.144***	-4.127***	I(1)
OIL_{it}^{+}		2.610***	1.700	--	--	I(0)
OIL_{it}^{-}		2.610***	1.700	--	--	I(0)
EXM_{it}		-1.793	-2.667***	--	--	I(0)
INV_{it}		-2.155	-2.454***	--	--	I(0)
POP_{it}		-2.171*	-1.837	-3.519***	-3.536***	I(1)
IPI_{it}	B Group	-1.747	-2.064	-4.438***	-4.726***	I(1)
$OILP_{it}$		2.610	1.700	2.610***	1.700***	I(1)
EX_{it}		-3.174***	-3.120***	--	--	I(0)
OIL_{it}^{+}		2.610***	1.700	--	--	I(0)
OIL_{it}^{-}		2.610***	1.700	--	--	I(0)
EXM_{it}		-1.376	-2.125***	--	--	I(0)
INV_{it}		-1.875	-2.185	-4.583***	-4.587***	I(1)
POP_{it}		-2.007	-2.447	-3.518***	-3.600***	I(1)
IPI_{it}	C Group	-1.589	-1.314	-4.361***	-4.651***	I(1)
$OILP_{it}$		2.610	1.700	2.610***	1.700***	I(1)
EX_{it}		-1.665	-2.052	-3.302***	-3.291***	I(1)
OIL_{it}^{+}		2.610***	1.700	--	--	I(0)
OIL_{it}^{-}		2.610***	1.700	--	--	I(0)
EXM_{it}		-1.520	-2.128***	--	--	I(0)
INV_{it}		-1.604	-1.521***	--	--	I(0)
POP_{it}		-1.792	-1.180	-2.668***	-2.834***	I(1)

I(0): stationary; I(1): integrated order one, nonstationary; Statistical significance level of 0.1% denoted by ***

--where variable is I(0) no need for test stat at 1st difference

The results of Cross Sectionally Augmented IPS for heterogeneous panel are dominant based on the fact that it presumes dependency among cross sections produced by single common element. To control the problem of serial correlation, we have used lag of the variables. The results by including trend and drift have also been reported. The positive and negative shocks for all groups of oil importing economies are stationary at level I(0) whereas, the oil price and industrial production index are integrated of order one I(1) for all three types of the oil importing economies. However exchange rate is integrated of

order one I(1) for highest and lowest oil importing economies and I(0) for economies with medium oil imports.

5.5 Interpretation of CS ARDL Results

After checking the integration properties of all series under consideration, we begin to check the dynamics of the oil price industrial productivity relation in both long run and short run. In this context, equation (4.12) and (4.14) has been estimated using dynamic common correlated estimator (DCCE) developed by Chudik *et al.* (2015)[38]. The models are represented without asymmetry (equation 4.12) and with asymmetry (equation 4.14). In the model 4.12 the oil price has not been decomposed into positive and negative component so equation 4.12 is symmetric version of model oil price to industrial productivity. The equation 4.14 decomposes the oil price shocks into positive and negative component so it is categorized as asymmetric version of relating the oil shocks to industrial productivity. The estimation results are presented in table 5.9. First the symmetric model results are reported for group A, B and C and then asymmetric for 3 groups respectively. Each column of the table reports regression results in the long run and short run with and without asymmetry respectively.

5.5.1 Interpretation of Results Symmetric Model (without Asymmetry):

The observed estimates are considered under two main headings without asymmetry and with asymmetry for oil importing economies with A group having oil imports (5-10%) B group having oil imports (10-20%) and C group with (20-30%). Lastly we have conducted the robustness check by changing oil variable proxy using West Texas

[38] Using command xtdcce2 in Stata -14 as indicated by Jan Ditzen (2018)

Intermediate oil price following Salisu, Isah et al. (2017). The results discussion is made in table 5.9 and 5.11 for analysis and robustness respectively.

Considering the short run results the oil price $\Delta OILP_{it}$ holds positive sign that is statistically significant in case of less and medium oil importing groups, whereas insignificant in case of high oil importing countries. The magnitude of elasticity is 0.028 and 0.022 for both the oil imports with (5-10%) and (10-20%) respectively. The effect of the oil price on industrial productivity is positive in the short run for economies with oil imports less than 20 percent.

Table 5.10: Panel Regression Results

	Without Asymmetry			With Asymmetry		
	A group b/p	B group b/p	C group b/p	A group b/p	B group b/p	C group b/p
			Short-Run Estimates			
$\Delta OILP_{it}$	0.028* (0.054)	0.022*** (0.001)	-0.045 (0.241)			
ΔEX_{it}	0.005 (0.906)	-0.174 (0.196)	-0.113** (0.015)	0.001 (0.977)	-0.149 (0.287)	-0.060 (0.481)
ΔINV_{it}	0.013*** (0.000)	0.015*** (0.000)	0.006 (0.177)	0.012*** (0.000)	0.015*** (0.000)	0.010** (0.045)

Table 5.9 : Panel Regression Results Cont.

ΔOIL_{it}^{+}				0.001* (0.081)	0.000 (0.794)	-0.000 (0.366)
ΔOIL_{it}^{-}				-0.000 (0.972)	-0.000 (0.774)	0.000 (0.807)
ECT	-0.161*** (0.050)	-0.222*** (0.000)	-0.309*** (0.008)	-0.125** (0.034)	-0.139*** (0.000)	-0.264*** (0.006)
			Long-Run Estimates			
$OILP_{it}$	-0.050 (0.557)	0.066 (0.220)	-0.142 (0.667)			
INV_{it}	0.036 (0.278)	0.021 (0.128)	0.030 (0.597)	-0.018 (0.613)	-2.708 (0.312)	0.003 (0.843)

EX_{it}	1.228**	0.856*	0.913	1.103*	1.220	0.472
	(0.039)	(0.075	(0.309)	(0.077)	(0.203)	(0.369)
OIL_{it}^{+}				-0.015	0.638	0.007**
				(0.218)	(0.295)	(0.060)
OIL_{it}^{-}				0.019	-2.012	-0.016
				(0.135)	(0.317)	(0.114)
CONS.	4.467***	3.070***	-1.857	3.670***	21.642	0.810
	(0.001)	(0.000)	(0.716)	(0.003)	(0.287)	(0.720)
CD Stats.	4.64	7.90	0.60	6.41	7.98	0.45
(*p value*)	(0.00)	(0.00)	(0.5505)	(0.00)	(0.00)	(0.6503)
No. Obs.	314.000	594.000	187.000	314.000	594.000	187.000
No of Periods	30	30	30	30	30	30
F(p value)	4.567	4.416	3.667	4.845	3.652	3.265
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Cross Sections	12	21	7	12	21	7

As the oil imports are higher from 20-30% its response is insignificant. The one possible reason may be demand shocks whether specific to oil or global do not act as supply rather acts as a positive demand shocks that increases industry level production and prices as indicated by Fukunaga, Hirakata et al. (2010).

The elasticity of exchange rate ΔEX_{it} to industrial production of oil importing economies is only significant for highest oil importing economies in the short run. For the economies with oil imports' being 20-30 percent and it is negative and significant, which reveals that as oil imports are higher the exchange rate signify its role in the determination of industrial production. Where unit increase in exchange rate causes a decrease in industrial production by 11.3 percent. The unit increase in exchange rate is depreciation of the currency as exchange rate has been defined as local currency units per foreign currency unit. So depreciation here is thought to increase the export demand of the oil importing economies and countries being oil importer are not able to meet increasing demand and

resulting decrease in industrial output in theses economies. However, the economies are able to meet the increasing export demands and increase in output takes place in the long run. As the exchange rate EX_{it} coefficient is signicant for the least and medium oil importing economies with magnitude of 1.228 and 0.856 respectively in the long run. That is an increase in exchange rate causes increase in industrial out put by 1.22 and 0.85 percent for less and medium oil importing economics respectively. A dpericiation in exchangc rate by unit causes an increase in output by 1.22 and .85 percent in less and medium oil importing economies respectively. The positive effect of depreciation on output in long run is line with the result of Habibi (2019)

The parameter of investment as percent of GDP $\Delta INV_{it}$is significant for lowest and medium oil importing economies with magnitude of 0.013 and 0.015. That is a unit increase investment in the economy will increase the industrial production by 1.3 percent and 1.5 percent for lowest and medium oil economies respectively. However its parameter is insignificant for higbest oil importing economy. The insignificant effect may be justified in the high level of oil imports of the economies. For first two groups of the oil importing the results are in line with the findings of Ozturk *et al.* (2017).

For the long run the oil price and investment as percent of GDP ΔINV_{it}has been used as an independent variables. The parameter of none of the variables stands significant. In the long run the oil price does not responds significantly to industrial production of the oil importing economies where these are significant in sbort run. Tbe insignificance of oil price to industrial production is evident of appropriation of asymmetric specification in long run. For this purpose the model is re estimated incorporating the oil price shocks

(positive and negative) to the specification and results are discussed in the following section.

5.5.2 Asymmetric Model Discussion

Our discussion about asymmetric model will start with the result of positive and negative oil price shocks on industrial production in the short run. The dependent variable is in logarithm whereas the independent variable is linear for interpretation of the linear transformation models followed Benoit (2011).

When asymmetry is examined in the relation, the observed parameters convey interesting results. The coefficient of ΔOIL_{it}^{+} (Positive Oil Price Shocks) for low oil importing economies is 0.001 that is .1 percent increase in industrial productivity is caused by a unit increase in price of oil in the short run. The positive shocks coefficient is significant at 10 percent level of confidence for low oil importing economies only and insignificant for rest in the short run. However, the ΔOIL_{it}^{+} (Positive Oil Price Shocks) are significant for the highest oil importing group of economies in the long run. The magnitude of the coefficient is 0.007. That is a unit increase in price of oil causes an increase in industrial production by 0.7 for highest.

The increase in industrial productivity in the long run due to positive shock can be justified by shifting of resource from oil intensive sector to non oil sectors. As there is increase in oil price the higher reallocation cost of resources from oil-intensive sectors causes labor intensiveness; substitution possibilities takes place and higher labor and capital intensity offset the effect by contributing to GDP. The results are in line to Gbatu,

Wang et al. (2017) that also found the positive shocks of oil boosting the Liberian economy.

The ΔOIL_{it}^{-} (Negative Oil Price Shocks) stands insignificant in short run for all of the groups. However considering ΔOIL_{it}^{-} negative oil price shocks in long run are again insignificant. The insignificance of negative shock in short can be justified on the basis of contractual agreements and non availability of the substitutes. In thc long run however the negative shocks also does not benefit the oil importing economies. The analysis of positive and negative shocks suggests there is symmetry in the short run in response of industrial production to oil price shocks. The results are in line with findings of Herrera *et al.* (2015) who, used the data set of OECD countries and found little support that response are asymmetric.

For the long run the exchange rate EX_{it} and investment as percent of GDP ΔINV_{it} has been used as an independent variables. The parameter of the exchange rate enters significanty in the model for leats oil importing economies. The magnitude is 1.103 that is unit increase in excahge rate causes 1.1 percent increase in output. However, its coefficient stood insignificant for the rest two groups.

The ECT error correction term is negative and significant for all three groups of economies providing evidence for model stability and long run relationship of the variables for both symmetric and asymmetric models. The magnitude of ECT term for symmetric model is -0.161 -0.222 and -0.309 for the lowest, medium and the highest oil importing economies respectively. That is for every short run disequilibrium 16.1, 22.2 and 30.9 percent of adjustment is made respectively each year. This implies that the

disequilibrium is corrected at 16.1 percent 22.2 percent and 30.9 percent each year by three groups. The magnitude of error correction term is higher as oil imports are higher along group. For asymmetric model for all three groups the rate of adjustment of the disequilibrium is 12.5%, 13.9% and 26.4% for lowest medium and highest oil importing economies respectively. Again a momentum is observed that is magnitude of oil imports increases the rate of elimination of disequilibrium is higher.

5.5.3 Testing Model for Short Run and Long Run Asymmetries

Frey and Manera (2007) argued that testing null hypothesis $\alpha_0^+ = \alpha_0^-$ gives information about contemporaneous impact of positive and negative shocks on industrial production. The rejection/acceptance will determine asymmetry/symmetry according to null hypothesis. Table 5.10 presents results of the tests.

Results presented in table 5.10 depicts the presence of asymmetry in the long run for lowest and highest oil importing economies. However, in the short run there is no evidence of asymmetry for any of the oil importing group of countries. The table also reports the number of years required for disequilibrium to halve for all three groups. The results are evident of the fact that number of years for disequilibrium to be halved decreases as the oil imports increase in case of symmetric model. However, the number of years required halving the disequilibrium also decreases as oil imports increase when splitting the oil shocks into positive and negative counterpart.

Table 5.11 : Decision about Short run and Long run Asymmetries

	Test Stats.		Decision		↓disequilibrium by 50% (# of years)	
Oil Imports	Short Run	Long Run	Short Run	Long Run	Symmetric	Asymmetric
Lowest oil Importing(A)	1.30	3.83**	Symmetric	Asymmetric	3.9	5.19
	(0.2564)	(0.0519)				
Medium oil Importing (B)	0.15	1.03	Symmetric	Symmetric	2.7	4.63
	(0.7001)	(0.3119)				
Highest oil Importing (C)	0.20	3.69**	Symmetric	Asymmetric	0.69	2.26
	(0.6557)	(0.0570)				

No of years has been calculated by expression $dissequilibrium\ after\ adjustment^n = .50$

5.5.4 Robustness Check

To check the robustness of analysis the sample is same however, recall the main estimation considers oil price as measured using Brent (oil price). Following Salisu *et al.* (2017) the Brent oil price is replaced with proxy of WTI oil price and re-estimated all the equations for sample. The results are summarized in table 5.11. From the results it is evident that the estimated results are robust to different oil proxies. In other words, it can be established that using different oil proxies (particularly Brent or WTI) will provide the similar conclusion. However, in terms of measure of influence a few differences are noticeable.

Table 5.12 : Panel Regression Robustness Results

	Without Asymmetry			With Asymmetry		
	A group b/p	B group b/p	C group b/p	A group b/p	B group b/p	C group b/p
Short-Run Estimates						
$\Delta OILP_{it}$	0.036**	0.022***	-0.045			
	(0.005)	(0.005)	(0.246)			
ΔEX_{it}	0.030	-0.163	-0.115***	0.006	-0.127	-0.047
	(0.492)	(0.222)	(0.009)	(0.903)	(0.345)	(0.620)
ΔINV_{it}	0.014***	0.015***	0.006	0.012***	0.015***	0.009**
	(0.000)	(0.000)	(0.163)	(0.000)	(0.000)	(0.048)
ΔOIL_{it}^{+}				0.001*	0.000	-0.000
				(0.069)	(0.687)	(0.936)
ΔOIL_{it}^{-}				-0.000	-0.000	0.000
				(0.510)	(0.339)	(0.846)
ECT	-0.155***	-0.223***	-0.304**	-0.131**	-0.134***	-0.291***
	(0.001)	(0.000)	(0.009)	(0.045)	(0.000)	(0.006)
Long-Run Estimates						
$OILP_{it}$	-0.077	0.046	0.077			
	(0.427)	(0.519)	(0.821)			
INV_{it}	-0.040	0.072	-0.038	-0.034	-0.027	-0.002
	(0.254)	(0.136)	(0.700)	(0.220)	(0.616)	(0.931)
EX_{it}	1.200**	0.725	-3.034	0.981	0.933**	0.790
	(0.251)	(0.146)	(0.305)	(0.166)	(0.030)	(0.282)
OIL_{it}^{+}				-0.043	-0.003	0.008
				(0.225)	(0.800)	(0.212)
OIL_{it}^{-}				0.062	-0.0303	-0.023
				(0.224)	(0.415)	(0.135)
$CONS.$	4.665***	3.394***	14.040	5.577**	3.614***	-1.123
	(0.000)	(0.000)	(0.410)	(0.017)	(0.000)	(0.771)
CD Stats. (p value)	4.93	8.02	0.86	5.66	7.84	0.25
	(0.00)	(0.00)	(0.3904)	(0.00)	(0.00)	(0.7991)
No. of Obs.	314.000	594.00 0	187.000	314.000	594.000	187.000
No of periods	30	30	30	30	30	30
F(p value)	4.672	4.388	3.667	5.225	3.742	3.705
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Cross Sections	12	21	7	12	21	7

5.6 Moderators Analysis Results Discussion

To analyze the role of moderators that is financial integration (Eqs. 4.18a and 4.19) and trade openness (Eqs. 4.20a and 4.21) Hausman test is prerequisite for determination of fixed/random effect model. In this context the table 5.12 below shows the Hausman test value for the all models to be estimated for three groups of the economies. Two models for each moderator have been estimated incorporating the interaction term in the second model and first without interaction term capturing the primary effect of the moderator and oil price. Results of the Hausman test show estimation of fixed effect model is appropriate for analysis under consideration.

Table 5.13: Hausman Test for Model Effects Estimation

Model Specification	OPEC	Developing	Developed
	$Chi-Square\ Statistic(Degree\ Freedom.)$		
$Eq.4.17a$	77.25***(5)	34.77***(5)	97.68***(5)
$Eq.4.18$	64.68***(6)	33.72***(6)	97.56***(6)
$Eq.4.19a$	113.54***(5)	32.01***(5)	54.24***(5)
$Eq.4.20$	82.67***(6)	26.82***(6)	97.56***(6)

The model 1 and model 2 has been estimated using domestic credit to private sector as proxy for domestic demand however approaching the data yielded three estimates of it first is the domestic credit to private sector second is the domestic credit to private sector to the banks and third to credit to financial sector.

5.6.1 Results Discussion of Financial Integration

The table 5.13 and 5.14 shows the results for equation 4.17 and equation 4.18 for OPEC, developing and developed economies for first moderator that is financial integration. The results for role of financial integration has been discussed by using two proxies for the

domestic demand. Results presented in the table 5.13 potrays the domestic demand as domestic credit to private sector. The financial Integration effects using domestic credit as given by financial institution are presented in the table 5.14.

Estimation of the equation 4.17 captures the primary effects of the selected macroeconomic variables that play a role in the adjustments of current accounts balances. The equation 4.18 estimated the moderated (interaction) effects of financial integration for all three groups of countries. The discussion of the results will be carried out considering the primary effect of the variable first and effect by incorporating the interaction terms in the regression in case of country grouping used. The dummy for low and high financial integration has been used for its effect on the oil price and current account relationship.

Table 5.14: Financial Integration using Domestic Credit to Private Sector

Dependent variable Current Accounts	OPEC		Developing		Developed	
	$Eq.4.17$	$Eq.4.18$ Cagdp	$Eq.4.17$	$Eq.4.18$ b/se	$Eq.4.17$	$Eq.4.18$ b/se
$DCPS_{it}$	-0.835***	-0.808***	-0.054***	-0.052***	-0.053***	-0.053***
	(0.096)	(0.096)	(0.013)	(0.013)	(0.007)	(0.007)
GDP_{it}	5.750**	5.843**	-0.311	-0.371	3.983***	3.989***
	(2.528)	(2.500)	(0.475)	(0.478)	(0.681)	(0.689)
EX_{it}	-1.250	-0.421	-0.679	-0.734	7.817***	7.854***
	(2.090)	(2.094)	(0.464)	(0.467)	(1.242)	(1.260)
$OILP_{it}$	6.351**	4.433	-1.055**	-0.970**	0.593	0.622
	(3.065)	(3.128)	(0.431)	(0.437)	(0.540)	(0.548)
FI_{it}	-20.345*	-33.222***	2.484	2.798	-0.459	-0.457
	(11.090)	(12.133)	(1.828)	(1.849)	(0.335)	(0.347)
$OILP * FI_{it}$		1.418**		-0.126		-0.004
		(0.572)		(0.112)		(0.091)
$CONS$	-136.263**	-137.198***	13.985	15.418	-119.080***	-119.558***
	(52.467)	(51.883)	(10.240)	(10.316)	(17.035)	(17.244)
N	245.000	245.000	674.000	674.000	629.000	619.000

Cross Sections		13		35		36
R^2	0.322	0.340	0.105	0.107	0.191	0.192
$F(p\ value)$	21.590 (0.000)	19.426 (0.000)	14.844 (0.000)	12.589 (0.000)	27.822 (0.000)	22.828 (0.000)

Table 5.15:Financial Integration using Domestic Credit by Financial Institution

	OPEC		Developing		Developed	
	Eq. 4.17	*Eq.* 4.18	*Eq.* 4.17	*Eq.* 4.18	*Eq.* 4.17	*Eq.* 4.18
		b/se		b/sc		b/se
$DCPSFIN_{it}$	-0.229***	-0.218***	-0.057***	-0.056***	-0.035***	-0.034***
	(0.050)	(0.049)	(0.012)	(0.012)	(0.006)	(0.006)
GDP_{it}	2.496	2.708	-0.395	-0.440	3.760***	3.757***
	(2.799)	(2.759)	(0.449)	(0.450)	(0.695)	(0.704)
EX_{it}	-2.611	-1.549	-0.443	-0.514		9.003***
	(2.304)	(2.303)	(0.464)	(0.466)	8.951***(1.261)	(1.280)
$OILP_{it}$	2.735	0.568	-1.225***	-1.128**	1.002*	0.998*
	(3.796)	(3.821)	(0.434)	(0.440)	(0.571)	(0.580)
FI_{it}	-26.227**	-41.862***	2.663	3.043*	-0.536	-0.559
	(12.199)	(13.265)	(1.821)	(1.842)	(0.347)	(0.357)
$OILP * FI_{it}$		1.745***		-0.150		0.028
		(0.626)		(0.111)		(0.094)
$CONS.$	-50.091	-54.062	16.917*	18.042*	-118.491***	-118.748***
	(56.848)	(56.037)	(9.599)	(9.628)	(17.478)	(17.704)
N	245.000	245.000	673.000	673.000	623.000	613.000
R^2	0.175	0.203	0.114	0.116	0.161	0.161
$F(p\ Value)$	9.661 (0.000)	9.586 (0.000)	16.270 (0.000)	13.885 (0.000)	22.399 (0.000)	18.273 (0.000)

Table 5.116a:Financial Integration using domestic credit to banks

	OPEC		Developing		Developed	
		Cagdp		Cagdp		Cagdp
		b/se		b/se		b/se
$DCPSBNK_{it}$	-0.848***	-0.819***	-0.057***	-0.055***	-0.053***	-0.053***
	(0.097)	(0.096)	(0.015)	(0.016)	(0.007)	(0.007)
GDP_{it}	5.598**	5.679**	-0.351	-0.414	3.922***	3.929***
	(2.507)	(2.481)	(0.474)	(0.477)	(0.681)	(0.689)
EX_{it}	-1.010	-0.191	-0.700	-0.752	7.600***	7.638***
	(2.063)	(2.070)	(0.465)	(0.467)	(1.248)	(1.266)
$OILP_{it}$	6.641**	4.784	-1.091**	-1.005**	0.548	0.574
	(3.044)	(3.109)	(0.431)	(0.438)	(0.540)	(0.548)
$TOPN_{it}$	-20.375*	-32.835***	2.631	2.929	-0.462	-0.463
	(11.032)	(12.077)	(1.832)	(1.851)	(0.336)	(0.347)
$OILP * FI_{it}$		1.373**		-0.123		0.001
		(0.569)		(0.112)		(0.091)
$CONS.$	-134.360**	-135.131***	15.117	16.587	-117.208***	-117.717***
	(52.053)	(51.512)	(10.164)	(10.250)	(17.031)	(17.240)
N	246.000	246.000	676.000	676.000	629.000	619.000
R^2	0.326	0.343	0.101	0.103	0.190	0.190
$F(p\ Value)$	22.067(0.000)	19.748(0.000)	14.264(0.000)	12.092(0.000)	27.526(0.000)	22.578(0.000)

Starting our discussion of results from the proxy of domestic demand that is domestic credit to private sector $DCPS_{it}$ is highly significant and showing negative relationship to current account in case of all three groups of countries. The coefficient is largest for the OPEC economies which indicate that with unit increase in domestic credit causes a negative impact (i.e. deficit in economy) on the current accounts by 0.83 units. Incorporating the financial integration as moderator causes change in magnitude slightly by 0.80 units being 0.83 in case of model 1 and for developing from 0.054 to 0.052. However, the coefficient value is stable for developed economies to the incorporation of the additional variable. The results of the table show that domestic demand is domestic credit by the financial sector $DCPSFIN_{it}$ is highly significant and showing a negative relationship to the current account in the case of all groups. The coefficient is highest for the OPEC economies with a unit increase in domestic credit causes a negative impact (i.e. deficit in economy) on the current accounts by 0.23 units. The coefficient is highest for the OPEC economies with a unit increase in domestic credit causes a negative impact (i.e. deficit in economy) on the current accounts by 0.218 units being 0.229 in case of model 1.the magnitude of the coefficient is 0.057 and 0.056 in case of both models not having interaction term and model with interaction term respectively. The magnitude for developed economies is 0.035 and 0.034 respectively both models.

The result of the coefficient is as expected by the theoretical model by Rebucci *et al.* (2006). The results agree with Herrmann and Winkler (2009) who used the variable in a different form and obtained similar results.

The coefficient is of GDP GDP_{it} is significant and positive for OPEC and developed economies that is the increase in GDP causes a positive effect on current accounts of the economy. However, for developing economies it is insignificant. The magnitude of the parameter for OPEC economies is 5.75 and 5.84 in both models respectively. The magnitude for developed economies is 3.98 for both models. For the model using domestic credit by the financial sector, the coefficient is of GDP GDP_{it} is significant and positive and significant only for developed economies and insignificant for rest. The results of the model including the interaction term are the same as the primary effects discussed. The magnitude of the coefficient is also the same 3.76 and 3.75. The results agree with the theoretical model of Rebucci, *et al.* (2006). These results are also in line with Chinn *et al.* (2003) finding a positive link of income to current accounts.

The parameter for the exchange rate EX_{it} is only significant and positive for developed economies for both models and insignificant for OPEC and developing economies in the case of both proxies. However, the magnitude of the coefficient is 7.817 and 7.854 in the case of domestic credit to the private sector and 9.003 and 8.951 in the interaction effect model respectively. This coefficient gives important insight about the effect of exchange rate on the current account that a unit increase in the exchange rate (depreciation) of the currency causes a surplus in the current account by 7.8 and 9.00 units on average in developed economies for both proxies respectively. This phenomenon is according as economic theory predicts the movement of these two variables where the devaluation of currency causes the domestic exports to be cheaper increasing the trade balance of the economy which in turn causes surplus in the country.

The coefficient of oil price $OILP_{it}$ shows quite interesting results being positive and significant for OPEC, negative, and significant for developing economies, and insignificant for the developed economies. For the model having interaction term oil price coefficient becomes insignificant for OPEC. For the developing economies, it remains negative and significant, and insignificant for developed economies.

However, using the second proxy for demand gives the coefficient of oil price $OILP_{it}$ positive and significant for developed economies for both models. It is negative and significant for developing economies and insignificant for OPEC. The magnitude of the coefficient is 1.002 and 0.998 for developed economies for model 4.18a and 4.19 respectively. However, the magnitude of the coefficient is 1.225 and 1.128 for both models respectively in the case of the developing economy. That is in the case of developing economies oil price increase cause deficit and surplus for developed economies. The results obtained for OPEC economies are in line with Allegret *et al.* (2014) who got a positive coefficient of oil price for current accounts of oil-exporting economies. However, Huntington (2015) obtained the deficit to be a reason for oil price shocks for a sample of 91 countries.

The primary effect of financial integration FI_{it} is only significant for the OPEC economies and insignificant for the rest. The magnitude of the parameter for financial integration on its impact on the current account is 20.34 that means a unit increase in financial integration causes a deficit of 20.34 units in the model without the interaction term. However, the magnitude of the coefficient is 33.222 in the model having an interaction term for OPEC and insignificant for the rest. Using the second proxy of

domestic demand Table 5.14 the primary effect of the financial integration FI_{it} is only significant for the OPEC economies and insignificant for the rest. The magnitude of the coefficient is 26.227 and 41.862 for both models. That is a unit increase in financial integration causes a negative impact on currents accounts by 26.227 and 41.826 units respectively for OPEC economies. The increase in financial integration causes an increase in the dispersion of the current account of the oil-exporting economies. So the surpluses generated due to positive shocks to oil prices will be larger (this conclusion is evident from the positive coefficient of oil price to the current account of the oil-exporting economies) will grow more due to higher financial integration. The results are in line with Herrmann *et al.* (2009) who finds a negative relationship of the financial integration with current accounts for variation in the income level of different economies.

The interaction effect $OILP * FI_{it}$ is positive and significant for OPEC only and insignificant for the remaining two groups. The magnitude of the coefficient is 1.418. The financial integration is dealt with hereby with the binary variable being 0 for economies with low financial integration and 1 for economies enjoying high levels of financial integration. The interpretation will be accordingly provided with $FI = 0$ (low financial integration) with one unit increase in oil price the expected value of current accounts will increase by 4.43 units. The $FI = 1$ (high financial integration), with one unit increase in oil price, the expected value of current accounts increases by 1.418 units. At the two different levels of financial integration, we get two straight lines with different slopes. The parallel lines have the same slopes in case of interaction effects if we get parallel that provides the evidence for no interaction effects.

Interestingly, in this case, at the two levels of financial integration, we find two straight lines with different slopes (4.43 and 1.418), which confirms that the lines are not parallel. In the context of our problem, these non-parallel straight lines indicate that the magnitude of the positive relationship between oil price and current accounts depends on the level of financial integration for OPEC. Here the effect of the moderator is enhancing as increasing the moderator value (from 0 = low financial integration to 1 = high financial integration) is causing a positive significant effect of oil price on current accounts. Again these results are in partial consensus with Herrmann *et al.* (2009) who finds dispersion in the current account of the economies with an increase in financial integration however the mentioned study does not consider the different levels of financial integration.

Analyzing the interaction term $OILP * FI_{it}$ the coefficient in the case of the second proxy of domestic demand that is table 5.14 results, it is evident that the magnitude of the coefficient is 1.745. The interpretation will be accordingly provided with $FI = 0$ with one unit increase in oil price. The expected value of current accounts will increase by 0.56 units. The $FI = 1$, with one unit increase in oil price, the expected value of current accounts increases by 1.745 units. At the two different levels of financial integration, we get two straight lines with different slopes. The parallel lines have the same slopes in case of interaction effects if we get parallel that provides the evidence for no interaction effects. Interestingly, in this case, at the two levels of financial integration, we find two straight lines with *different* slopes (0.56 and 1.745), which confirms that the lines are not parallel. In the context of our problem, these non-parallel straight lines indicate that the magnitude of the positive relationship between oil price and current accounts *depends* on the level of financial integration for OPEC. Here the effect of the moderator is enhancing as the

increasing the moderator value (from 0= low financial integration to 1= high financial integration) is causing a positive significant effect of oil price on current accounts.

The calculation of financial integration finding its role by such interaction term has not been previously adopted in the literature. However, we can say that results are in partial consensus with Herrmann *et al.* (2009) who argues that higher financial integration leads to a country's ability to borrow abroad and plays an important role in the pattern of current accounts of the economies.

5.6.2 Discussion of the Results of the Second Moderator (Trade Openness)

Table 5.15 presents the results of trade openness as a moderator on the relationship between oil price and current accounts. The results are discussed as first the main effects and then the model incorporating the moderator in estimation.

Table 5.17: Trade Openness using Domestic Credit to Private Sector

	OPEC		Developing		Developed	
	$Eq.4.19$	$Eq.4.20$ b/se	$Eq.4.19$	$Eq.4.20$ b/se	$Eq.4.19$	$Eq.4.20$ b/se
$DCPS_{it}$	-0.819***	-0.799***	-0.058***	-0.055***	-0.050***	-0.050***
	(0.109)	(0.110)	(0.013)	(0.014)	(0.007)	(0.007)
GDP_{it}	4.012	4.390	0.051	0.023	3.143***	3.173***
	(3.419)	(3.420)	(0.496)	(0.496)	(0.727)	(0.731)
EX_{it}	-0.351	-0.330	-0.706	-0.735	6.743***	6.655***
	(2.403)	(2.397)	(0.458)	(0.458)	(1.283)	(1.298)
$OILP_{it}$	6.293	5.044	-1.412***	-	0.287(0.543)	0.296(0.544)
	(3.905)	(3.988)	(0.453)	1.335***(0.456)		
$TOPN_{it}$	0.021	-0.023	0.030**	0.036***	0.036***	0.038***
	(0.065)	(0.072)	(0.012)	(0.013)	(0.011)	(0.012)
$OILP * TOPN_{it}$		1.173(0.805)		-0.181(0.142)		-0.083 (0.181)
$CONS.$	-98.657	-102.174	5.199	5.448	-97.444***	-98.109***
	(73.800)	(73.651)	(10.846)	(10.843)	(18.285)	(18.355)
N	238.000	238.000	692.000	692.000	630.000	630.000
R^2	0.524	0.515	0.108	0.111	0.203	0.203
$F(p\,Value)$	17.891	15.340	15.862	13.501	29.921	24.936

Table 5.18: Trade Openness using Domestic Credit to Financial Institutions

	OPEC		Developing		Developed	
	Eq. 4.19	*Eq.* 4.20 b/se	*Eq.* 4.19	*Eq.* 4.20 b/se	*Eq.* 4.19	*Eq.* 4.20 b/se
$DCPSFIN_{it}$	-0.185***	-0.174***	-0.053***	-0.052***	-0.034***	-0.035***
	(0.048)	(0.048)	(0.011)	(0.011)	(0.006)	(0.006)
GDP_{it}	-5.149	-4.485	-0.192	-0.181	2.729***	2.782***
	(3.354)	(3.360)	(0.460)	(0.459)	(0.734)	(0.738)
EX_{it}	-2.419	-2.372	-0.468(0.459)	-0.512	7.450***(1.301)	7.304***
	(2.590)	(2.578)		(0.459)		(1.316)
$OILP_{it}$	10.846**	9.274**	-1.466***	-1.385***	0.646	0.668
	(4.351)	(4.423)	(0.454)	(0.456)	(0.569)	(0.570)
$TOPN_{it}$	-0.161**	-0.212***	0.026**	0.035***	0.047***	0.049***
	(0.065)	(0.071)	(0.012)	(0.013)	(0.011)	(0.012)
$OILP * TOPN_{it}$		1.523*		-0.226		-0.138
		(0.871)		(0.141)		(0.184)
$CONS.$	120.438*	111.176	11.499	10.793	-91.500***	-92.657***
	(70.419)	(70.292)	(9.948)	(9.945)	(18.574)	(18.645)
N	238.000	238.000	691.000	691.000	624.000	624.000
R^2	0.163	0.175	0.112	0.115	0.182	0.183
$F(p\ Value)$	8.587	7.733	16.410	14.140	25.951	21.703
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5.19a: Trade Openness using Domestic Credit to Financial Institutions

		(2)OPEC		(2)dev		(2)ded
		Cagdp b/se		Cagdp b/se		Cagdp b/se
$DCPSBNK_{it}$	-0.828***	-0.808***	-0.058***	-0.056***	-0.051***	-0.051***
	(0.109)	(0.109)	(0.015)	(0.015)	(0.007)	(0.007)
GDP_{it}	3.701	4.104	-0.063	-0.080	3.055***	3.083***
	(3.371)	(3.373)	(0.495)	(0.494)	(0.725)	(0.729)
EX_{it}	-0.029	-0.013	-0.722	-0.760*	6.483***	6.401***
	(2.368)	(2.362)	(0.459)	(0.459)	(1.287)	(1.302)
$OILP_{it}$	6.757*	5.470	-1.402***	-1.313***	0.238	0.246
	(3.854)	(3.941)	(0.454)	(0.457)	(0.542)	(0.543)
$TOPN_{it}$	0.016	-0.027	0.028**	0.036***	0.038***	0.039***
	(0.065)	(0.071)	(0.012)	(0.013)	(0.011)	(0.012)
$OILP * TOPN_{it}$		1.187		-0.220		-0.077
		(0.800)		(0.141)		(0.181)
$CONS.$	-93.451	-97.427	8.014	7.953	-94.858***	-95.472***
	(72.816)	(72.669)	(10.764)	(10.753)	(18.243)	(18.313)
N	239.000	239.000	694.000	694.000	630.000	630.000
R^2	0.293	0.300	0.102	0.106	0.202	0.202
$F(p\ Value)$	18.307(0.000)	15.705(0.000)	14.929(0.000)	12.871(0.000)	29.832(0.000)	24.856(0.000)

The coefficient of domestic credit to the private sector $DCPS_{it}$ is significant and negative in case of all groups of economies being highest in magnitude for OPEC economies that is a unit increase in domestic credit cause a negative impact on current accounts of economies by 0.819 units. Incorporating the interaction term yields the coefficient significant and negative in case of all groups of economies being highest in magnitude for OPEC economies, that is a unit increase in domestic credit causes a negative impact on current accounts of economies by 0.799 units. The magnitude of the coefficient is 0.055 for developing economies and 0.050 for developed economies. The results of the obtained coefficient are similar to the obtained in the case of the first moderator. The results are in line with Herrmann *et al.* (2009) obtained for industrialized economies.

The coefficient of GDP GDP_{it} stands significant and positive for its effect on current account in case of developed economies and insignificant for the other two groups. That is a unit increase in GDP causes an increase in the current account of developed economies by 3.143 units. The coefficient of GDP stands significant and positive for its effect on the current account in the case of developed economies and insignificant for the other two groups. That is a unit increase in GDP causes an increase in the current account of developed economies by 3.173 units.

The exchange rate $EX_{it}the$ coefficient is positive and significant in the case of developed economies and insignificant for the rest. The exchange rate coefficient is positive and significant in the case of developed economics and insignificant for the rest. The magnitude of the coefficient is 6.655 that a unit increase in the exchange rate causes a positive impact on current accounts by a magnitude of 6.655 units. The results are in

line with predicted by economic theory that is depreciation causes an increase in export demand being cheaper and enhancing the trade balance causing a surplus for the economy.

The coefficient of oil price $OILP_{it}$ is negative and significant for the developing economies and insignificant for the other two. The magnitude shows that a unit increase in oil price causes a deficit in the developing economies by 1.412 units. The coefficient of oil price is negative and significant for the developing economies and insignificant for the other two. The magnitude shows that a unit increase in oil price causes a deficit in the developing economies by 1.335 units. The stated results are partially in line with Huntington (2015) who found the oil export as the factor for surplus in oil-exporting economies and high oil imports to be the reason for deficit in countries relatively with high incomes.

The coefficient of trade openness $TOPN_{it}$ is significant for developing and developed and insignificant for OPEC economies. The magnitude of the coefficient is 0.030 and 0.036 positive for developing economies that is an increase in trade openness that causes a positive effect on the current account by 0.030 and 0.036 units respectively. For developed economies, the magnitude of the coefficient is 0.036 and 0.038 positive for both models respectively that is an increase in trade openness causes a positive effect on the current account by 0.036 and 0.038 units in developed countries respectively. The coefficient value and sign are again the same as in the earlier proxy of the domestic demand the results are in complete agreement with Chinn *et al.* (2003) and Huntington (2015) who finds a positive effect of trade openness on current accounts of the economy.

Using domestic credit by financial sector Table 5.16 provides the trade openness $TOPN_{it}$ the significant coefficient for all however is negative for OPEC and positive for the other two groups. A unit increase in trade openness causes a decrease in OPEC by 0.161 units and 0.212 units for both models respectively. For developing economies the increase in trade openness causes an increase of 0.026 and 0.035 respectively for both models. However, for developed economies, a unit increase in trade openness generates an increase in current accounts by 0.047 and 0.049 units in the case of both models. The coefficient of trade openness is significant and negative for OPEC however positive and significant for the other two groups. This result has been earlier obtained in literature by Arezki *et al.* (2013) and Allegret *et al.* (2014) dealing with developing countries so obtained results are in partial consensus with the above-mentioned studies.

The interaction term $OILP * TOPN_{it}$ stands insignificant for all groups of economies that are the trade openness does not play a moderator role in the relationship of the oil price and currents accounts of the OPEC developing and developed economies. However using the second proxy in analysis Table 5.16 provides quite interesting insights as, the coefficient of the interaction term $OILP * TOPN_{it}$ is significant with the magnitude of 1.523 for OPEC and insignificant for the rest of the groups. The interpretation will be accordingly provided with TOPN= 0 with one unit increase in oil price the expected value of current accounts will increase by 9.274 units. The TOPN= 1, with one unit increase in oil price, the expected value of current accounts increases by 1.523 units. At the two different levels of trade openness, we get two straight lines with different slopes. The parallel lines have the same slopes in case of interaction effects if we get parallel that

provides the evidence for no interaction effects. Interestingly, in this case, at the two levels of trade openness, we find two straight lines with *different* slopes (9.274 and 1.523), which confirms that the lines are not parallel. In the context of our problem, these non-parallel straight lines indicate that the magnitude of the positive relationship between oil price and current accounts *depends* on the level of trade openness for *OPEC*. Here the effect of the moderator is buffering as increasing the moderator value (from 0= low trade openness to 1= high trade openness) is causing a decrease in the effect of oil price on current accounts. The role of trade openness for adjustment of the current account balances after oil price shocks has not been previously analyzed in such a manner. However, studies have been conducted to determine its role in the current account. Selçuk *et al.* (2017) analyzed the trade liberalization role for Turkey and found a negative impact on the trade balance and an insignificant impact on the current accounts.

CHAPTER 6

CONCLUSION AND POLICY RECOMENDATION

6.1 Conclusion

Lesser dependence on imported oil can decrease trade or current account balances of oil importing nations and also decreases their vulnerability to fluctuation in its price. The decrease in vulnerability of oil importing economies to oil price fluctuation demands to explore the role of different mediators in adjustments of balances. In this context the present study is an attempt to empirically investigate the effects of oil price shocks on current account imbalances. The analysis is carried out on the cross-country panel of 160 countries that are divided into three different groups based on their level of oil imports. The findings of the study reveal that for all three groups of countries the oil price shocks pose a positive effect on the current account through the trade channel. Whereas, the current account of all three groups is negatively associated with oil price shock through the wealth channel. The valuation channel holds a mix results across country groups about the effect of oil price shock on the current account balances. In the case of low and major oil importer countries, oil price shock is negatively associated with the current account, whereas the current account of medium oil importer countries is improving with an increase in oil prices. The findings of the mediation analysis show that real exchange rate signify its role as a mediator in the relationship between oil price shock and current account imbalances.

This paper examines the responses of industrial productivity of oil importing economies to oil price shocks. The study has used annual data for period of 1990-2019 by dividing the oil importing economies into low, medium and high oil importing economies. By following Chudik *et al.* (2015) model gives interesting results. The oil price variable stands significant in short run for low and medium oil importing economies being insignificant for high oil importing economies and insignificant for all groups in long run. However, following Shin *et al.* (2014) when oil price is disjoined into positive and negative integrant, the negative shocks stand insignificant for all oil importing economies in short run and long run. However, a positive shock appears significant only for low oil importing economies in short run.

In the long run, oil price positive shocks are significant and positive for highest oil importing economies. As far as the lowest oil importing economies are concerned positive shocks increases industrial productivity of the economies. For highest oil importing economies positive shocks increases the industrial productivity of the economies in the long run. The implication of the analysis is that there is no evidence of asymmetry for all categories in short run. In the long run there is asymmetry for lowest and highest oil importing economies. As in long run the positive shocks causes an incraese in productivity for highest oil importing economies that can be due adjustments of inputs in long run.

The present study has attempted to analyze the effect of two moderators by using annual data from 1999-2020 obtaining the estimates for OPEC developing and developed countries. Using fixed-effects models the study finds that financial integration and trade

openness both plays role in the adjustment of balances of the OPEC economies. However, the process of adjustments of the currents accounts of the economies is slowed with an increase in trade openness and financial integration.

6.2 Policy Recomendation

Despite the fact that the study entails some limitations, however, we believe that present analysis may prove beneficial to direct policies about the adjustment of the current account of the oil-importing countries. The outcome of the present study provides the evidence about the negative effects of the oil price shock on current account imbalances of oil-importing countries through valuation and wealth channels. The study entails oil-importing countries' exchange rate policy to mitigate the negative effect of oil price shock on the current account. Similarly, the results of mediation effects (wealth effects) direct for the exchange rate policy of the oil-importing countries. In addition, the findings indicate a positive impact of the oil price shock on current account imbalances through the trade channels, which demands trade policy of oil-importing to encourage exports in order to harvest potential gain from the oil-exporting countries markets.

The significance of the terms of trade variable implies that an increase in terms of trade has a positive effect on current accounts. So the policies to enhance the terms of trade should be made as there is an increase in magnitude observed with an increase in oil imports. High oil importing economies are more vulnerable to oil price shocks so it is imperative for policymakers to create initiatives to enhance the terms of trade.

The real exchange rate plays a mediator role in the transmission of oil shock to the current accounts of the economy. This result implies that policies related to the exchange rate can

mitigate the negative impacts of oil price shocks. The policymakers can improve their policies keeping in view the role of the exchange rate as a mediator. The presence of mediation effect of the exchange rate is evident of the fact that any policy related to oil price and current accounts of the economy should incorporate policies related to exchange rate and inflation of economy (as real exchange rate is taken nominal divided by CPI of the economy). Further any economic regression having relation of oil and current accounts should include exchange rate other wise it can lead to supurious conclusion.

The direct effect of all the mediators is negative and significant for all groups which implies the presence of partial mediation. That means that oil price has some additional effect on the current accounts of the economy that are not mediated by each mediator used in analysis. The implication from such result is to expand the discussion by including more mediators for oil price and current account relationship.

The negative and significance of the oil price coefficient imply that high oil-importing economies are more vulnerable to oil price shocks so steps should be taken to decrease the magnitude of negative economic impacts of oil price shocks. Significance of non oil trade balance in case of highest oil importing nations is evidence of trade composition effect. This trade composition is change of oil trade balance to non oil trade balance . The implication from the analysis is that increase in oil price causes detrioration of oil trade balance can be compensated by increase in non oil trade balnce. However, the positivity of non-oil trade balance implies that shifting resources from oil intensive production to non-oil intensive production can have a beneficial impact on the highest oil-importing

economy. By making policies to enhance the non oil intensive production can play a major role to decrease the costs of oil price shocks to high oil importing countries.

The increase in oil price has a positive impact on the industrial productivity of the highest oil-importing economies which implies that as oil price increases there is reallocation from oil intensive production to non-oil intensive goods. The policy measures should be taken in the highest oil-importing nation to boost the service sector to decrease the vulnerability to higher oil prices. The reallocation also implies the use of smart energy forms of the *smart energy are* .

- *Wind Energy*
- *Solar Energy*

Further to decrease the vulnerability of the high oil importing economies it is nnedded to relallocat the resources

The financial integration does not seem to play role in the adjustment of the balance of developing economies however it widens the gap from the equilibrium for OPEC. Such a result implies for OPEC economies to control the financial integration of those countries to achieve the equilibrium faster. Trade openness also plays the role in widening the gap from equilibrium so there is a dire need for OPEC economies to make policies to handle the shocks.

Pakistan lies in the highest oil importing economy so trade composition effect plays a role in ease of positive oil price shock . it is recomende to shift the resources to non oil sector

to be less vulnerable to increase in oil price. Further financial integration and trade openness does seem to play role for the relationship between oil price and current account.

The role of exchange rate is prominent for countries with high oil imports so more focus should be made on exchange rate and its determination while incaese in oil price .

Future Direction

The finding of the study opens some direction for further future research. Further studies are invited to investigate the mediation effect for the oil-exporting or resource-rich economies. Further supporting the mediation analysis with the bootstarping approach will also yield interesting and precise results. The addition of moderators to the relation of oil price shocks and current accounts is a naïve avenue for research.

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APPENDIX

Appendix A

The list of countries used in the analysis of Mediation effect is as follows:

Table 8.1: List of Countries Used in the Analysis of Mediation Effect

Less oil importing Economies (Group A)	Albania, Algeria, Angola, Argentina, Aruba, Austria, Australia, Azerbaijan, Bolivia, Brunei, Canada, Central African Republic, China, Colombia, Comoros, Congo, Czech Republic, Denmark, Djibouti ,Dominica, Ecuador, Egypt, Equatorial Guinea, Gabon, Grenada ,Hong Kong SAR, China, Iran, Iraq, Ireland, Kuwait, Lesotho, Libya Luxembourg ,Macao SAR China,Malaysia,Mexico,Namibia,Nigeria,Norway,Oman,Qatar,Russia,Rwanda,Saudi Arabia, Slovenia, St. Kitts and Nevis ,Switzerland, United Arab Emirates, United Kingdom, Venezuela
Medium oil importing Economies (Group B)	Antigua and Barbuda, Armenia, Bangladesh, Barbados, Belgium, Belize, Benin, Bhutan, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cameroon, Chad, Chile, Costa Rica, Croatia, Cyprus, Dominican Republic, El Salvador, Estonia, Ethiopia, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Honduras, Hungary, Iceland, Indonesia, Israel, Italy, Jordan, Kazakhstan, Lebanon, Lesotho, Macedonia, Madagascar, Malawi,Maldives,Malta,Mauritius,Morocco,Mozambique,Netherlands,Nepal,New Zealand, Niger, Nicaragua, Panama, Papua New Guinea,Paraguay,Peru,Philippines,Poland,Portugal,Romania,Samoa,Serbia,Seychelles,Singapore,Slovak Republic, South Africa, Spain, Sri Lanka, St. Vinct.gerand, Sudan, Suriname, Sweden, Syrian Arab Republic, Thailand, The Gambia, Togo, Tonga, Tunisia, Turkey, Uganda, United States, Uruguay, Vanuatu, Victnam, Yemen, Zambia, Zimbabwe
High oil importing Economies (Group C)	Bahrain ,Brazil, Côte d'Ivoire, Fiji, Guyana, India, Jamaica, Japan, Kenya, Korea, Kyrgyz Republic, Liberia, Lithuania, Mali, Mauritania, Moldova, Mongolia, Pakistan, Senegal, Tanzania , Turkey, Ukraine, Vietnam, Zambia (35)

No of countries in group A =50 B=90 C=20

The list of countries used in the analysis of asymmetries is as follows:

Table 8.2 List of Countries Used in the Analysis of Asymmetries

Less oil importing Economies (Group A)	Austria, Australia, Canada, Czech Republic, Denmark, Ireland, Luxembourg , Malaysia, Norway, Slovenia, Switzerland, United Kingdom,
Medium oil importing Economies (Group B)	Bangladesh, Barbados, Belgium, Cyprus, Finland, France, Germany, Hungary, Italy, Jordan, Malawi, Malta, Netherlands, Poland, Portugal, Romania, Spain, Sweden, Tunisia, Turkey, United States,
High oil importing Economies (Group C)	Brazil, Côte d'Ivoire, India, Japan, Korea, Lithuania, Senegal

No of countries in group A =12 B=21 C=7

Table 8.3 List of Countries for Moderator Analysis

OPEC Countries	Algeria , Angola, Equatorial Guinea, Gabon ,Iran , Iraq ,Kuwait, Libya, Nigeria, Saudi Arabia, UAE, Venezuela, Congo (13)
Developed Countries	Australia, Austria, Belgium, Bulgaria Canada, Cyprus, Czech Republic, Denmark, Estonia ,Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, , Croatia, New Zealand, Japan, Switzerland, Norway, Iceland, Slovenia, Slovakia, Romania, Poland, Malta, Lithuania, Latvia, , United States , United Kingdom, (36)
Developing Countries	Albania, Argentina, Bangladesh, Brazil, Cameroon, China, Egypt, El Salvador, Dominican Republic, Georgia, Guatemala, India, Indonesia, Jamaica, Korea, Kyrgyz Republic, Lebanon, Malaysia, Mauritius, Mexico, Morocco, Namibia, Pakistan, Paraguay, Philippines, Russia, South Africa, Sri Lanka, Sudan, Thailand, Tunisia,

Appendix B

$$m - q = \lambda i + \phi y \tag{3.1}$$

$$q = \beta p + (1 - \beta)(e + p^*) \tag{3.2}$$

$$i = i^* + \dot{e}^E \tag{3.3}$$

$$y = a + \delta(e + p^* - p) \tag{3.4}$$

The first equation states that continuous monetary equilibrium prevails in the domestic economy. The use of the index q rather than p in (1) indicates that consumers in an open economy are concerned with their real purchasing power over both domestic and foreign (i.e., U.S.) final goods. The price index is defined in equation (2) as a simple (multiplicative) average of prices of domestic and (U.S.) goods. The parameter β signifies the degree of 'openness' of the domestic economy. The third equation asserts that the yield on domestic securities, net of expected exchange depreciation,$(i - \dot{e}^E)$ be equal to the yield on U.S. securities. Only then will domestic and U.S. financial assets, be regarded ex-ante, by domestic residents, as being perfect substitutable. Eq. (4) depicts the determination of domestic real income. Specifically, aggregate demand depends upon the relative price of U.S. goods vis-a-vis home goods.

An increase in the price of foreign goods switches domestic aggregate demand towards home goods and thus raises real income. The parameter δ depicts the degree of substitutability between the two final goods and is hence, a measure of the integration of the domestic goods market with the U.S. goods market. Eq. (5) is the aggregate pricing equation for the domestic economy. It states that domestic producers adjust their prices

according to pure cost push pressure and are prepared to supply output elastically, at a price that covers their unit costs.

Eq. (6) indicates that nominal wages are adjusted to maintain constancy of real wage (defined in terms of the aggregate price index)." It can be assumed that labor supply is unionized and that unions write in escalator clauses in their wage contracts. The parameter μ can capture the frequency with which wage contracts are renegotiated. Finally, eq. (7) specified the scheme whereby domestic exchange rate expectations are generated and will be seen to be a generalization of the regressive expectations scheme popularized by Dornbusch (1976). According to equation (7), exchange rate expectations of domestic residents are affected by their observation of two distinct sets of information, i.e., the deviation of current exchange rates and wage rates from their respective steady-state values. The latter are assumed to be known and analytical solutions for these will be described below. The justification of a '2-dimensional' scheme such as (7) is that, for properly constrained θ_1, and θ_2, it will be consistent with perfect foresight. Attaining the perfect foresight path requires that the economy's agents 'know' how the actual economy behaves and they make efficient use of information relevant to the prediction problem. It will turn out that the information relevant to accurately predicting exchange rates is embodied in the knowledge of any two of the states of the economy,$(e - \bar{e})$, $(w - \bar{w})$, $(y - \bar{y})$, and$(p - \bar{p})$. The other two states can be directly inferred from the first two. We have chosen $(e - \bar{e})$ and $(w - \bar{w})$ to represent the two independent states but any other choice will provide exactly the same solutions.